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HANDELSHØJSKOLEN

Market efficiency in emerging markets and how it relates to investor protection

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Abstract

This thesis is an investigation into the market efficiency of emerging markets. A sample containing equities from 15 emerging markets from around the world in the time period of January 1990 to April 2016 is looked into. The thesis sheds light on the literature on market efficiency, emerging markets, investors protection, and momentum. The works of Titman & Jegadeesh (1993), Moskowitz, Ooi & Pedersen (2012) on momentum as well as the works of La Porta et al. (1998) and Djankov et al. (2006) on investor protection are the primary sources of inspiration for the analysis.

The tests for the market efficiency are conducted by testing for momentum in both the cross section and the time-series of a large sample of equity data. Equity indices are also tested for whether they follow a random walk or exhibit signs of autocorrelation.

The thesis finds evidence of time-series momentum trading strategy outperforming a similar US strategy in 5/15 countries, Statistically significant cross-sectional momentum in 4/15 countries. And autocorrelation in 7/15 countries. There is no significant correlation between the resulting figures of the different analysis.

The results are regressed on indices which quantify different aspects of investor protection. Evidence is found that momentum in the time-series can be explained by an index representing rule of law as well as well as one representing the ability to repatriate capital. The coefficients for these results are negative, thus indicating that market efficiency is positively related to investor protection.

Table of contents

1. Introduction

An efficient market can be defined as a one in which price discovery mechanism are accurate to the extent that "prices fully reflect all available information" (Fama, 1970). The degree of market efficiency in an investment environment can have wide reaching effects on its investors, but how can it be quantified? The additional asset pricing factors added to the CAPM by Fama & French (1993) price-to-book and market size can both be argued to be compensation for risk. Momentum stands out from the rest, since it is hard to attribute it to risk compensation, but easier to make the argument that it is caused by behavioral biases that does not net out in the aggregate; in other words, it is a market inefficiency.

In this thesis, I will use momentum both in the cross section and in time-series as a proxy for market inefficiency. I consider this to be reasonable, since momentum represents both a violation of weak form market efficiency because of its trend element and a violation of semi-strong market efficiency because of the inconsistent reaction to new information. If a market was efficient in the semi-strong sense, then that market would react to new information immediately and it would be impossible to profit from trends brought on by new information (Roberts, 1967). For stock data it is to be expected, that if markets are efficient, historical returns should not matter and there should be no appreciable effect on future returns and thus market timing strategies should not be viable.

I will utilize a number of empirical tests in order to find out if the stock markets in emerging economies deviate from a random walk and whether or not there is autocorrelation in the time series of stock data. in my examination of momentum in the cross-section, I look for statistically significant evidence of momentum and other factors predicting returns. I do this using a modified version of Fama & French's 5 factor asset pricing model.

For my analysis of momentum in the time-series I will run backtests for momentum trading strategies for portfolios consisting of individual stocks within a given market. I will compare these backtests to a similar strategy used on the US market. Finding out whether market timing strategies are more or less viable in emerging markets than in a developed one will be an indicator in answering the question of whether or not emerging markets are efficient, relatively speaking. I will also evaluate the effect of trading costs on this trading strategy.

It is also relevant to ask the question of whether market inefficiency is connected to the state of investor protection within a country. There are a number of different investor protection indices, most notably made by La Porta et al. (1998) and Djankov et al. (2006), that quantify how well legislation in a given nation is able to protect the rights of minority investors. I will investigate whether these indices have any explanatory power over the results from the above mentioned analyses that I take to be proxies for market efficiency.

2. Problem statement

Are emerging markets efficient? Is there evidence of market inefficiencies in the stock markets of emerging markets and is this level of efficiency related to investor protection?

In this thesis I am going to take an empirical approach to answering the question of whether the capital markets of emerging nations can be classified as efficient. I will test for the presence of different equity style patterns in stock data in the cross section. Since the traditional asset pricing factors like size and value can be viewed as compensation for risk, I will focus on momentum and view

this as a proxy for market inefficiency. I will run backtests of time series momentum trading strategies in nations with developing capital markets. I will test to see if observed returns in developing markets follow a random walk by testing for autocorrelation and by doing a runs test. Then, I will investigate if momentum is a phenomenon that can be explained by investor protection indices and, whatever the outcome of that investigation, attempt to explain why that may be the case and what the relevant financial literature says about that.

2.1 Methodology

Chapters 3, 4 and 5 are the descriptive, theoretical part of the thesis and is based on mostly qualitative data with some quantitative sources used to illustrate key points. Herein, I will describe the various theories that make up the foundation of knowledge necessary to understand the subsequent analyses I make and what I aim to discover.

Chapter 6 is analytical in nature and empirically tests the theories that were outlined, on a conceptual level, in the previous chapters. It is primarily inspired by the works of Titman & Jegadeesh (1993) as well as Moskowitz, Ooi & Pedersen (2012). I am utilizing deductive reasoning in the sense that I am operating under the notion that emerging markets are inefficient and attempting to find evidence of this hypothesis. This chapter is based on primarily secondary quantitative data sources in the form of individual equity data and market index data that I have gained access to through Datastream.

In the 7th chapter I am using inductive reasoning because I am examining data and attempting to arrive at a theory that explains the observations I made in chapter 6. This section is also analytical and quantitative in nature. It is primarily inspired by the works of La Porta et al (1998), (2006a) and (2006b). It relies heavily on indices collected from secondary quantitative data from scientific databases as well as from the webpages of analysis institutes.

Throughout my thesis I have utilized a pragmatic approach to research in the sense that I acknowledge that there are some philosophical schools of thought that might possibly have steered

me in a different direction. I acknowledge that I could have chosen a different approach but since I am ultimately limited by the availability of data I have chosen the techniques and models that well suits the type of data I have had access to.

2.2 Delimitation

This thesis limits itself to the time period of January 1990 until April 2016 since many of the countries that make up my data sample do not have any equity data before the mid-90s. In the case of some emerging markets, a longer time series of data could have been acquired, but in order to make results at least somewhat comparable across countries, I have settled on a shorter time span.

In this thesis I have investigated exclusively emerging markets. Broadening the sample to also include developing developed markets is beyond the scope of this thesis.

3. Related Literature

If we accept the efficient market hypothesis which says that the price given by a market always reflects the total amount of information available, then the value of a security at any given time is the sum of all future cash flows discounted. A market exhibiting these properties will then be considered an informationally efficient market meaning that all expectations and all information is correctly reflected in prevailing prices and future price changes will thus be unforecastable (Campbell, Lo & MacKinlay, 1997). Fama (1970) states that there is no evidence against the weak and semi strong form of the efficient market hypothesis and only limited evidence against the strong form of the EMH.

Grossman & Stiglitz (1980) are proponents of the idea that markets incorporate an equilibrium level of disequilibrium wherein markets correctly reflect the knowledge of informed investors only up to the point where markets are sufficiently inefficient to compensate investors for their cost of acquiring knowledge. Vishny & Shleifer (1995) demonstrate the “limits of arbitrage” stating that there is an

upper limit on the efficiency gain to financial markets from arbitrageurs exploiting and eliminating stock mispricings because of the inherent risks and costs involved in implementing these kinds of trades.

The concept of Momentum was first written about in 1993 by Titman and Jegadeesh and by Asness in 1994. The core concept of the classic momentum strategy is that relative outperformance of a security over the last 3 to 12 months over its peers is a good determinant of a trend and will tend to continue to outperform in the short run before the effect diminishes after roughly 2 years. The trading strategy they utilized is a cross-sectional one wherein they look at the relative rankings of these assets, going long the securities with the highest returns and shorting the ones with the lowest. Titman & Jegadeesh (1993) hypothesize that the momentum effect is caused by investors under reacting to information about the short term prospects of a firm and overreacting to information affecting the long term prospects. Hurst, Ooi & Pedersen (2013) offer an explanation of the underlying behavioral patterns that make trend following strategies viable; they theorize that trends are caused by initial under reaction making it so that it takes a while for prices to fully reflect new information. As the herding effect intensifies with investors jumping on the bandwagon and investing in the assets that are deemed to be “hot”, the trend thus continues its “life-cycle” in the form of delayed overreaction, finally coming to an end when the market realizes that the asset is out of step with its fundamental value.

Slightly different from momentum strategies are strategies based on the idea of mean reversion meaning that you sell recent “winners” and buy recent “losers” making it essentially the opposite of a momentum strategy, only with a different time horizon. Although, like the momentum strategy, mean reverting trading strategies are based on the notion that waves of optimism or pessimism carry (or depress) stock prices for periods of time causing a deviation from the fundamental value. Lo & MacKinlay (1990) demonstrate that stock markets notably do not follow a random walk and that a mean reverting strategy yields positive returns on average and state that is caused in part by stock market overreaction and in part due to positive cross-autocorrelations across securities.

Different from cross-sectional momentum is time-series momentum where the trend is determined, not based on the relative ranking of an asset, but instead on the asset's own past returns. Moskowitz, Ooi and Pedersen (2011) found that time series momentum strategies across a wide range of different asset classes show strong abnormal returns in especially extreme markets that cannot be explained by regressing on standard asset pricing factors. They further state that time series momentum offers one of the most direct tests of the random walk hypothesis.

La Porta, Lopez-de-Silanes, Schleifer & Vishny (1999) investigate some of the differences between publicly traded companies in different capital markets and find that investor protection – understood as investor's level of protection from expropriation from managers and controlling shareholders – is a useful way to understand other factors such as dividend policy and access to external finance. They reach the conclusion that strong investor protection is associated with effective corporate governance, dispersed share ownership, broad financial markets and efficient allocation of capital across firms. They further conclude that investor protection is a well suited proxy for the overall effectiveness of corporate governance. La Porta, Lopez-de-Silanes, Schleifer & Vishny (2001) further extend their research to include the valuation of corporations and find that valuations are higher in economies with better investor protection.

The question of whether the returns of emerging market equities can be explained using standard risk factors has been looked into by Hanauer & Linhart (2015). They use value and momentum portfolios and using a 4 factor model consisting of the standard 3 as well as "winners minus losers". They find only weak statistical significance for size and market premiums, strong significance for value and somewhat weaker significance for momentum. They also find that factor loadings constructed based on local factors have a greater degree of explanatory power than global factor loadings, suggesting that developed markets and emerging markets are not fully integrated into the global economy.

4. Market Efficiency

According to Roberts (1967) there are 3 forms of market efficiency: weak form efficient markets which suggest that prices offered by the market reflect all past information meaning that it is impossible to predict future prices based on past prices. Semi-strong market efficiency which implies that, not only do prices reflect past price history, but they also take into account all public information. This means that information such as mergers and acquisitions, share repurchases, earnings reports or other announcements about a company cannot be traded on as the large number of investors who all have access to the exact same information thus eliminating any opportunity of exploiting a mispricing. Strong form market efficiency implies that prices reflect all past, public and private information. This means that not even insider information will make an investor able to secure an excess return as even this information is already incorporated into the prevailing prices (Snopek 2011).

On the topic of market efficiency, Eugene Fama in 1970 said that a market can be said to be efficient when it "fully reflects" all available information. Malkiel (1992) expanded upon Fama's definition:

> *"A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. formally, the market is said to be efficient with respect to some information set (…) if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set (…) implies that it is impossible to make economic profits by trading on the basis of [that information set]."*

Malkiel's first sentence echoes Fama's, but he then goes on to say that market efficiency can be measured by inspecting a given market, revealing some information and then measuring the resulting price adjustments. if there is no price adjustment as a result of the information being revealed, then a market can be said to be efficient with respect to that information set. Finally, Malkiel says that market efficiency can be tested by measuring profits made by trading on information. If certain market players with access to information that is not publicly available outperform in terms of risk-adjusted returns, then markets can also be said to not be efficient. This definition has the advantage that mutual fund data is easy to acquire and analyze but has the drawback that it is not easily

observable which information mutual fund managers are trading on at any given time (Campbell, Lo & MacKinlay, 1997).

According to Fama (1970) the following conditions are sufficient but not necessary in order to ensure that a market is efficient: the market would have to be frictionless meaning that there would be no transaction costs associated with the trading of securities. Secondly, there would have to be costless access to all information for all market participants and lastly, all investors participating in the market would have to be in perfect agreement about how to interpret news about a given stock and how these news affect prices. Fama refutes the notion that any of these three conditions not being met would mean that markets are not efficient. To the first condition he states that just because trading on a given market is associated with large transaction costs does not mean prices do not reflect all past information. To the second point, Fama argues that, just because information is not universal but limited to a "sufficient number" of investors then markets may still be efficient. And to the third point: all investors not agreeing on the interpretation of market information does not mean that markets are inefficient unless there are some investors that are consistently able to be more correct than others (Fama, 1970). It can be argued, that these conditions put forth by Fama are not met since transaction costs do exist and likewise for information in the form of data feeds, media coverage of significant company events. And likewise institutional investors, with business analysts on staff are more likely than a private investor, to interpret publicly available information in such a way to arrive at an accurate estimate for the fundamental value for a company.

Fama (1970) comments on the empirical evidence of the existence of market efficiency and states that there is some evidence of dependence between successive returns in day-to-day data but that this in itself does not make markets inefficient since this is still consistent with the "fair game" model. Although he concedes that the movements of markets do not quite follow a random walk. About the efficient market hypothesis in the semi-strong form, Fama states that the evidence largely supports the EMH. On strong form market efficiency, Fama states that, while there are some corporate insiders that have monopolistic access to information, the list is so limited as to not create too much of a deviation from the EMH.

De Bondt & Thaler (1985) state that there is significant evidence that portfolios made up of “loser” stocks outperforming those made up of “winners” and that this outperformance is often realized around January. This is a deviation from the weak form of the EMH since past returns should not have any effect on future returns.

Cohen, Jackson & Mitts (2015) look at the actions of company insiders in the time period leading up to company events and find that company insiders are able to realize abnormal returns that cannot not be attributed to random chance. This violates strong form of the EMH since it means that private information is not reflected in prices and that there is a group of players in the market that have special access to information that is not adequately factored into stock prices.

If we accept the EMH then any mispricings will be eliminated as soon as new information becomes available and prices update near instantly. Under these circumstances, it is impossible to beat the market in the long run and the most efficient answer will be to capture the market return instead by engaging in passive investing such as in an index fund. If we say that the efficient market hypothesis does not hold on the other hand, then that means there are some areas of the market that are priced incorrectly and that returns that are in excess of the market return can be attained as part of an active investment strategy (Snopek, 2011).

Grossman and Stiglitz (1980) on the other hand, take a dissenting view and argue that in a market divided between informed and uninformed investors, when prices reflect all information, then the returns of the two groups of investors are the same but the informed investors are not being compensated for the costly acquisition of information. They argue for an equilibrium level of disequilibrium. In this system, when markets are efficient informed investors are no longer incentivized to pay for information, since they know they cannot do better than the uninformed investors. This causes the market to return to its inefficient form and an opportunity arises once again to secure a return that is in excess of the cost associated with the acquisition of information at which point the cycle begins again (Grossman & Stiglitz, 1980).

This raises the question of, If everyone invested passively then how would markets be able to remain efficient? Since the continued efficiency of markets depends on active investors “ironing out” the

mispricings through their transactions, without active investors, markets would become less efficient. But if markets are already efficient, then why are investors paying asset managers large sums of money in fees? It seems intuitive that not all markets everywhere are efficient at all times since then there would never be any incentive to engage in active investing since prices already reflect all information you could ever be able to collect (Pedersen, 2015).

Grossman and Stiglitz (1980) have shown that abnormal returns exist when there are costs associated with the collection and gathering of information and that the magnitude of these abnormal returns decrease as markets increase in size and liquidity. It is because of these reasons it is interesting to look at emerging markets since their underdeveloped state makes it conceivable that they could be more susceptible to market inefficiency. Furthermore, if there is a lack of regulation in the area of accounting standards for instance, this could mean that, Grossman & Stiglitz' informed investors might have an advantage in understanding the full scope of the lack of investor protection and will be able to correctly interpret information that is publicly available. In other words, inadequate corporate governance may lead to financial statements that are misleading due to various creative accounting tricks. This would effectively mean that investors have a more difficult time securing reliable information, thus making the market less efficient. If we accept Grossman & Stiglitz' theory of market efficiency, then that would suggest that if corporate governance is underdeveloped this could mean a breach of the EMH. Whether this less efficient proliferation of information affects stocks markets in any quantitatively appreciable way is what I intend to investigate in this thesis.

4.1 The Behavioral Finance perspective

Despite the definition of market efficiency given above, we know that markets do not always fully reflect all information available and that mispricings do exist on occasion. Behavioral economist Robert Shiller states that the reason for market inefficiency is due to a number of biases that humans are prone to by nature and which do not cancel out in the aggregate (Pedersen, 2015).

One bias humans are prone to is the overconfidence bias. Humans have a tendency to attribute success to their own skills while failures are attributed to factors outside of their control or simple unlucky happenstance. This bias affects decision making and does not correct itself as people are locked into their beliefs about their own ability. This bias has been shown to be more pronounced among experts of a given field such as for instance institutional investors trading on a stock market (Odean, 1998). Regret avoidance is when people are more concerned with avoiding losses than with securing gains. This manifests in a kink in the value function at a given reference point since people experience the negative feeling of the loss more powerfully than the commensurate positive feeling of the gain. This can lead investors to avoid selling stocks that have gone down after having bought them in order to avoid the bad feeling of realizing a loss and conversely to sell stocks that have increased in value to avoid regret if the stock should depreciate again in the future. Confirmation bias is the ability of people to ignore evidence that goes against what they believe and to give too much credence to the things that supports their own point of view. Anchoring has in studies been shown to manifest when people are asked to answer some quantitative question and use a value as a starting point for working out their own estimate even when this value may have been arbitrarily chosen. In a stock market context, when people let past stock prices or stock prices in other territories inform their own decision about the value of an asset (Shiller, 1998).

The various behavioral biases displayed by participants in financial markets sometimes opens the door for rational traders to what is known as arbitrage. An arbitrage trade is a risk free trade after transaction costs, wherein a trader takes advantage of two securities which gives the rights to the same set of cash flows but have different prices. Arbitrageurs earn a positive profit on average and arbitrage trading thus has a stabilizing effect on financial markets because of its ability to eliminate mispricings. This stabilizing effect can for instance occur when there is a profit motive for traders to buy shares that are undervalued and sell shares that are overvalued, thus bringing stock prices more in line with their fundamental value. However, even though in theory arbitrage trading is risk free, the viability of these trades is limited by the risks and the costs involved. This is due to the fact that, even though a share is mispriced, the behavioral biases of other traders may cause the share price to drift even further away from fundamental value (Schleifer & Vishny, 1995). It can be argued, that the

existence of arbitrage strategies is because certain strategies are loaded on certain price risks. E.g. carry trading which on average has positive return but has very negatively skewed tails on their profit and loss distribution. It is comparable to selling insurance against extremely adverse events or selling out of the money put options (insurance against the market crashing). On average you will make money but the profile of cash flows is highly undesirable in the bad state of the world. The existence of arbitrage is not itself evidence of market inefficiency, it is compensation for risk.

4.2 Momentum

Momentum investing, also known as trend-following investing is defined by Lasse Pedersen (2015) as:

"buying securities that have been rising while shorting those that are falling"

Momentum is the phenomenon in stock data, where stock prices that have been rising tends to continue to rise and prices that have experienced a fall tends to continue to fall. When talking about momentum, the financial literature is talking about one of two things: cross sectional momentum which means looking at the relative outperformance of stocks over a time period and structuring a portfolio based on that. And time-series momentum which means looking at each stock isolated and going long or short based on its performance over a time period irrespective of performance relative to other stocks (Moskowitz et al. 2011). Unless otherwise stated, references to momentum in the financial literature is referring to cross sectional momentum.

Asness et al. (2014) find an abnormal, annual return of a momentum strategy of 8,3% in excess of market returns based on a sample of US stocks from 1927-2011 and also find evidence of momentum in equities going back all the way to the year 1801. Jegadeesh & Titman (1993), Based on a sample of American equities from 1965 to 1989, manage to produce an abnormal return of approximately 12% annualized compared to holding the market.

Interestingly, the opposite pattern can also be observed in stock data, meaning that so-called contrarian trading strategies of buying the losers and selling the winners has also been shown to

produce abnormal returns, although this strategy is viable at different time horizons (Pedersen, 2015). While momentum strategies are profitable in the medium term for 3-12 months investment horizon, contrarian trading strategies have been shown to be profitable in the short term (week or single month basis), and in the long term of 3-5 years or longer (Conrad & Kaul, 1998). These strategies have been shown to do well in extreme markets because of the fact that when markets undergo wild fluctuations it does not happen overnight but rather happens over months or even years (Pedersen, 2015).

There are a number of different schools of thought as to the cause of the momentum phenomenon in stock data. There is the behavioral model which points to initial under reaction and delayed overreaction as the causes of the momentum phenomenon. The initial under reaction theory states that momentum is caused by the market's inability to include new information in a timely manner leading to an initial under reaction when faced with new information. This under reaction can be caused by a number of biases one of which is the "anchor effect" since investors base their views of a stock on historical values and have trouble adjusting those view in the light of new information. Regret avoidance is another explanation for initial under reaction since it creates a sales pressure on stocks that are performing well and, conversely, to hang on to losers in the hope that they will make it back to break-even and not sustain a loss which prevents stock prices from adjusting downwards.

Delayed overreaction is the second half of behavioral model's explanation for momentum and one of the hypothesized reasons for it is that investors are prone to herd behavior and when they observe that one stock has been increasing for a while they choose to jump on the bandwagon and to make the assumption, that the direction of recent realized returns will continue into the future, something that is also called feedback trading. Delayed overreaction can also be explained by confirmation bias, where investors will look for proof for the beliefs they already hold and ignore proof to the contrary. An investors making the observation that a stock has been increasing (decreasing) in value might see this as the final proof he needed that a certain stock was undervalued (overvalued) which then causes the trend to continue. The trend finally ends once the market realizes that a trend has carried the prices too far away from fundamental value resulting in a mean reversion, something which usually

happens after 3-5 years (De Bondt & Thaler, 1985). The reversal in the stock price is only partial since the initial underreaction part of the trend does not reverse while the delayed overreaction does (Pedersen, 2015).

There is also the risk premium theory of momentum which states that momentum is actually a compensation for the added risk that companies experiencing growth are subject to. Growth can be difficult for companies, since with growing demand for a product, there is a growing strain on the cash flows of a company. Tying up liquidity for production capacity and increasing inventory can bring a company to the edge of its operating credit, and as the number of customers goes up increase in accounts receivable from customers can further exacerbate the cash flow situation, both of which lead to impairment of the company turnover ratios (Asness et al, 2014). Growth can also be a liability if the continued quest for more growth forces a company into new ventures or new markets that its employees does not have the expertise to navigate competently (Forbes.com, 1, 2013). In addition to this, momentum may also actually be a risk premium in the sense that it is a reflection of an increased discount rate. This increase, stems from the fact that companies undergoing heavy growth, may be exhausting its list of positive net present value projects it can undertake and is forced to take on riskier business ventures to sustain continued growth (Asness et al, 2014). The risk premium theory of momentum is tempting as an explanation for growing companies, but it has major issues in explaining momentum in prices of falling stocks.

Non-profit seeking behavior of large investors in the market is another possible reason for initial under reaction. For instance, balance funds sometimes mechanically adjust their portfolio to comply with a mandated stock/bond balance by selling stocks and buying bonds whenever stocks are outperforming and vice versa (Pedersen, 2015). The pattern of flows of capital into mutual funds and hedge funds is also a possible explanation since investors investing in funds will often pull money from those funds that our underperforming which will prompt the portfolio manager of said fund to reduce their position in underperforming assets – a behavior that further enforces the trend (Pedersen, 2015).

Shleifer et al. (1990) discuss what they refer to as “positive feedback trading”, which is essentially the same as momentum, and state that once a positive feedback loop starts, for whatever reason, it effectively creates more volatility in estimates about fundamental value. Irrational investors desire to “jump on the bandwagon” which then further destabilize the market. Under this model, momentum can be explained as returns realized by rational investors who acknowledge that prices are disconnected from their true fundamental value, but are expecting to be able to buy high and sell even higher. This entry of rational investors adds to the lifespan of the positive feedback loop. Rational investors will then close their position when they estimate the lifespan of the trend is at an end which then ultimately stabilizes the market and brings the stock price back in line with fundamentals.

4.2.1 Momentum as a proxy for market inefficiency

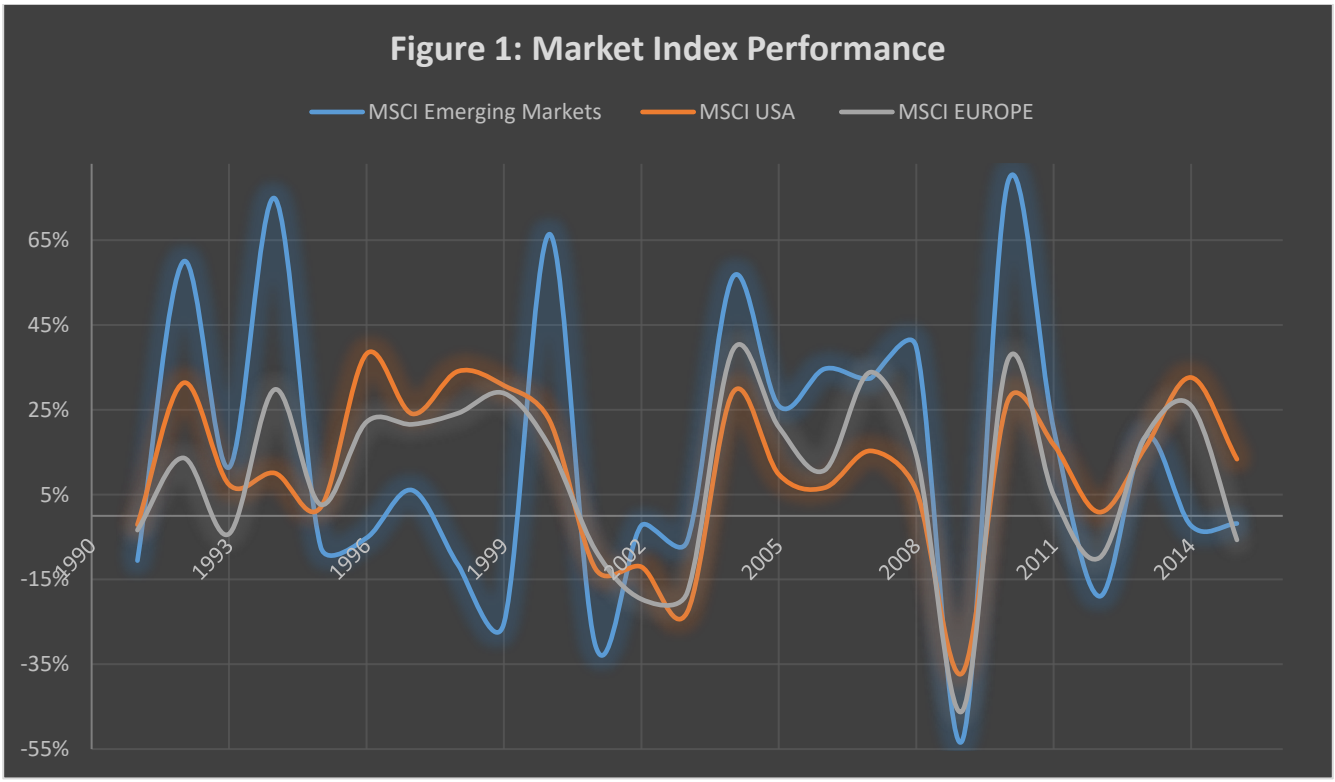
Unlike the other traditional asset pricing factors price-to-book (HML) and market capitalization(SMB), momentum is unique in the sense that it cannot, according to most theoreticians, be attributed to risk. SMB can be explained as a compensation for the fact that small companies tend to be less diversified and thus are more sensitive to adverse financial events and their stocks are typically less liquid. HML premium can be argued to be compensation for companies that – all things being equal – are closer to bankruptcy because they have run into financial hardship or the market is expressing doubt about their future earnings (Borchert et al, 2003). If one does not accept the theory that momentum is compensation for risk that I presented in chapter 4.2, then it is more reasonable that momentum is caused by behavioral biases and that it therefore would not exist in a perfectly rational market.

Alternatively, one could have used certain trading strategies typically used by hedge funds like pairs trading where you look at discrepancies in the pricing of different classes of the same shares and take long/short positions based on these discrepancies and wait for the prices to converge. Or, I could

have looked at company acquisitions and how profitable it is to invest in companies that are slated to be the target of these deals.

But ultimately, I chose momentum to be a proxy for market inefficiency as it is an interesting deviation from both weak form and semi-strong form of the efficient market hypothesis since it contains both a reaction to new information and a trend over time. Furthermore, the study of momentum is linked to the study of stock bubbles and the "greater fool" theory of stock picking and it is interesting to ask the question of how susceptible to bubbles a population of investors are on a national level.

5. Emerging markets



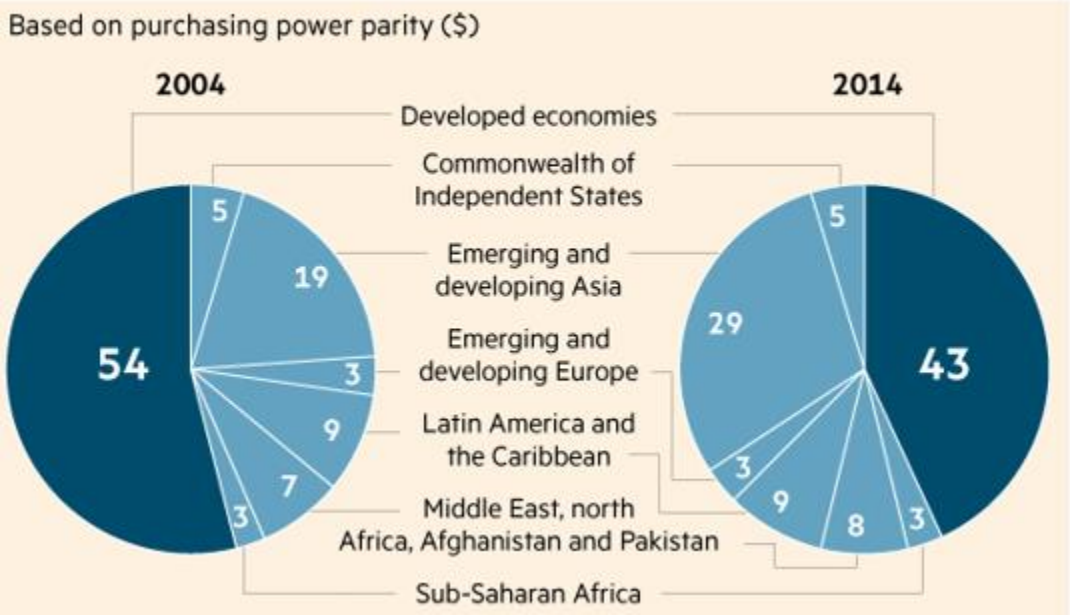
Source: Datastream

Table 1: Market Index Performance

	MSCI Emerging Markets	MSCI EUROPE	MSCI USA
Total return	14,0%	10,0%	11,5%
Standard deviation	34,5%	20,6%	18,8%
Sharpe ratio	0,41	0,49	0,61

As can be seen from the above graph and table, emerging markets have superior returns when compared to developed markets, but are not superior in terms of the Sharpe ratio. The term emerging market is bandied about a lot in financial literature, but it generally means countries wherein there is an increase in foreign investments, less developed infrastructure, which is in a transition from a closed economy to a growing one and a country that has a younger population (Thebalance.com, 1). In the following, I will follow the MSCI emerging market index as a way to determine what constitutes an emerging market. The description "emerging market" covers about 57% of the world's nations and encompasses economies wherein there is a low level to middle level of income but which typically have a high level of growth.

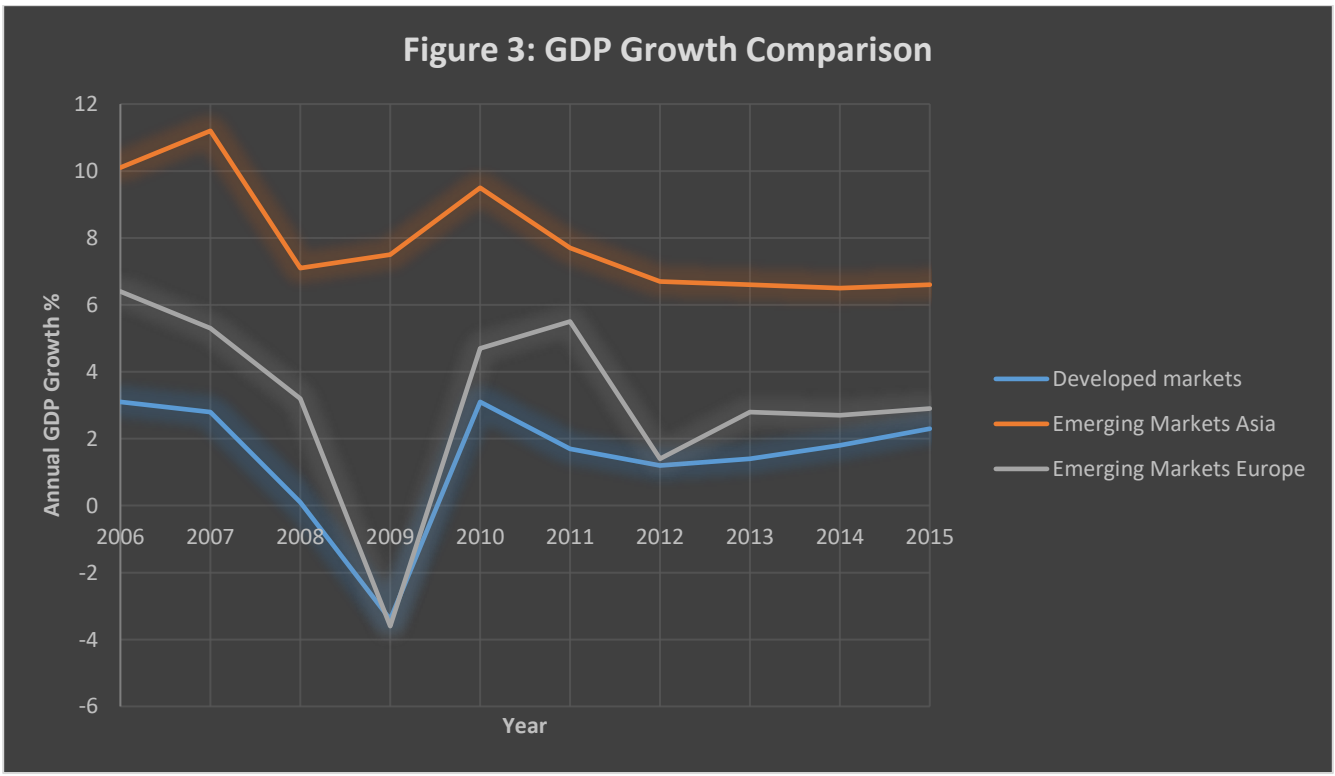
Figure 2: Share of World GDP



Source: ft.com, 1

As evidenced from the above, emerging markets are something investors are forced to acknowledge. Gone are the days where an investor could gain access to more than half of the world's economic output by investing solely in the developed world (Gaeta, 2012), a change brought about by the many years of much higher growth rates in emerging economies.

From the point of view of investors, emerging markets represents an opportunity to invest in an asset with low correlation to the stock markets of the developed world without having to pay 2 and 20 for alternative funds like absolute return products or private equity. Indeed, for an investor interested in emerging markets, great care must be taken to correctly distinguish those markets worth investing in from those that are still too unstable (Gaeta, 2012). Markets that are emerging can be classified based on their size or growth of capital markets in order to rank their relative attractiveness, with further focus placed on factors such as accessibility, regulations, liquidity, size and transparency to attempt to determine the markets which are expected to generate high incremental GDP growth in the future and thus be attractive objects of investment (Gaeta, 2012).



Source: gfmag.com, 1

Classic examples of the term include the BRICS countries (Brazil, Russia, India, China, South Africa). Many emerging markets demonstrate a desire towards creating functioning financial infrastructure for domestic as well as foreign investors through for instance economic liberalization as a means of creating functioning equity and debt markets (Vishwanath, 2009).

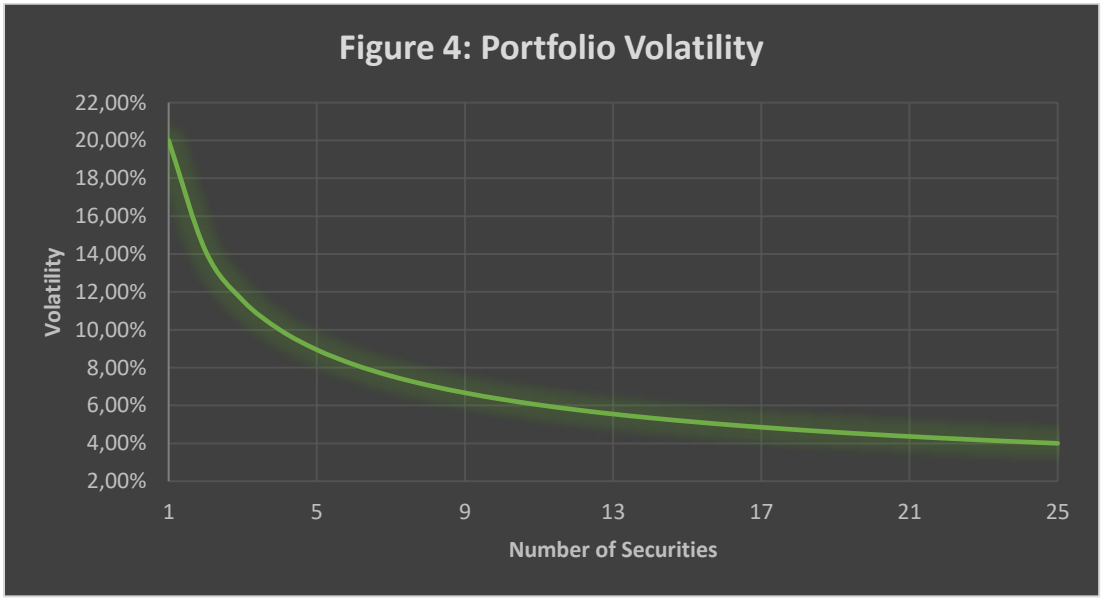
Markets beyond the classical groupings of emerging markets are often excluded because they do not have functioning stock markets or their capital market is deficient in some other way. These markets are often called "frontier markets" so there are really two subgroupings within the term developing markets: investible emerging markets and less investible frontier markets (Gaeta, 2012). There are 21 markets classified as emerging with nations such as China, India, Brazil, Russia, Peru, Malaysia, Singapore, Indonesia, and South Africa falling into this category. Common for this group is that they have had about 15-20 years to grow their economy (Hale, 2012). The other group is frontier markets which are still in a more nascent period in terms of the development of their financial markets and have much lower level of capitalization and are often dependent on some form of resource extraction like oil. There are 34 nations classified as frontier markets including many African and middle eastern nations as well as nations such as Sri Lanka, Vietnam and Bangladesh. The amount of time it takes a frontier market to achieve the rank of emerging market depends on factors such as liquidity and the growth of local capital markets as well as on whether the country is able to maintain a current account surplus and the nation's industries' ability to drive growth through exports. As of 2012, the 21 emerging markets represented a combined $21 trillion of GDP while the 34 frontier markets represented a combined $3.7 trillion (Hale, 2012).

Further subdivisions can be made into pre-emerging, emerging, established and mature with Vietnam and Russia would be examples of pre-emerging, South Korea, India and Thailand can be considered emerging, Singapore and Hong Kong are established and the USA, western Europe and Japan are mature markets (Vishwanath, 2009). In this thesis, the term emerging market will be used interchangeably about any nation with a level of income lower than that of the US, Western Europe and Japan.

Saving rates are another way emerging markets are distinct from the developed world. For various reasons the peoples of the emerging world tend to save a greater portion of their earnings. This is largely due to the fact that the lower average age of the population of the developing world, means that many people are just now entering the work force or will do so in the near future. Furthermore, in the example of China, there has long been a cultural tendency to save up for future generations (Mobius, 1994). The higher savings rate is beneficial, because the added savings means that more capital is available for investments into replacing the depreciating part of capital stock as well as additional investments, something which leads to economic growth (Colorado.edu, 1).

5.1 Diversification opportunities

In portfolio theory, risk is defined as the variance of a portfolio's historical returns. When evaluating the performance of a portfolio, one must look at both the returns and the risks realized. It is very likely that a portfolio yielding high returns has a large amount of variance in its returns. A way to achieve lower portfolio risk is to invest in different investment objects that have low correlation between market movements (Mobius, 1994).



The effect of diversification on a portfolio is part of the reason emerging markets are a desirable investment object. fundamentally, risk can be decomposed into two parts: systemic risk which denotes the risks that are present in the economy at large, and idiosyncratic risk which denotes risk factors that an individual stock is subject to. Diversification works because the prices of different elements in a portfolio do not move exactly together, so the idiosyncratic risk is reduced. This effect can be acquired by diversifying into assets with less than perfect correlation, in fact, the lower the correlation the larger the beneficial portfolio effect (Brealey, Myers & Allen, 2011).

Below can be seen the correlations between widely used European and American market indices respectively, with a number of indices representing the stock markets of part the developing world. It is worth noting the low correlations of for instance the S&P 500 with India of only 0,1 or Brazil of only 0,33. For Europe the correlation with Indian stocks of only 0,29 is noteworthy.

Table 2: Correlation matrix of Market Indices

Market Index Name	S&P Europe 350 USD	MSCI BRIC USD	MSCI China USD	MSCI India USD	MSCI Brazil USD	MSCI Russia USD
S&P Europe 350 USD	1	0,72	0,63	0,29	0,4	0,57
MSCI BRIC USD	0,72	1	0,88	0,42	0,73	0,64
MSCI China USD	0,63	0,88	1	0,3	0,4	0,35
MSCI India USD	0,29	0,42	0,3	1	0,18	0,13
MSCI Brazil USD	0,4	0,73	0,4	0,18	1	0,57
MSCI Russia USD	0,57	0,64	0,35	0,13	0,57	1

Market Index Name	S&P 500 USD	MSCI BRIC USD	MSCI China USD	MSCI India USD	MSCI Brazil USD	MSCI Russia USD
S&P 500 USD	1	0,61	0,67	0,47	0,33	0,1
MSCI BRIC USD	0,61	1	0,88	0,42	0,73	0,64
MSCI China USD	0,67	0,88	1	0,3	0,4	0,35
MSCI India USD	0,47	0,42	0,3	1	0,18	0,13
MSCI Brazil USD	0,33	0,73	0,4	0,18	1	0,57
MSCI Russia USD	0,1	0,64	0,35	0,13	0,57	1

Source: Morningstar Direct. The correlations are computed based on 3 years of data and using net returns.

In some cases, there may be a political desire to manipulate stock markets. Politicians often respond to the complaints of investors, and when these are complaining about stock markets, politicians will sometimes respond by taking certain steps to prop up the markets. They may for instance resort to such methods as using government controlled banks or mutual funds to buy up shares (Mobius, 1994). Another method that may be utilized by the governments of emerging nations is what was

seen in China in early 2016 where the government had to respond to an increase in stock market volatility, they dealt with this by putting a ban on investors with more than a 5% stake in a company selling shares outside of private deals (Centerfinplan.com, 1). Such government interference in stock markets can disrupt the formation of fair prices since the market itself is not allowed to reach its own equilibrium price. The risk for investors is, that if local governments are not able to create a legislative framework that helps to ensure minority investor protection, local stock markets will not be seen as a safe place to invest your retirement fund but rather as a gambling den (Mobius, 1994).

One thing that is needed in emerging markets is the establishment of more powerful and specialized securities regulating organizations to facilitate the development of equity market development. Financial reporting, fair and timely issuance of, for instance, rights issues and bonuses, transparency of trading and stricter enforcement of contract law (Mobius, 1994).

5.2 Investor protection within emerging markets

> *When an investor chooses to invest in a given company, it gives him or her certain legal rights. Rights to dividends, to vote for directors, to call and to participate in shareholder meetings, to subscribe to new security issuances, to sue directors and so forth. when the enforcement of private contracts is difficult in a given nation due to shortfalls in the rule of law, it can have wide reaching effects for capital markets (La Porta et al., 1999).*

Emerging markets are typically markets wherein the rule of law only exists to a limited degree compared to the developed world, and where the enforcement of it in terms of registration, prosecution and conflict resolution is often subject to the whims of local business interest and where the legal process as a whole can be very uncertain. This is caused by the fact that deeply ingrained behavior patterns as well as cultural norms are not aligned with government legislation which come to be seen as more of a guideline than a rule book (Gaeta, 2012).

While factors such as growth and development are often regarded by investors as being the most important when choosing which emerging market to invest in, legal pitfalls present in a given country are not evident from the traditional macroeconomic key figures. These typical measures do not capture a market's commitment to supporting fair business undertakings on an institutional level, the freedom of contract or the freedom of capital flows. Indeed, the ability of investors to execute, protect and exit investments without fear of expropriation should be viewed as one of the main factors that differentiate investor-friendly emerging markets from high risk markets (Gaeta, 2012). Problems can exist even in those emerging markets with relatively well functioning stock markets where the buying and selling of a stock is possible in an orderly manner and where the eventual repatriation of funds is possible.

Problems can still exist at the company level where funds are diverted away from the business due to deficient legal framework conditions, diverting part of the earnings away from the investor. Issues like licensing, supply, operation and distribution all place a huge demand on a country's legal system to oversee the undisturbed business operations and protect investors. Failures in investor protection can lead to additional costs for investors in the form of bureaucracy, legal disputes or contract renegotiation. When operating in emerging markets, the settlement of these kinds of issues will often prove to be expensive and time consuming process as the judgement of local administrative and justice systems are often subject to cronyism and cannot be counted on to offer objective legal rulings (Gaeta, 2012).

In order for the stock market of a given nation to be a viable object of investments it needs to have both a functioning financial system that facilitates trading and uninhibited fund flows and in addition it needs a rule of law that is sufficiently developed to enable the smooth resolution of legal disputes. Some emerging markets operate under an informal economy while others have started the shift into a formal economy where there is an established rule of law under the administration of the government and the court system. In these markets local interest may still affect business operations, but in this situation it is possible to seek redress without having to rely on interpersonal relationships with local influential players (Gaeta, 2012). As a foreign investor in a frontier market, you are seen as

an outsider and as such there is no social stigma in ripping you off and even if you have a legal team assisting you and laws exist that support your case, these may not be adequately enforced. This places a great deal of emphasis on allying yourself with the right group of locals that can assist you and whom people will be more hesitant to rip off. Choices like who to pick as your business partner, investment target and business focus become very important in protecting your investment (Gaeta 2012).

While it is largely true that sometimes profitable investments can be realized in markets with questionable legal infrastructure, the fundamental shortcomings cannot be ignored and it stands to reason that one of the main parameters to consider when investing in emerging markets is the functionality of a legal framework that can protect investor's interests. This makes an economy investible and allows for a high quality stock investing environment, not high returns (Gaeta, 2012).

La Porta et al. (1999) state that there is are large differences in ownership concentration, access to external financing as well as the breadth and depth of capital markets of different countries and that part of the explanation for these differences lies in investor protection for both shareholders and creditors. Investor protection, which is an important element of corporate governance, can be understood as the level of protection from expropriation from both managers and controlling shareholders. This threat of expropriation can take many forms: for instance "asset stripping" wherein the insiders of a company will sell existing assets cheaply to another company that is under their control. "Transfer pricing" is another example which means that the produced output of a firm is sold at prices that are below market price. Or the powerful company insiders will engage in "investor dilution" which will dilute the value of stocks by issuing new shares to external companies they own. There are many other examples of expropriation such as nepotism, but, although many of these methods are strictly speaking legal, they all destroy value for minority investors and divert profits towards the established company insiders (controlling shareholders or managers).

Unlike employees and suppliers who continue to be valuable to the firm, investors depend on the rule of law to be protected from expropriation once they are invested in a company and vulnerable to having value expropriated. According to Jensen & Meckling (1976) the return of cash flows from

company projects back to investors is not something that can be taken for granted. According to La Porta et al. (1998), the legal rules governing investor protection exists on a spectrum where, on one extreme a country has no or close to no investor protection and powerful company insiders are able to expropriate a company's profits effortlessly. This state of total lawlessness is a situation a rational investor would never wish to place himself in unless the given company had a very trustworthy reputation. To more moderate cases, where investor protection is more developed, insiders have to resort to less efficient methods of expropriating value such as using intermediary companies which they can channel funds through. As investor protection becomes more and more extensive, the private benefit company insiders enjoy becomes less significant, at some point it simply becomes more efficient for insiders to pay out a general dividend. In other words, as investor protection improves through more extensive legislation, manager and controlling shareholder behavior improves and companies are able to acquire external financing on better, more consistent terms.

There are many different levels of rules and legislation that confer some kind of protection to investors: company, security, bankruptcy- takeover- and competition laws, stock exchange regulations and accounting standards. These, are enforced by market regulating entities, local courts or by market participants themselves. If rules are not enforced, mechanisms for external financing breaks down as controlling shareholders and company managers would have little reason to distribute profits to other shareholders and external investors would have no reason to invest as their rights were not protected, something that ultimately affects valuations (La Porta et al., 1999).

> *"On average, investors recognize a risk of expropriation, penalizing "firms that fail to contractually disclose information about themselves and to contractually bind themselves to treat investors well." (La Porta et al., 1999)*

The types of legal structures put into place in different nations has been shown to be derived from a few legal "families" with their roots in the countries that initially "invented them". Legal families such as English common law, German and French civil law and the Scandinavian system, have been spread across the globe through colonization, conquest or voluntary adoption. With English law being prevalent in all the former colonies of Great Britain, south east Asia as well as parts of Africa, French

law being used, in addition to France, in Netherlands, Belgium, Spain as well as Latin America. German law is used mainly in German speaking countries, but also in South Korea and Taiwan (La Porta et al., 1999).

The degree to which outside investors are protected varies across the legal families with English common law exhibiting the highest amount of stockholder protection, French civil law exhibiting the worst and German and Scandinavian law being in the middle of that spectrum but with better creditor protection (La Porta et al. 1999). The level of law enforcement is also different across the four legal families. Law enforcement is understood here as the efficiency of the judicial system, the lack of corruption as well as the quality of the employed accounting standards. Since the origins of these legal families predate the invention of financial markets, it cannot be said that legal rules have been shaped by markets - rather - the preexisting legal framework in a given country has had a hand in shaping the financial market in that particular nation. So in other words, the content of the law and therefore the level of investor protection, is highly correlated with the legal family that shaped the legal system of a given nation. (La Porta et al. 1999).

One explanation is that rulings in common law nations are made based on legal precedents as well as determining whether situations are in concordance with legal principles such as fiduciary duty or fairness. In the example of investor expropriation this means that a judge will weigh in the notion of fairness when faced with an unprecedented legal situation. This will cause expansion of legal precedents and the fear of this expansion will cause company insiders to limit their expropriation. Unlike in common law countries, nations utilizing the civil law system do not go beyond codified statutes and company insiders who find a way to expropriate wealth from outside investors that are not formally defying the law, can do so without fear of an adverse legal ruling (La Porta et al., 1999).

Judges in common law nations initially have more power to influence investor protection. This fact stems from historical differences in the relative power of the ruler and property owners. Due to incidents in the 18th century in England where the crown lost control of the courts, there is a lot of focus on protecting property owners, a focus which later on was extended to protecting investors as

well. In contrast, protection of property owners was a more recent development in France and Germany's legal systems where judges are, relatively speaking, less deferential to legal precedents.

La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) measure the quality of various aspects of the efficiency of law enforcement for both shareholders and creditors. They use these findings to craft indices which are a way to quantify investor protection. It is worth asking the question of whether the differences that exist between countries in terms of legislation is able to explain differences in the market efficiency of markets.

6. Empirical analysis of market efficiency

In this section I will empirically test for market efficiency in emerging markets. As proxies for market inefficiency I have selected return autocorrelation of stock indices, momentum in the cross-section of stock data and momentum in the time-series of stock data. starting off, I will investigate whether equity indices follow patterns of random movement.

6.1 Data

I examine equities from a group consisting of 15 different emerging market in the time period from January 1990 until April 2016. The data originates from Datastream and uses return indices on a monthly basis. The study does not take into account transaction costs or market impact costs. The analysis includes not just companies that are active today, but also ones that have since been delisted, for whatever reason, to ensure there is no survivorship bias in the sample. Only common stock has been used in the data sample. For my study of randomness and autocorrelation, total return indices of the relevant MSCI stock indices have been used.

Where appropriate, a relevant 1-month interest rate relevant to a given country have been used as a risk free rate. All calculations have been done as base currency. A complete list of the countries I have included in my sample can be seen from the below list:

Table 3: Data Sample starting dates

Country	Starting date
Brazil	01-09-1995
Russia	01-08-1997
India	01-06-1992
China	01-04-1994
Philippines	01-01-1992
Mexico	01-08-1991
Turkey	01-08-1991
Indonesia	01-08-1992
South Africa	01-08-1991
Thailand	01-05-1992
Vietnam	01-03-2008
Malaysia	01-08-1991
Poland	01-10-1996
South Korea	01-01-2000
Taiwan	01-06-1993

Note that for my analysis I have attempted to looked at stock data going back to January 1990 and up until April 2016 but shorter periods have been used when such as in the case of Russia and Poland where, naturally, there is no stock data before a few years after the fall of the Soviet Union.

6.2 Test of market efficiency

In the following I will take the raw data mentioned in above chapter and transform it into results that can be interpreted as proxies for market efficiency. But first, I am going to explain what is meant by a random walk.

6.2.1 Random walk theory

The random walk theory states that stock prices are random and that there is no way to predict the movements of stock prices in the future. Essentially, the theory states that stock prices tomorrow are equal to stock prices today plus a random shock that cannot be forecasted. Prices today would follow the pattern:

$$P_t = P_{t-1} + u_t \quad (1)$$

Where u_t is a white noise error term with a mean of zero and a variance σ^2. From this it follows that prices in future time periods would be:

$$P_{t+1} = P_t + u_{t+1} \quad (2)$$

And:

$$P_{t+2} = P_{t+1} + u_{t+2} = P_t + u_{t+1} + u_{t+2} \quad (3)$$

The variance of this process is:

$$Var(P_t) = t\sigma^2 \quad (4)$$

Which means that variance increases indefinitely as the time horizon increases. Our expectation of future stock prices P_t is the initial stock price P_0 plus the sum of random shocks in the interim. Because of this, the impact of price shocks is never negated and the impact of shocks are maintained within the stock price indefinitely (Gujarat, 1995).

6.2.2 Run test

A run test is a test that enables you to test for randomness in an evenly spaced time series of data. it works by looking at the amount of “runs” which are continuous sequences of a certain outcomes in data, in this case, negative or positive excess returns on equity indices from the different emerging

markets in my sample. it is non parametric meaning that you do not have to have knowledge of the probability distribution of the variable you are examining. The run test works by looking at the amount of empirically observed runs in a data series and comparing that to the amount we would expect to see if the observations were independent of each other (Gujarat, 1995). If the observed outcome deviates from what we would expect, then we are left to conclude that return patterns of that particular market are non-random.

In the time-series of an equity index, if market stock returns are independently distributed, we would expect to see the amount of runs as indicated by this formula:

$$E(R) = \frac{2N_1N_2}{N} - 1 \quad (5)$$

Where E(R) is the amount of runs we expect to see, N is the total amount of observations in the time series and N_i is the amount of observations of outcome i. In this case, there are no draws, so there are only two possible outcomes: positive (1) and negative (2) returns. Again, assuming independence between observations, the variance of the amount of runs in the sample is:

$$\sigma_R^2 = \frac{2N_1N_2(2N_1N_2-N)}{(N)^2(N-1)} \quad (6)$$

Standardized z-statistics can be taken using the formula:

$$Z = \frac{R-\mu}{\sigma_R} \quad (7)$$

Where R is the observed number of runs and μ is the number of runs one could expect if the observations are independent and normally distributed. When the z-statistic is computed, I can test for the probability of getting that value given the relevant cumulative probability distribution. And with this I can test the null hypothesis H_0: R = μ which tests whether the time series is random against the alternative hypothesis of H_a: R ≠ μ which would mean that the time series is not random. This is conceptually the same as constructing a confidence interval around the mean of ± 1,96σ where 1,96 for a two tailed test is equivalent to a 5% significance level. If the observed number of runs is within the confidence interval, I am unable to reject the null hypothesis of randomness and if it is outside the

interval I reject the null hypothesis and conclude that the time series, for whatever reason, does not show signs of white noise (Gujarat, 1995).

My findings for monthly returns, sorted by p-value, can be seen from below table:

Table 4: Runs test results - monthly data

Country	Positive periods	Negative Periods	Expected # runs	Observed # runs	p-value
China	143	136	140	120	0,01428
South Korea	161	154	158	138	0,02110
Brazil	185	130	154	135	0,02948
The Philippines	170	145	158	139	0,03553
Indonesia	173	142	157	147	0,25560
Thailand	166	149	158	148	0,25568
Taiwan	161	154	158	149	0,28734
Poland	139	140	140	132	0,30801
Malaysia	172	143	157	149	0,35264
Mexico	193	122	150	143	0,37251
Russia	141	114	127	124	0,69674
Vietnam	48	64	56	54	0,71887
South Africa	162	117	137	136	0,91457
Turkey	177	138	156	157	1,00000
India	148	131	140	144	1,00000

For the countries China, South Korea, Brazil and The Philippines, I reject the hypothesis that time series for equity indices follow a random walk at a 5% level of significance whereas for the rest of the countries I examine I fail to reject the null hypothesis of randomness. It is worth noting that, with the exception of India and Turkey, all nations have fewer runs than we would expect under the assumption of a random walk. This can be interpreted as runs having a long length and may be indicative of positive autocorrelation since returns continue with the sign they had in the previous period.

I conduct the same test for daily data and find different results which are viewable from below table. For the markets in my sample I am only able to find daily total return data from January of 2001 onwards so my findings from daily data is not completely comparable.

Table 5: Runs test results - Daily data

Country	Positive periods	Negative Periods	Expected # runs	Observed # runs	p-value
Vietnam	1143	1293	1214	1069	0,00000
The Philippines	1971	2008	1990	1847	0,00001
Indonesia	2023	1956	1990	1870	0,00014
Malaysia	2019	1960	1990	1875	0,00026
Mexico	2072	1907	1987	1886	0,00132
India	2033	1948	1991	1903	0,00547
South Africa	2040	1939	1989	1931	0,06470
Thailand	1919	2060	1988	1935	0,09241
Russia	2098	1881	1985	1953	0,31515
Taiwan	1925	2056	1989	1963	0,40311
South Korea	1999	1980	1990	1973	0,57992
China	2019	1960	1990	1977	0,67865
Turkey	2009	1970	1990	1979	0,71986
Brazil	1965	2014	1990	2000	1,00000
Poland	1946	2033	1990	2039	1,00000

In contrast with my investigation of monthly data, Brazil, China, Malaysia and South Korea now seem to exhibit a white noise pattern. for Mexico, India, Vietnam and Indonesia at 5% significance and South Africa and Thailand at the 10% level the opposite is the case, and these countries do not exhibit white noise in contrast with the findings of the monthly results. The vastly different results may be attributable to the difference in time period or it may say something about how randomness exists at different time intervals.

6.2.3 Autocorrelation test

Autocorrelations are computed using the following formula:

$$r_k = \frac{\sum_{t=k+1}^{n}(Y_t\bar{Y})(Y_{t-k}\bar{Y})}{\sum_{t=1}^{n}(Y_t-\overline{Y})^2} \quad (8)$$

Where r_k is how much successive observations correlate to observations k time periods apart. The autocorrelations of monthly returns with the month before it can be seen in the table below sorted by p-value:

Table 6: Return Autocorrelation (1st lag)

Country	Autocorrelation	Q*	p-value
Brazil	0,355	40,0471	0,0001
Indonesia	0,129	5,2935	0,0214
Russia	0,141	5,1222	0,0236
Vietnam	0,204	4,7901	0,0286
Philippines	0,007	4,6690	0,0307
Poland	0,116	3,8149	0,0508
Malaysia	0,102	3,3197	0,0685
Taiwan	0,090	2,5932	0,1073
China	0,080	1,8057	0,1790
Korea	0,072	1,6383	0,2006
Turkey	0,063	1,2448	0,2645
India	0,062	1,0987	0,2945
South Africa	-0,044	0,5331	0,4653
Thailand	-0,006	0,0127	0,9101
Mexico	0,003	0,0021	0,9634

The autocorrelation factor (ACF) tests for correlation between a time series and itself lagged k time periods. This is similar to taking the correlation between a time series of data and itself skewed one time period. It reveals if there is a consistent pattern of observations in one time period being dependent on observations in the adjacent time period. Like with the runs test, the existence of autocorrelation also indicates non-stochasticity since observations are not independent. In terms of non-random results, only the case of Brazil and the Philippines are consistent with my previous findings using the runs test in the previous subchapter.

I test for statistical significance of the 1 period skewed autocorrelation using the Ljung-Box Q* statistic which is defined as:

$$Q^* = n \sum_{k=1}^{h} (n-k)^{-1} r_k^2 \qquad (9)$$

Where h is the maximum lag being considered, r_k is the autocorrelation of the k'th lag and n is the amount of observations. This test statistic is compared to a chi-square distribution to find the critical

value for rejecting the null hypothesis of no auto correlation in the set of lags in a time series (Makridakis et al., 1998).

It can be seen from the results in table 6, that Brazil, Indonesia, Russia, Vietnam and the Philippines have positive autocorrelation lags significant at the 5% level indicating that each month is affected by the month that preceded it. For Poland and Malaysia, the same is the case at the 10% level.

In chapter 7 I investigate whether these autocorrelation lags can be explained by indices for investor protection to see if there is some statistical relationship between the countries that have nonrandom returns and those that have low protection for investors.

6.3 Cross-sectional asset pricing

To investigate whether momentum returns exist in emerging markets I estimate the coefficients to a number of asset pricing factors for each country using a variant of the Fama-Macbeth (1973) methodology of regressions. I chose the following model for describing returns in the cross section of stock data for each i company for 1, …, n in each of the time periods t included in my sample:

$$(R_{it+1} - rf_{t+1}) = \alpha + \beta_1 * LN(Size)_{it} + \beta_2 * LN(Value)_{it} + \beta_3 * Profitability_{it} + \beta_4 * Investments_{it} + \beta_5 * Momentum_{it} \quad \textbf{(10)}$$

Each month, cross sectional regressions of formula 10 are made and the resulting figures averaged across all time periods. With the resulting time-series standard errors, I run t-tests for the mean coefficients for the null hypotheses of β=0 for each of the j variables. The resulting coefficients will allow me to test whether the factors I have chosen for my model are significantly able to predict returns over the following month. The Fama-Macbeth method makes it possible to allow for the fact that factor coefficients may not necessarily be constant over time.

6.3.1 Data and variables

For my model, I am testing a modified version of the Fama-French 5 factor model where I omit the market premium variable since it does not make sense to test for this factor in the cross section since the independent variable for would be the same for every equity within a given time period. Instead I am adding a variable to measure momentum style returns, this variable is computed in the following way:

$$Momentum_t = \frac{RI_{t-1} - RI_{t-12}}{RI_{t-12}} \quad (11)$$

Where RI is the total return index meaning that it can be interpreted as a price index where dividends are reinvested and other corporate actions are accounted for. The reason for dropping the last month is twofold. 1: to ensure that the trading strategy is implementable and not reliant on trading signals that would only be observable when it is too late to act and 2: in order to avoid the short term mean reversions that exist in 1-month data (Conrad & Kaul, 1998).

Where return at time t (R_t) is defined as:

$$R_t = \frac{RI_t - RI_{t-1}}{RI_{t-1}} \quad (12)$$

And size is shorthand for market capitalization:

$$Size_t = Market\ Capitalization_t \quad (13)$$

If a small cap premium exists, this number will be negative and small cap companies will be outperforming large cap companies. The log of market capitalization is taken to create a “shrinking” effect so that extreme observations will be less extreme.

Value is defined the following way:

$$Value(t) = \left(\frac{BV\ Equity_{t-6}}{MV\ Equity_t}\right) \quad (14)$$

This factor indicates whether a stock has a low stock price compared to its book value of equity meaning it is a "value" stock or alternatively whether it is a stock that has seen stock price growth lately making it a "growth" stock. As with the market capitalization variable, the log is taken of the value variable. As this variable is made up partially of accounting data (book value of equity), a lag of 6 months is imposed to allow for the fact that 1: accounting data is not recorded continuously like market data and 2: that there is a lag between the date an accounting data value is applicable and when it is published as an annual report or semi-annual report. A similar approach is used for the two below variables Profitability and Investments that also are constructed based on accounting data, for the same reasons as the value factor.

Profitability (formula 15) is supposed give a sense of whether companies that are highly profitable outperform less profitable ones. As a measure of profitability, the key figure return on equity is used which is simply the profits a company is able to generate as a percentage of the book value of shareholder equity. For investment (formula 16), which is a measure of how aggressively a company expands, the growth rate of total assets is used. Companies that have high values for this factor might be more subject to empire building or some form of non-productive growth, but might also simply be quickly expanding. These two variables are defined as:

$$Profitability(t) = \ Return\ on\ equity\ (t-6) \tag{15}$$

And:

$$Investments\ (t) = \frac{Total\ assets\ (t-6)}{Total\ \ assets\ (t-18)} - 1 \tag{16}$$

The regressions are run as equal weighted, and the lower 20th percentile of the range of market capitalizations are eliminated from the sample to ensure that the regression is not dominated by micro-cap companies that would not be viable investment targets for most institutional investors. This approach, while not returning the same result as a value weighted regression, has the advantage that it does not place an overemphasis on a single enormous company or a handful of large companies while almost ignoring smaller companies. Since I have eliminated micro-caps from my

sample I assume that all equities are equally viable investment objects and therefore deserve to be equally weighted.

Once the cross sectional regressions have been run in each time period, the list of coefficients for each factor are then averaged resulting in one final result for each of the asset pricing factors for each country. More specifically, the coefficient values for β and α are estimated using the following formulas:

$$\hat{\beta}_j = \frac{1}{T}\sum_{t=1}^{T} \widehat{\beta_{J,t}} \tag{17}$$

And:

$$\hat{\alpha} = \frac{1}{T}\sum_{t=1}^{T} \widehat{\alpha_t} \tag{18}$$

The null hypotheses that the βs are actually zero is then tested and t-statistics are constructed and these values, in absolute terms, are compared to a t-table to determine whether they are statistically significant at a 5% level. The t-statistic values are computed by using the following formula:

$$\frac{\widehat{\beta}_j}{\sigma_{\beta_j}/\sqrt{T}} \tag{19}$$

And

$$\frac{\widehat{\alpha}}{\sigma_{\alpha}/\sqrt{T}} \tag{20}$$

Note, that we are able to calculate t-stat in this manner because we are assuming that estimates are independent so that one estimate does not affect another and identically distributed so that estimates are drawn from the same normal distribution throughout the time period included in the sample.

6.3.2 Results and interpretation

The computed factor coefficients can be observed from the below table:

Table 7: Emerging markets - Average factor coefficients.

	Brazil		Russia		India		China		Philippines	
Begin date	01-09-1995		01-08-1997		01-06-1992		01-04-1994		01-01-1992	
# of stocks	394		427		1226		2038		272	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Momentum	-0,0005	-0,051	-0,0041	-0,337	0,0075	2,880***	0,0028	-0,974	-0,0084	-1,065
Investments	0,0369	1,568	0,0300	1,98*	0,0029	1,090	0,0015	2,070*	0,0156	1,452
Profitability	0,0032	0,080	0,0778	2,521**	0,0741	5,290***	0,0360	3,474***	0,0410	1,804
LN(BE/ME)	0,0039	2,135*	0,0250	2,603***	0,0272	3,333***	0,0029	2,635***	0,0072	1,982*
LN(Size)	-0,0150	-2,982***	-0,0131	-1,971*	-0,0072	-4,609***	-0,0128	-3,862***	-0,0083	-2,881***
Alpha	0,1248	3,796***	0,1318	2,195*	0,0882	4,252***	0,1173	4,166***	0,0830	3,452***
	Mexico		Turkey		Indonesia		South Africa		Thailand	
Begin date	01-08-1991		01-08-1991		01-08-1992		01-08-1991		01-05-1992	
# of stocks	257		333		500		668		643	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Momentum	-0,0011	-0,292	0,0004	0,134	-0,0057	-1,532	0,0093	3,417***	0,0056	2,039*
Investments	0,0132	2,892***	0,0037	1,003	0,0144	2,350**	0,0009	0,486	0,0080	2,378*
Profitability	0,0655	4,766***	0,0212	2,528**	0,0583	7,603***	0,0086	2,650***	0,0338	6,657***
LN(BE/ME)	0,0125	3,876***	0,0098	3,852***	0,0128	5,119***	0,0039	2,383**	0,0112	6,971***
LN(Size)	-0,0032	-2,737***	-0,0032	-2,116*	-0,0050	-3,154***	-0,0060	-6,560***	-0,0048	-4,545***
Alpha	0,0324	3,694***	0,0506	5,029***	0,0764	3,527***	0,0529	7,438***	0,0454	5,309***
	Vietnam		Malaysia		Poland		South Korea		Taiwan	
Begin date	01-03-2008		01-08-1991		01-10-1996		01-01-2000		01-06-1993	
# of stocks	631		889		478		1023		809	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Momentum	-0,0042	-0,794	-0,0017	-0,308	0,0048	1,190	0,0075	2,935***	-0,0046	-1,214
Investments	0,0055	1,498	0,0017	1,743	0,0079	1,939	0,0079	2,703***	0,0105	2,880***
Profitability	0,0661	6,555***	0,0229	7,306***	0,0306	3,959***	0,0084	0,668	0,0577	7,019***
LN(BE/ME)	0,0121	3,796***	0,0070	5,952***	0,0118	4,983***	0,0047	1,129	0,0124	4,630***
LN(Size)	-0,0040	-2,619***	-0,0025	-2,686***	-0,0040	-2,326**	-0,0261	-3,141***	-0,0033	-3,456***
Alpha	0,0448	2,106*	0,0202	2,330**	0,0282	2,355**	0,3133	3,117***	0,0349	3,249***

Significance levels: *: 5%, **: 2%, ***: 1%.

I will start the analysis of these results by looking at the values for momentum which are visible from the below table:

Table 8: Momentum Coefficients

Country	Coefficient	t-statistic	p-value
South Africa	0,0093	3,42	0,0007
South Korea	0,0075	2,94	0,0034
India	0,0075	2,88	0,0040
Thailand	0,0056	2,04	0,0418
Poland	0,0048	1,19	0,2343
China	0,0028	-0,97	0,3299
Turkey	0,0004	0,11	0,9087
Brazil	-0,0005	-0,05	0,9586
Mexico	-0,0011	-0,29	0,7699
Malaysia	-0,0017	-0,31	0,7580
Russia	-0,0041	-0,34	0,7360
Vietnam	-0,0042	-0,79	0,4274
Taiwan	-0,0046	-1,21	0,2248
Indonesia	-0,0057	-1,53	0,1260
Philippines	-0,0084	-1,07	0,2876

In the cases of India, South Korea, Thailand and South Africa, highly statistically significant evidence of momentum predicting returns is found. South Africa is the country in my sample where returns in the following month can best be explained by momentum returns with an estimate of 0,0093. Using South Africa as an example, this means that if returns over the last 12 months (dropping the last month) increases by 10% for a given stock, the return for that stock over the following month will on average be 9 basis points higher. 9 basis points does not seem like a big effect but this is a monthly value while the hypothetical 10% is yearly. If you extrapolate this effect over the course of a year, then a long position in a share with 10% higher momentum return than a long position in a non-momentum share would outperform by 12*10*0,0093 = 1,116% yearly. The same pattern is present in India where the effect translates to 0,9% yearly.

These numbers are based on the very conservative example of a spread of 10% between two long positions. Since the spread between winners and losers can easily be imagined to be much greater than the 10% used here, we can instead imagine a self-financing long-short portfolio that goes long high momentum stocks (winners) and short in low momentum stocks (losers) with an average spread

of 50%, this would mean a monthly return of 0,47%. The higher the spread between winners and losers, then the more profitable a momentum strategy will be.

The rest of the countries I have analyzed do not exhibit momentum patterns that are statistically different from zero. This is somewhat surprising as it means that momentum in the cross section have no consistent explanatory power for predicting returns in these countries. It is however possible that this effect is present in shorter intervals but that the pattern breaks down when aggregated over time due to extreme observations caused by violent market events that create noise in the data or due to a too short time period such as in the case of Vietnam which only has sufficient data from 2008 onwards. The analysis of China was based on data of stocks from both the Shanghai and Shenzhen stock exhange, but the same overall pattern is evident when examining each of these exchanges individually.

There is a broad tendency for the emerging markets analyzed to exhibit a negative factor premium to market capitalization. All nations tested significant at a 5% level or greater with the exception of Turkey which is still significant at the 10% level. Simply put, this means that small capitalization companies on average exhibit higher returns than large capitalization companies. Since this predictor variable is log transformed it means that the coefficient can be interpreted as the increase in return in response to the logarithm of the fixed percentage increase in size over any baseline value of size holding other variables constant. Generally, the exposure to size is: $\beta(size) * (\ln(2) - \ln(1)) = \beta(size) * \ln(2/1)$. Using Brazil as an example with a size coefficient of -0,015 this means that the mean change in return from a 100% increase in market capitalization is $-0,015 * \ln(2) = -0,0104$. Put plainly, every time a Brazilian company doubles its market capitalization it decreases its monthly return by just over 1%.

This small cap premium may be compensation for the fact that the shares of smaller companies are less liquid meaning higher spreads between bid and ask prices or it may be compensation for the volatility that comes with small cap stocks due to them being less diversified. Another explanation is that a lot of mutual funds have clauses in their prospectus which prohibits them from owning more than a certain percentage of a given company. in the case of small cap companies this places an upper

limit on how many shares can be bought thus reducing buying pressure and leading to shares being undervalued (Banz, 1981). Small cap companies also have more uncertainty about earnings, a greater chance of bankruptcy (SSGA 1, 2016) and so it is natural that their shareholders expect a greater return on their investments. This effect was first described by Banz in 1981 who conducted his analysis on US stocks.

Figure 5: Performance of Market Indices

Investment Name	Cumulative Return	Annualized Return	Initial Value	Ending Value
FTSE Emerging Small Cap TR USD (Market Return, USD,	199,59%	9,12%	1,00	3,00
FTSE Developed Small Cap Ex US TR USD (Market Retur	160,83%	7,93%	1,00	2,61

Source: Morningstar Direct

As can be seen from the above graph of cumulative returns since 2004, the market index representing small capitalization companies in emerging markets yields higher returns than the index representing small capitalization companies in the developed world excluding the US. Drew & Veeraraghavan (2002) look at size premium in emerging markets with a focus on the Malaysian stock market and find that this effect, as well as value, is much bigger than in US equities. They further state, that this premium is not a seasonal effect and they conclude that this is a compensation for risk.

Without exception, all countries included in my analysis exhibit statistical significance for the value variable. This means that there is a clear pattern of those companies with a high ratio of book value of equity over market value of equity outperforming those with a low ratio. This is interesting because

this essentially means that you can earn a profit from buying the losers and selling the winners; the opposite of momentum. Although as I have already stated in chapter 4, mean reversion is profitable on a different time horizon than momentum investing.

In the case of India, which is found to have a value coefficient of 0,0272, this means that if we imagine the somewhat extreme situation of an Indian company that starts out with a book/market ratio of 1 and then the book value of equity doubles (or the market value halves) then, according to my model, this will mean an increase in return of 0,0272 * ln(2) = 0,019 or just under 2% a month.

My profitability variable is based on return on equity and in this study there is highly significant evidence for almost all nations displaying positive returns to return on equity. The one exception is the nation of Brazil which does not exhibit this pattern, which is curious since the variable is significant at the 99% level in all other countries. In my analysis of autocorrelation as well as runs test, Brazil also distinguished itself meaning that the country exhibits a large 1 time-period lag autocorrelation and is notably not random. All other significant coefficients are positive meaning that the companies that are able to generate a high net income compared to the shareholder equity are, on average, also the ones able to generate higher stock returns over the course of the following month.

The profitability variable is not a perfectly reliable data point since there are differences across industries that makes it difficult to compare the effect it has on returns. For example, the biotechnology sector historically has secured high returns on equity while companies in the mining industry or in agriculture typically has had low returns on equity (Stern NYU, 1, 2016). That being said, companies that have less volatility in their returns will typically have an easier time of levering up which compensates somewhat for the discrepancy. For instance, companies that operate within the real estate sector, which is a relatively low return industry, have easy access to leverage since the underlying asset of real estate makes for suitable collateral. This fact somewhat smooths out the problems with this data point concerning the differences between industries.

The investments variable is the monthly growth in total assets. This variable is found significant in Russia, China, Mexico and Indonesia at 95% level of significance and at the 90% level for Malaysia and

Poland. The coefficient is always positive meaning that the companies that are able to grow the value of the total company assets are able to generate higher returns or in other words, companies with more aggressive balance growth exhibit higher returns. Contrary to my findings, Titman, Wei & Xie (2013) find that high asset growth typically predicts negative returns for markets within developed capital markets, but that this negative result is small and insignificant in markets less financially developed. Their sample stretches from 1982 to 2010 and is based on 26 developed markets and 14 developing markets which may account for the different results.

6.4 Time series momentum trading strategies

Next, I am going to conduct back tests that capture the profitability of time series momentum investing. Time series momentum is different from cross-sectional momentum because it uses the performance of stocks over time as a trading signal instead of relative over/under performance.

This backtest utilizing time-series momentum trading strategy is modeled in the following way: for each month, for each underlying stock in a given market, I look back 12 months up until the point in time 1 month ago, thus making the lookback period 11 months in total. If the amount of positive return months in that period is greater than the amount of negative return months, a long position is taken. If the opposite is the case, a short position is taken. The portfolio is rebalanced at the end of every month as the trading signals change or as new stocks reach the necessary amount of return history that makes it possible to discern a trading signal. The strategy uses a uniform notional position size for each time period, meaning that, the positions in each equity both long and short are the same. This has the disadvantage that the strategy is not necessarily self-financing as the total short and the total long position need not be the same size at any given time.

As the strategy requires 12 months of data to establish a trading signal and since the beginning date of my data sample is January 1990, the back test is simulated from January 1991 until April 2016, although in the case of some countries such as for instance Russia, data availability is an issue so, as was the case with the cross sectional study, the back test is conducted on the background of a shorter time period.

All strategies are calculated based on excess returns meaning that a relevant "risk free" rate, usually a 1-month rate issued by a relevant central bank has been subtracted from monthly returns. Data availability was an issue for securing time series of suitable risk free rates which is why some strategy returns are computed based on total returns in those months.

The results of the back tests can be viewed from table 9 below:

Table 9: Emerging Markets Time Series Momentum Returns

	Brazil	Russia	India	China
Excess return	12,1%	4,5%	3,6%	6,5%
Standard deviation	24,5%	19,2%	22,8%	27,4%
Sharpe Ratio	0,49	0,24	0,16	0,24
Information Ratio	0,18	-0,22	-0,13	-0,05

	Mexico	Turkey	Indonesia	South Africa
Excess return	8,8%	13,7%	-1,3%	9,9%
Standard deviation	11,6%	30,2%	25,3%	7,7%
Sharpe Ratio	0,76	0,45	-0,05	1,29
Information Ratio	0,09	0,24	-0,28	0,20

	Poland	Vietnam	Malaysia	South Korea
Excess return	11,8%	5,8%	4,0%	-8,0%
Standard deviation	15,9%	29,2%	27,0%	27,0%
Sharpe Ratio	0,74	0,20	0,15	-0,30
Information Ratio	0,17	-0,18	-0,10	-0,49

	Taiwan	Thailand	The Philippines
Excess return	-2,6%	4,8%	0,3%
Standard deviation	17,2%	22,1%	24,5%
Sharpe Ratio	-0,15	0,22	0,01
Information Ratio	-0,45	-0,07	-0,22

All numbers annualized

The information ratio is a figure that explains excess return that is generated from the excess risk relative to the benchmark (CFA Institute, 2011).

Information ratios are computed based on a similar strategy based on using a comparable US time-series strategy as the one described above. The methodology is not exactly the same as It is not

conducted on individual stocks but on an equity index comprised of NYSE and NASDAQ stocks. I take this to be what a comparable trading strategy would yield if implemented on US equities.

The results of this trading strategy on the US market in annualized terms can be seen in the below table:

Table 10: US Time-Series Momentum

Return	6,81%
Standard deviation	14,82%
Sharpe Ratio	0,46

A ranking of the Sharpe ratios generated by the time-series momentum trading strategies can be viewed from the below table:

Table 11: Sharpe Ratio Ranking

Country	Sharpe Ratio
South Africa	1,29
Mexico	0,76
Poland	0,74
Brazil	0,49
Turkey	0,45
China	0,24
Russia	0,24
Thailand	0,22
Vietnam	0,20
India	0,16
Malaysia	0,15
The Philippines	0,01
Indonesia	-0,05
Taiwan	-0,15
South Korea	-0,30

Consistent with my cross-sectional analysis, South Africa is exhibiting outstanding returns to momentum style trading with a Sharpe ratio of 1,29 and an information ratio of 0,20 over a comparable US strategy. Mexico, Brazil and Poland, which displayed no statistically significant momentum coefficient in the cross section shows strong results with Sharpe ratios over that of the US and thus positive information ratio. Turkey outperforms in terms of returns but not in terms of Sharpe

ratio. India, which displayed statistically significant positive returns to momentum returns in the cross section, comes in at a 10th place in the ranking of countries with a Sharpe ratio of 0,16 and a negative information ratio meaning it underperforms the US benchmark. India does not display the same degree of outperformance as South Africa which brings into question the issue of whether the countries with momentum in the cross section are the same ones that outperform in the time-series. On the opposite end of the spectrum are Thailand and South Korea which underperform the US benchmark despite showing significant momentum in the cross section.

Below can be seen the average positions of 2 countries in my sample that are representative:

Table 12A: South Africa - Average Position

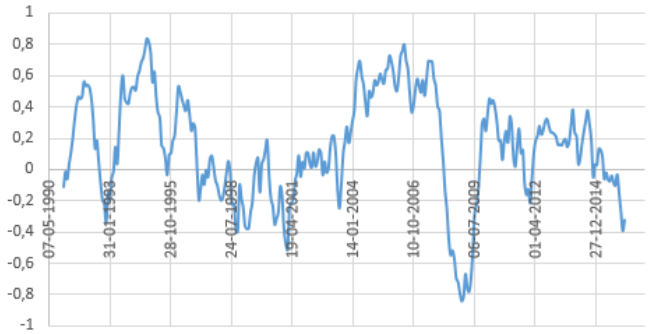
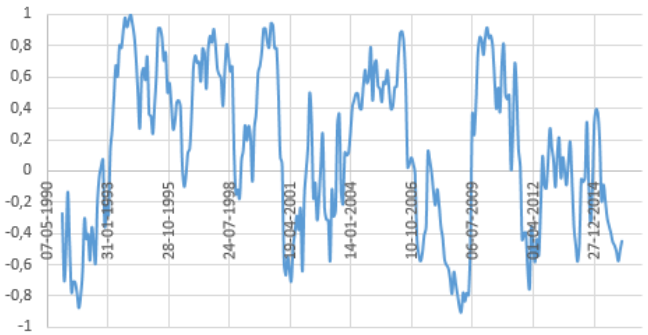


Table 12B: Turkey - Average Position



A position of 1 mean that the strategy is long every single stock while a position of -1 would conversely mean that the strategy was short every single stock in the market. It can clearly be seen that the time-series momentum trading strategy responds to events in the overall market, with clear downturns around the 2001 dot.com bubble and the great recession in 2007-2008 and the early 2010s. The two examples shown above are representative of the entire sample which display a similar pattern.

6.4.1 Momentum strategies and transaction costs

The argument can be made that, since momentum trading is a high turnover trading strategy, it is limited by or even completely eliminated by trading costs. After all, momentum trading relies on

frequent rebalancing which incurs fees as well as taxes on capital gains that could have been put off indefinitely by utilizing a buy-and-hold strategy. Furthermore, a large portion of the strategy consists of short selling which requires paying a fee to the lender of the stock in addition to the standard transaction cost. Korajczyk & Sadka (2004) in their study of momentum's robustness to trading costs find that abnormal returns on momentum trading strategies are a declining function of portfolio size and investigate the break-even sizes of both equal- value- and liquidity-weighted portfolios. They find that especially equal weighted momentum strategies suffer when introducing trading costs and market impact costs into the model due to the fact that equal weighted portfolios are heavy on illiquid equities with large bid/ask spreads. They conclude that returns of equal weighted momentum portfolios decline significantly when introducing trading costs while the momentum pattern of abnormal returns is still present for value weighted and liquidity weighted portfolios.

Israel & Moskowitz (2013) also look into the effects of trading costs on momentum strategies and present the results that there is a significant statistical relationship between momentum returns and trading costs, and hypothesize that this is due to the limit that high trading costs place on arbitrage that would otherwise reduce momentum returns. They also find that among small cap momentum trading, this effect is even more profound. This suggest that trading costs is a real factor that investors have to take into account when evaluating the merits of momentum trading. Frazzini et al. (2013) find that, when looking at the trading record of over a trillion dollars' worth of trades made by institutional investors across the developed world in the years from 1998 to 2013, and they find that trading costs are in the order of 5 to 6 times smaller than that previously cited in the literature. They attribute this to the use of aggregated trade and quote data used in previous financial literature on the nature of trading costs and state that large institutional investors are able to realize trades at a cost level far below that of the average investor.

So to summarize, Korajczyk et al. (2004) state that momentum strategies, and especially ones based on equal weighted portfolios, display decreasing abnormal returns as a function of portfolio size which diminishes the attractiveness of momentum trading. Frazzini et al. (2013) takes a dissenting view to this and contends that the literature on trading costs overstates the effect of transaction costs

by taking fees at their listed face value prices and that this effect would be much less for an institutional investor.

What this means for my results depends on your assumptions about the profile of who is doing the trading. Due to high variability in performance between countries, time-series momentum has in my analysis shown to be able to result in negative rates of return before even asking the question of what you had to pay in terms of transaction costs. It is conceivable that large institutional investors that are able to negotiate favorable rates for trading are able realize profits that, after fees, on the most favorable market, are in excess of a buy-and-hold strategy. for the average investor however, most likely momentum trading would not yield returns in excess of a buy-and-hold strategy.

6.5 Correlation coefficients of results

It is worth finding out whether momentum in the cross section is correlated with momentum in the time-series and indeed, if either of these are correlated with the results for autocorrelation. I analyze this by testing the null-hypothesis that ρ = 0 where ρ is the Pearson correlation coefficient (Pearson's r). Correlation is computed between momentum in the cross section, return autocorrelation and momentum in the time series (which I split into two list, one for returns and one for Sharpe ratios). The correlation coefficient is found using the following formula:

$$\rho = \frac{Cov_{X,Y}}{\sigma_X \sigma_Y} \tag{21}$$

Calculating this value for the results I have obtained I end up with the correlation coefficients visible from the below table:

Table 13A: Pearson's correlation coefficient

	TS-Mom return	TS-Mom SR	CS-Mom	Autocorr.
TS-Mom return	1	0,8033	0,1730	0,1599
TS-Mom SR		1	0,3899	-0,1775
CS-Mom			1	-0,3136
Return autocorrelation				1

The hypothesis that ρ = 0 is tested by computing the t-statistic of the correlation coefficient through formula 22:

$$t = \frac{\rho\sqrt{n-2}}{\sqrt{1-\rho^2}} \quad (22)$$

With a sample of n=15 nations the critical values for significance on a one-tailed test for 5% and 10% significance are respectively 0,514 and 0,441. It can be seen from table 13A that there is not significant statistical evidence of a correlation between the different classes of results.

The results are based on the assumptions that the values are normally distributed. However, since I do not know for sure the distribution of the parameters of the variables I have found and since I cannot test this assumption due to a small sample size, this brings the accuracy of the Pearson correlation into question. I address this issue by supplementing my study of correlation between these variables with Spearman's r. Spearman's r is a nonparametric method for measuring the correlation between the ranks of the different variables when the joint probability function is not known. Unlike Pearson's r which tests for a linear relationship, Spearman's r tests for a monotonic relationship, which is to say, "a function which is either entirely nonincreasing or nondecreasing. A function is monotonic if its first derivative (…) does not change sign" (Wolfram Mathworld,1,2016).

The formula for Spearman's r (which is equal to a Pearson's r calculated from the ranked values of the data they are based on) is:

$$r_s = 1 - \frac{6\sum d_i^2}{n(n^2-1)} \quad (23)$$

Where d_i is the difference in rank of data pair i. The results of my findings are summarized in below table:

Table 13B: Spearman's correlation coefficient

	TS-Mom return	TS-Mom SR	CS-Mom	Autocorr.
TS-Mom return	1	0,9143	0,3036	0,0107
TS-Mom SR		1	0,3857	-0,1643
CS-Mom			1	-0,4500
Return autocorrelation				1

The critical values are 0,521 for 5% significance and 0,446 for 10% (Zar, 1984).

In terms of Spearman's correlation, the returns of time-series momentum are more correlated with momentum in the cross section. This means that the relationship between the two variables fits better with a monotonic relationship than with a linear relationship. This may also be due to the fact that the Spearman correlation attributes less power to extreme values since all data observations are limited to the value of their ranks. Despite this, there is no strongly significant, positive correlations between the different results which is what could have been expected. It can be seen that there is somewhat weak, negative statistical evidence of significance at the 10% level between return autocorrelation and momentum in the cross section which is somewhat unintuitive.

6.6 Discussion and literature review

In my analysis of momentum in emerging markets I demonstrate that the existence of momentum is highly variable across the countries that make up my sample. Some countries have clear signs of momentum in the cross section while others do not display any signs of momentum. in total only 4/15 of the nations in my sample show statistically significant momentum in the cross section. In my time series results, 5/15 countries outperform, in terms of returns, the time series momentum portfolio I have used as a benchmark. Interestingly, with the exception of South Africa, these are not the same countries that displayed significant results in the cross section.

Moskowitz, Ooi & Pedersen (2011) look at time series momentum trading on equity indices from 9 developed economies and test whether the returns of a cross-sectional trading strategy is able to

explain the returns. Their investigation shows a highly significant, positive relationship between the two trading strategies with an R^2 of 15%. They also look at patterns for commodities, fixed income and currencies and also find positive, significant coefficients. In their study, they find that there is larger correlation between the time-series momentum returns of different asset classes then there are between the asset classes themselves, suggesting a strong common component directing the trend directions across different time series strategies used on different assets. Unlike the results of Moskowitz et al. (2011) my analysis finds no statistically significant correlation between the cross sectional and time series results.

Hanauer & Linhart (2015) run regressions on the regional level for market index returns. Their survey is conducted on Emerging markets in 4 regions: Latin America, Asia, BRIC and the EMEA region with 21 countries in total and going from 1996 to 2012. They construct local factor loadings for each region consisting of market risk premium, SMB, HML and UMD. They find a highly significant value effect and also a strong but less significant momentum effect. They attempt to explain the same market index returns using global factor loadings but find that the model performs poorly leading them to conclude that the variation in emerging market stock prices are not integrated into those of the global economy. these results offer a possible explanation for why I have not found significant correlation between cross-sectional and time-series momentum unlike Moskowitz et al. (2011); they are looking at the developed world and I am looking at emerging markets.

Conrad & Kaul (1998) find that returns from cross sectional momentum strategies are driven by variation in the cross section of stock returns and that it therefore, is not a violation of the efficient market hypothesis. In their own words:

> *"We find that an important determinant of the profitability of trading strategies is the estimated cross-sectional dispersion in the mean returns of the individual securities comprising the portfolios used to implement the strategies. (…) specifically, the cross-sectional dispersion in mean returns witnessed during different time periods can potentially generate the observed profits of (…) the momentum strategy (…)". Conrad & Kaul (1998)*

They go on to say that this cross sectional variation has no effect on the time-series pattern of returns. Titman & Jegadeesh (2002) dispute this claim and state that cross sectional variation in stock returns explains only very little of the returns of cross-sectional momentum strategy returns. They argue that the findings of Conrad & Kaul's paper are flawed because of biases in their data set and maintain that momentum is not something you would observe in an efficient market.

He & Li (2014) Look at time-series momentum in American stocks. They find that the profitability of time-series momentum strategies is positively related to the activity of momentum traders in the market and negatively related to the investment horizon of the time series momentum trading strategy. They say that short term time-series momentum investors underreact in the short-run while long term time-series momentum investors overreact in the long-term. The final outcome of this is that momentum is profitable on shorter time horizons while contrarian strategies are profitable on long investment horizons. In other words, according to He & Li (2014), variation in the profitability of time-series momentum trading can be explained by the prevalence of momentum traders within a given market.

Cakici, Faboci & Tan (2013) look at equities from 18 different emerging markets around the world in the years 1990-2011 and regress market indices of the countries onto factor loadings for value and momentum for small and big companies. they find that both small and big capitalization companies both exhibit the value premium while momentum is mainly a small cap phenomenon that is a decreasing function of size. This might explain my inconsistent results of momentum in the cross section of some countries, and suggests that I might find different results if I had screened based on market capitalization.

7. Regressing on investor protection indices

The business environment faced by company owners is different from country to country and likewise the privileges they enjoy in terms of investor protection. These differences in legislation may lead to differences in the behavior of investors and their willingness to open up positions that exposes them

to risk of having value expropriated from them by controlling shareholders or managers. As La Porta et al. puts it:

> *"Since the protection investors receive determines their readiness to finance firms, corporate finance may critically turn on these legal rules and their enforcement" (La Porta et al. 1998)*

Access to external financing, both in terms of equity and debt, enables a company to grow by either expanding their investments in their current profitable business activities or into new projects that have positive net present value. However, the ability to secure external funding hinges on those investors feeling that they are either protected by the law or that they are compensated through additional returns for taking on additional risk. As La Porta et al. (1998) puts it:

> *"(…) variation in laws and its enforcement are central to understanding why firms raise more funds in some countries than in others." (La Porta et al. 1998)*

For these reasons, it makes sense to look at the performance of markets in terms of market efficiency and to hold this up to the international differences that exist in terms of investor protection.

In the following, I am going to find out whether the legal differences in countries can be used to explain market efficiency as well.

7.1 The different measures of investor protection

Based on the work of La Porta et al. (1998), and Djankov et al. (2006) the following indices, which I will now describe, each measure some facet of investor protection. I will now regress my results from chapter 6 on these various indices to see if they co-relate.

7.1.1 Anti self-dealing index

The anti self-dealing index by Djankov et al. (2006) is an attempt to quantify the ability of a minority shareholders to prevent self-dealing by controlling shareholders or managers. Self-dealing is defined as acts of diverting corporate wealth to oneself at the expense of other investors while still following the letter of the law. These acts can for instance be things like excessive executive perks, personal loans to insiders expropriation of corporate opportunities or the transfer of assets out of the company and into another at below market prices (Johnson et al, 2000). The index is constructed by sending questionnaires to major law firms of different countries around the world covering 99,3% of the world's stock market capitalization. The sent out questionnaires ask the law firms to describe the degree of difficulty facing a controlling shareholder or manager as they try to carry out a self-dealing act. The more difficult the law makes it to carry out this act of self-dealing in a given country, the higher that country's score on the anti self-dealing index. The scores that make up the index are all constructed based on binding rules and regulations, not voluntary guidelines or codes of conduct (Djankov et al, 2006).

7.1.2 The Revised Anti-Director Rights Index

The anti-director rights index by La Porta et al. (1998) is a measure of how strongly the legal system of a country favors minority shareholders against controlling shareholders or managers in situations of corporate decision making such as voting. It is based on such things as whether or not shareholders are allowed to exercise their voting rights by mail, whether they are able to submit their vote preemptively on a particular vote, whether there is a mechanism in place to protects oppressed shareholders and how low the minimum percentage of shareholders necessary to call for an extraordinary shareholder meeting. The higher this score is, the more protected shareholders are (Djankov et al, 2006). The index was initially made in 1997 but I am using a revised version which was created in 2006. The revised version addresses some concerns raised by the academic community about methodology and it also fixes some coding errors in the initial version.

7.1.3 Law and Finance indices

I am also going to be using a group of 5 indices that I collectively refer to as the "Law and Finance" indices which was the name of La Porta et al's academic paper that inspired this thesis. These indices were originally constructed in 1998 but for 4/5 of the indices, newer 2015 figures of the same variables have been used.

The Rule of law index is an "assessment of the law and order tradition in the country". This index takes into account the impartiality of the courts acting within a country as well as how well the laws are enforced.

The Corruption index measures how government officials at both high and low levels are likely to demand bribes for things such as import or export licenses and tax assessment.

The Contract Viability index represents the level of protection from expropriation or contract repudiation when doing business with the government. Expropriation can be when a company is nationalized or its assets confiscated by the government. Contract repudiation can be when the government of a country modifies the parameters of a contract it has entered into. This can be due to the government in question being forced to institute budget-cuts or after a change in government where it changes its social and economic priorities.

Repatriation is an index that measures the ease with which a foreign investor is able to liquidate his investment and return it to his country of origin.

The Accounting standards index is from 1990 and is created by examining annual reports in a number of companies within a given country and looking at their methodology for working out the income statement, balance sheet and the general information. The index thus attempts to capture the degree of honesty (or conversely how misleading it is) used in the reigning accounting standards of a country. The numbers are based on different industry groups with financial companies representing no more than 30% (La Porta et al., 1998).

The indices all have in common that more is better in the sense that a higher score is always what is more desirable from a foreign investor's point of view. The revised anti-director index and the anti

self-dealing index are constructed by La Porta et al. 2006, Contract Viability, Repatriation, Rule of Law and Corruption indices are made by the PRS Group's International Country Risk Guide and are from January 2015, the Accounting Standards index was originally constructed in 1990 by The Center for International Financial Analysis and Research.

The values that make up the above described indices can be seen from below table:

Table 14: Investor Protection Indices

Country	Corruption	Rule of Law	Contract Viability	Repatriation	Anti-director Index (revised)	Anti-self-dealing index	Accounting standards
Brazil	2	2	3	2,5	5	0,27	54
India	2,5	4	2,5	2,5	5	0,58	57
Indonesia	3	3	2,5	3	4	0,65	-
Korea	3	5	3,5	3,5	4,5	0,47	62
Malaysia	2,5	4	3,5	3	5	0,95	76
Mexico	1,5	1,5	3	3	3	0,17	60
Philippines	2,5	2,5	3	2,5	4	0,22	65
South Africa	2,5	2	2	2,5	5	0,81	70
Taiwan	3	5	3,5	4	3	0,56	65
Thailand	2	2,5	2,5	2,5	4	0,81	64
Turkey	2,5	3	2	2	3	0,43	51
China	2	3,5	2	2	1	0,76	-
Poland	3,5	4,5	3,5	3	2	0,29	-
Russia	1,5	3	2,5	2,5	4	0,44	-
Vietnam	2,5	4	3	2,5	-	-	-

There are 15 countries in my sample, but since the records for Vietnam is incomplete a sample size of n=14 is used unless otherwise indicated. The accounting standard index is handled separately to allow for incomplete records.

7.2 Regressions

For my regressions, I am regressing the results from chapter 6 on the investor protection indices described in subchapter 7.1. In other words, I am going to investigate if momentum in the cross section, momentum in the time series or return auto correlation can be explained by the amount of investor protection. This inspires the following model:

$$Dependent\ variable_i = \alpha + Rule\ of\ Law_i * \beta_1 + Corruption_i * \beta_2 + Contract\ viability_i * \beta_3 + Repatriation_i * \beta_4 + Anti\ director\ index_i * \beta_5 + Anti\ Self\ dealing\ index_i * \beta_6$$

(24)

This model however suffers from issues of multicollinearity as the "law and finance" indices are highly correlated with each other. While this issue does not affect the model as a whole it impacts the individual predictors. Since I am interested in the isolated effect of the explanatory variables this is a problem for the model. Even though the bi-variate correlations is not a definitive test for multicollinearity in a multi-variate regression, it can be a useful indicator of multicollinearity (Makridakis et al. 1998). The correlations of the indices are evident from below correlation matrix:

Table 15: Investor Protection Indices Correlation Matrix

	Corruption	Rule of Law	Contract Viability	Repatriation	Anti-director Index (rev)	Anti-self dealing index
Corruption	1	0,675	0,407	0,483	-0,054	0,067
Rule of Law		1	0,503	0,549	-0,175	0,194
Contract Viability			1	0,791	0,109	-0,282
Repatriation				1	0,101	-0,060
Revised Anti-director Index					1	0,174
Anti-self-dealing index						1

n=14

It is evident, that especially the rule of law index and the corruption index are highly correlated with a positive correlation of 0,675 and the contract viability and the repatriation indices are extremely highly correlated with a correlation coefficient of 0,791. These two blocks are also relatively highly correlated with each other with a correlation between the indices of at least 0,4. The revised anti-director index and the anti self-dealing index do not suffer from this weakness so I instead opt to run the model in the following way:

$$Dependent\ variable_i = \alpha + Explanatory\ Variable_j * \beta_1 + Anti\ director\ index_i * \beta_2 + Anti\ Self\ dealing\ index_i * \beta_3 \quad (25)$$

Where "explanatory variable j" is one of the 1…j "law and finance" variables that would otherwise exhibit multicollinearity when modelled together and i is the 1…n countries in my sample. Indeed, upon experimenting with these reduced models, some of the individual variables display significant estimates. Below are the regression coefficients when regressing the returns of time-series momentum and the regression coefficients when regressing Sharpe ratios on the investor protection indices:

Table 16: Time-Series Momentum Regression

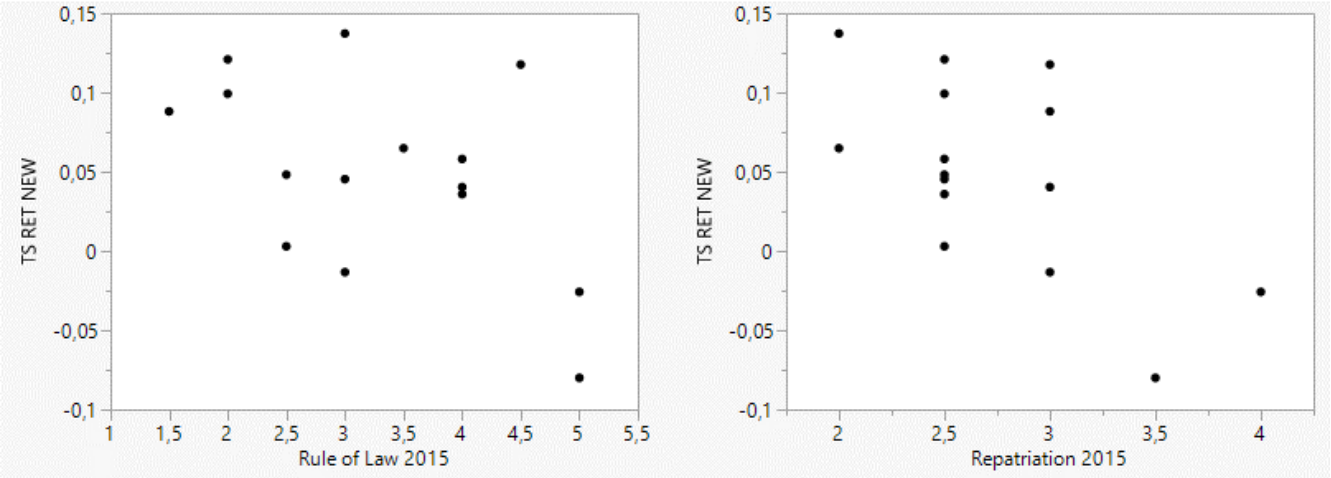
Dependent variable:	TS-MOM returns				Dependent variable:	TS-MOM Sharpe Ratio			
Independent variable	**Coefficient**				**Independent variable**	**Coefficient**			
Corruption	-0,032805				Corruption	-0,152048			
	-1,05					-0,69			
Rule of law		-0,03202			Rule of law		-0,227465		
		-2,19*					-2,28**		
Contract viability			-0,050045		Contract viability			-0,301591	
			-1,61					-1,36	
Repatriation				-0,070656	Repatriation				-0,297485
				-2,58**					-1,32
Anti-director index	-0,010358	-0,01566	-0,005421	-0,005644	Anti-director index	-0,014189	-0,054494	-0,333649	0,006114
	-0,68	-1,17	-0,38	-0,46		-0,13	-0,6	-0,63	0,06
Anti self-dealing index	-0,027065	0,001068	-0,070164	-0,046422	Anti self-dealing index	-0,082816	0,132824	0,014072	-0,167032
	-0,36	0,02	-0,94	-0,75		-0,15	0,29	0,14	-0,33
Intercept	0,181552	0,210939	0,245592	0,288753	Intercept	0,770238	1,177247	1,267909	1,1875
	1,8	2,78**	2,26**	3,2***		1,08	2,28**	1,64	1,6
R^2	0,152225	0,363306	0,252235	0,435551	R^2	0,050237	0,346674	0,161596	0,153861

Significance levels: *: 10%, **: 5%, ***: 1%. Each column under the "coefficient" headline represents a separate regression for the dependent variable in question. The numbers next to the empty rows are t ratios for the regression estimate in the cell above it.

The results from my time series momentum backtests in terms of raw returns show significant negative relationships with the rule of law and repatriation indices and also has significant positive intercepts. when regressing on Sharpe ratios, only the rule of law index is significant with the intercept also being significant. The sign for all 3 significant independent variables are negative showing that when the degree of investor protection increases, time-series strategies become less profitable. If we take my results from chapter 6 to be proxies for the market efficiency within a given nation, then what the regressions show, is that there is significant evidence that the less efficient markets are also the ones with the lowest degree of investor protection. For the time-series momentum returns, the R^2 hovers in the 0,15-0,43 range for the different regressions while the Sharpe ratio test is around 0,05-0,34. The indices for corruption and contract viability are not significantly able to explain neither returns nor the Sharpe ratio and the same is the case for the anti-director and anti self-dealing index.

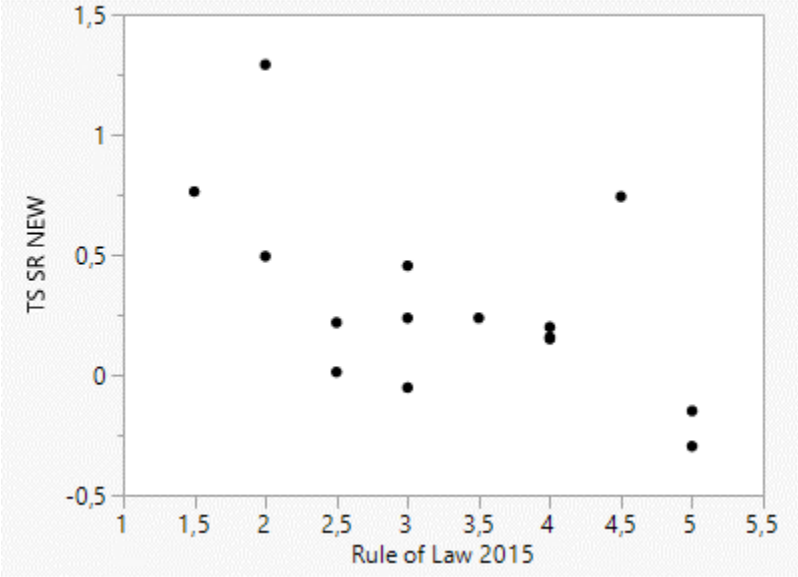
Scatterplots of the time-series momentum returns and the two significant indices rule of law and repatriation can be seen below:

Figure 6: Scatterplot (Time-Series Momentum Return)



And a scatterplot of the Sharpe ratios plotted against the rule of law index can be seen here:

Figure 7: Scatterplot (Time-Series Momentum Sharpe Ratio)



The results of regressing 1-period return autocorrelation on investor protection indices can be seen below:

Table 17: Return Autocorrelation Regression

Dependent variable:	Return Autocorrelation			
Independent variable	**Coefficient**			
Corruption	0,001921			
	0,04			
Rule of law		0,014213		
		0,54		
Contract viability			0,027904	
			0,54	
Repatriation				-0,001268
				-0,02
Anti-director index	0,013033	0,015799	0,010815	0,013036
	0,54	0,65	0,45	0,54
Anti self-dealing index	-0,110946	-0,125898	-0,090107	-0,110804
	-0,93	-1,04	-0,73	-0,93
Intercept	0,08878	0,044797	0,013002	0,096846
	0,56	0,33	0,07	0,55
R^2	0,091676	0,11719	0,117258	0,091591

The regressions for return autocorrelation does not significantly relate to neither the anti-director index, the anti-self dealing index or any of the law and finance indices. The R^2 of the autocorrelation regressions hovers in the 0,09 to 0,11 range. This suggests there is no appreciable relationship between the degree to which monthly returns correlate with the returns from the month before and investor protection.

The regression coefficients from regressing my cross sectional momentum results on investor protection indices can be seen below:

Table 18: Cross-Sectional Momentum Regression

Dependent variable:	CS Momentum			
Independent variable	**Coefficient**			
Corruption	0,001094			
	0,39			
Rule of law		0,000484		
		0,32		
Contract viability			-0,00135	
			-0,45	
Repatriation				-0,00137
				-0,45
Anti-director index	0,000231	0,000292	0,000299	0,000266
	0,17	0,21	0,22	0,19
Anti self-dealing index	0,006736	0,006428	0,005962	0,006699
	0,98	0,91	0,83	0,98
Intercept	-0,00626	-0,00524	0,000299	3,69E-05
	-0,69	-0,66	0,03	0
R^2	0,114382	0,110003	0,11899	0,119053

The cross sectional momentum results originating from my Fama-Macbeth regressions have an R^2 of approximately 0,11 and exhibits no statistically significant relationships with any of the indices utilized in this analysis.

To sum up, the rule of law and repatriation indices have explanatory power over how effective a time-series momentum trading strategy is. When looking at the Sharpe ratio, only the rule of law index has explanatory power. None of the indices I am utilizing here are able to explain neither momentum factors in the cross section nor monthly return autocorrelation. Neither the corruption index, the contract viability index, the anti-director rights index or the anti self-dealing index has any explanatory power over any of my measures for market inefficiency.

Based on these results, I cannot reject the hypothesis that market inefficiency can be partially explained by 1) the ease with which an investment can be liquidated and moved outside of the country and 2) the impartiality of local courts and their ability to enforce laws. if one accepts that

momentum is a proxy for market efficiency, then my results suggest that nations with less investor protection are also the nations with low market efficiency.

7.2.1 Accounting standards index

The index "accounting standards" is less complete than the other indices so regressions that include this index are based on a smaller sample. The correlations of the Accounting Standards index look like this:

Table 19: Accounting Standards Correlations

	CS MOM	TSMOM Return	TSMOM SR	Autocorr.	Corruption 2015	Rule of Law 2015	Contract Viability 2015	Repatriation 2015	Anti-director Index (Rev)	Anti-self-dealing index
Accounting standards	-0,046	-0,360	-0,001	-0,375	0,225	0,176	0,352	0,378	0,312	0,644

It is based on 9 nations so the critical values for significance is 0,666 at the 5% level and 0,562 at the 10% level.

It is evident that the index is highly correlated with the anti self-dealing index which makes sense since it seems intuitive that self dealing would be easier given more opaque accounting standard methods.

To remedy this, I exclude the anti self-dealing index from the regression and simply regress my results on the accounting standards index and on the anti-director index for the 9 countries. The results can be viewed from the below table:

Table 20: Regressing on Accounting Standards

	Independent variable:			
Dependent variable:	**Alpha**	**Anti-Director (rev)**	**Accounting Standards**	**R^2**
CS Momentum	-0,00276	0,0035036	-0,000167	0,256094
	-0,17	1,55	-0,62	
TS Momentum Returns	0,533071	-0,004567	-0,006858	0,199065
	1,54	-0,1	-1,22	
TS Momentum SR	0,698466	0,0972205	-0,010414	0,028627
	0,38	0,39	-0,35	
Return Autocorrelation	0,317334	0,0557777	-0,007667	0,320022
	1,05	1,36	-1,57	

It can be seen that accounting standards does not explain any of my results with even weak significance. The R^2 is higher on the return autocorrelation regression, demonstrating that this model is slightly better at explaining the variation of this data set than any of the other models.

The correlation matrix based on the full sample is visible from the below chart:

Table 21: Complete Correlation Matrix

	CS MOM	TSMOM Return	TSMOM SR	Ret. autocorr.	Corruption	Rule of Law	Contract Viability	Repatriation	Anti-director Index	Anti-self-dealing index
CS MOM	1	0,188	0,386	-0,258	0,134	0,143	-0,208	-0,147	0,097	0,314
TSMOM Return	0,188	1	0,808	0,155	-0,304	-0,522	-0,399	-0,619	-0,205	-0,162
TSMOM SR	0,386	0,808	1	-0,165	-0,213	-0,567	-0,358	-0,380	-0,038	-0,069
Return Autocorrelation	-0,258	0,155	-0,165	1	-0,017	0,068	0,250	0,027	0,117	-0,251
Corruption	0,134	-0,304	-0,213	-0,017	1	0,675	0,407	0,483	-0,054	0,067
Rule of Law	0,143	-0,522	-0,567	0,068	0,675	1	0,503	0,549	-0,175	0,194
Contract Viability	-0,208	-0,399	-0,358	0,250	0,407	0,503	1	0,791	0,109	-0,282
Repatriation	-0,147	-0,619	-0,380	0,027	0,483	0,549	0,791	1	0,101	-0,060
Anti-director Index	0,097	-0,205	-0,038	0,117	-0,054	-0,175	0,109	0,101	1	0,174
Anti-self-dealing index	0,314	-0,162	-0,069	-0,251	0,067	0,194	-0,282	-0,060	0,174	1

Df=14-2=12, critical values for significance: 5%: 0,532, 10%: 0,457

7.3 Discussion and literature review

La Porta et al. (1998) look at older iterations of some of the indices I have used in my analysis like the anti-director index, rule of law, corruption and risk of expropriation (which in newer versions of the index is consolidated with contract repudiation into the contract viability index). They find that the accounting standards index is significantly negatively related to the ownership concentration among firms in a given country. They cite the reason as an adaptive mechanism that can be observed in nations with poor investor protection. In these nations, minority investors will avoid companies that are largely controlled by a small number of controlling shareholders because they fear that the returns on their investments will never materialize because of expropriation.

Djankov et al. (2006) look at the ability of the anti-self dealing index and find that it is a statistically significant predictor of a number of financial development figures like stock-market-

capitalization/GDP, firms/population and IPOs/GDP. They find that the index is a good predictor of financial development in the cross section of nations. They conclude that investor protection is closely tied with financial development.

La Porta et al (2002) finds that countries with higher scores on the anti-director index have higher valuations reflected in higher Tobin's q figures. They argue that countries where financiers are protected from expropriation have capital markets that are bigger in terms of both capitalization and number of firms. They argue that this is because investors feel more secure so they are more willing to tie down their capital. They also find that, in countries with poor investor protection, companies with higher cash flow ownership in the form of dividends are valued higher and attribute this to the fact that the act of expropriation is expensive and difficult and when cash flows are distributed through dividends it becomes less attractive to expropriate minority shareholders.

In my analysis I have found evidence that the best predictors of market efficiency are the rule of law and the ability to repatriate funds. The repatriation index quantifies how likely investors are to get their capital locked in because of tax code or because of government rules on foreign direct investments. The rule of law index quantifies how impartial courts are and how good they are at enforcing the rules that are on the books.

The findings of this thesis can be explained in light of Grossman & Stiglitz' (1980) theories about informed investors and uninformed investors and how markets become increasingly more efficient as long as informed investors are rewarded for expending resources to acquire information about the true value of risky assets that allows them to take better positions than the uninformed investors. Under this model, the informed investor will continue to make the market more efficient as long as the marginal benefit of being informed is greater than the price paid for said information. I propose, that when the efforts of the informed investors to acquire information about the true value of an asset are thwarted by shortcomings in investor protection, price discovery mechanisms in the given market breaks down. As the market becomes less efficient in terms of determining prices in the light of new events, investors are more prone to behavioral biases like initial under reaction and delayed overreaction which are the ingredients needed for a momentum pattern in stock returns.

8. Conclusion

In this thesis I have investigated how market efficiency co-relates with investor protection. I explained my motivation for why it is reasonable to view momentum as a proxy for market efficiency and I conducted a literature study where I explained the efficient market hypothesis, Shiller's theories of behavioral finance as well as the theories surrounding momentum. Then I listed some of the different reasons why emerging markets are something that the investors of today cannot ignore. This is because emerging markets typically have low correlation with portfolios based on stocks from the developed world so there are beneficial portfolio effects for investors who use emerging markets to diversify away their idiosyncratic risk.

In my analysis, I did a runs-test on excess returns of MSCI equity market indices representing the emerging markets in my sample and found that 4/15 countries show signs of randomness, meaning that the remaining 11 countries are not showing randomness in monthly return data. I also looked at auto correlation and found that 7/15 have statistically significant autocorrelation between month t and month t-1.

Then I conducted Fama-Macbeth regressions on stocks within emerging economies where I used common asset pricing factors to predict returns in the follow month. I found out, that while every country in my sample has statistically significant, negative size premium, and almost every country has a significant positive value premium, only 4/15 countries shows momentum in the cross section. Furthermore, every country except Brazil shows positive returns to the profitability factor and surprisingly, 6/15 countries show, significant positive relationship between asset growth and returns in the following month.

I conducted paper trades of time-series momentum trading strategy on equities of emerging markets. In these trades, I looked at the last 12 months of return data (dropping the most recent month) and went long if there were more positive return months than negative return months, or took a short

position if the opposite was the case. I found that 5/15 countries outperformed a similar strategy conducted on the US market in terms of returns and 4/15 outperformed in terms of Sharpe ratio. I also evaluated the effect of trading costs on the viability of momentum trading and reached the conclusion that the strategy most likely will not beat a buy-and-hold strategy for average investors.

I then computed the correlations of the results of my analysis. I found no statistical significance for neither parametric or non-parametric correlation for either my time-series momentum, cross-sectional momentum or return autocorrelation results.

Then I looked at whether the results for my proxies of market efficiency were related to indices for investor protection. I used recent iterations of indices formulated by La Porta et al. in 1998 in his paper "Law and Finance" and one index made by Djankov et al. (2006) used in the paper "The Law and Economics of Self-Dealing". These indices deal with different measure of the protection of minority investors from the abuse of either controlling shareholders or managers.

I regressed the results of my analysis on these 6 indices, and after adjusting for issues with multicollinearity, I found that the returns of time series momentum trading in emerging markets can be explained by an index for rule of law as well as one for the repatriation of funds. The time-series momentum strategies, when in the form of Sharpe ratio, can still be explained by the rule of law index but no longer the repatriation index. All significant coefficients are negative. Accepting the notion that time-series momentum is a proxy for market inefficiency, my results suggest that nations that have lower investor protection are also the ones that show higher returns from time-series momentum strategies. Neither the cross-sectional momentum results nor the return autocorrelation results relate significantly to any of my quantitative measures of investor protection.

I then discuss my findings in light of the conclusions of other theoreticians. There are precedents in financial literature of investor protection indices having explanatory power over economic figures; the anti self-dealing index explains stock-market-capitalization divided by GDP and the number of firms per capita, the accounting standards index explains ownership concentration and the anti-director index explains Tobin's Q. My results show that the returns of time-series momentum trading can be explained by indices for the rule of law and repatriation. I offer as an explanation that, the

governmental failure to protect investors cause a breakdown in price discovery mechanisms and makes the given market more prone to momentum. An explanation that can be understood in the light of Grossman & Stiglitz' (1980) theory of the equilibrium level of disequilibrium.

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10. Appendix

Appendix 1:

OLS cross section of 15 countries

Dependent variable:	TS-MOM returns		
Independent variable	**Coefficient**	**t Ratio**	**p-value**
Corruption	0,0201372	0,35	0,7350
Rule of law	0,0032173	0,09	0,9311
Contract viability	-0,041957	-0,53	0,6112
Repatriation	-0,112072	-1,45	0,1909
Anti-director index	-0,018314	-0,82	0,4370
Anti self-dealing index	-0,023846	-0,19	0,8515
Intercept	0,5411415	3,23	0,0144
R^2	0,6173		

Dependent variable:	TS-MOM Sharpe Ratio		
Independent variable	**Coefficient**	**t Ratio**	**p-value**
Corruption	0,2353861	0,75	0,4800
Rule of law	-0,254074	-1,28	0,2403
Contract viability	-0,225516	-0,52	0,6204
Repatriation	-0,092414	-0,22	0,8349
Anti-director index	-0,034949	-0,28	0,7839
Anti self-dealing index	0,1266881	0,19	0,8570
Intercept	1,6557955	1,79	0,1164
R^2	0,4699		

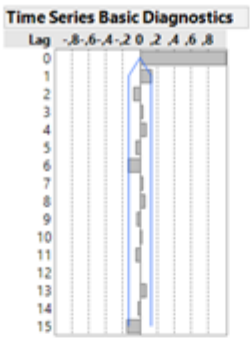
Dependent variable:	Autocorrelation		
Independent variable	**Coefficient**	**t Ratio**	**p-value**
Corruption	-0,001146	-0,12	0,9111
Rule of law	-0,000977	-0,16	0,8794
Contract viability	0,003707	0,27	0,7939
Repatriation	-0,01156	-0,86	0,4170
Anti-director index	0,0035977	0,94	0,3809
Anti self-dealing index	-0,031335	-1,47	0,1840
Intercept	0,0440457	1,52	0,1727
R^2	0,4658		

Dependent variable:	CS-MOM		
Independent variable	**Coefficient**	**t Ratio**	**p-value**
Corruption	0,0012481	0,28	0,7874
Rule of law	0,0013429	0,48	0,6456
Contract viability	-0,002148	-0,35	0,7369
Repatriation	-0,00193	-0,32	0,7582
Anti-director index	0,0007688	0,44	0,6704
Anti self-dealing index	0,0033283	0,35	0,7381
Intercept	0,000078945	0,01	0,9953
R^2	0,1946		

Appendix 2:

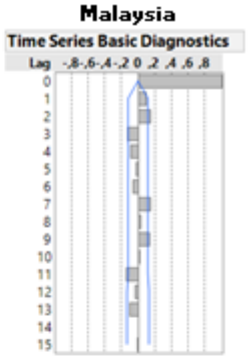
Brazil

Russia



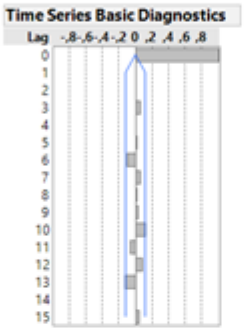
India

Malaysia

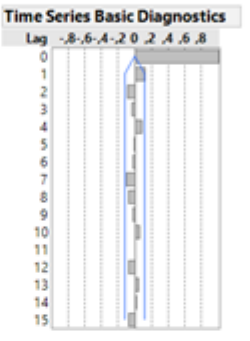


China

Mexico



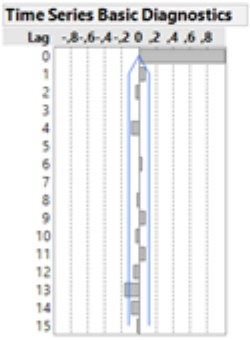
Indonesia



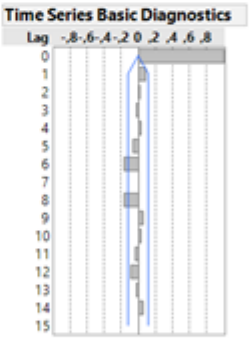
Thailand

Turkey

South Korea



Taiwan



South Africa

The Philippines

Vietnam

Poland