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# Testing the Information Efficiency in Emerging Markets

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## Abstract

One of the most common issues for investors regarding markets nowadays is to what extent these markets are efficient as all of them aim to increase their gains and beat the market as much as possible. This competition among them will inevitably result in markets becoming efficient and, therefore, prices quickly adjusting to the new coming information. Eventually, investors will most probably receive only a sum that makes up for the risk they took and the time value of money they invested. This is where market efficiency, its theory and forms come into question. There have been many researches conducted assessing the efficiency of different markets located throughout the world. However, there are still a lot of gaps in research involving emerging economies which needs to be completed for the sake of investment decisions. Therefore, the purpose of this chapter is to show how information efficiency relates to the stock markets of emerging economies, how it implicates investors, analyze the stock prices of 24 emerging economies to look for their weak form efficiency, and to put forward a set of commonalities found in results of literature relating to emerging market information efficiency.

**Keywords:** information efficiency, efficient market hypothesis, emerging economies, weak form of efficiency, anomalies

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## 1. Introduction

One of the most common issues for investors regarding markets nowadays is to what extent these markets are efficient as all of them aim to increase their gains and beat the market as much as possible. But what do we mean by 'efficiency'? The term 'efficiency' is used in many different contexts with different meanings. If we look at the productivity side, efficiency is

used to refer to a situation where the quantity produced is at such a level that the more you produce from this point onwards it will lead to a fewer productions of the other. In a similar context, one can also think of Pareto efficiency: distribution of resources to make one better off but at the expense of another [1].

When analysing financial markets, whether these markets are from a developed or from an emerging economy, the term 'efficiency' refers to the informational efficiency of the market, which is about the degree of information reflected in the prices of financial assets [2]. It reflects how the financial asset prices adapt to the incoming information. The quicker it reflects the more informational efficient the market will be, making it hard for these investors to beat the market [3, 4].

In this chapter, we will be explaining the efficient market hypothesis (EMH), which is the main theory behind information efficiency; relevant definitions will be given and the different forms of efficiencies will be identified using previous studies. Possible anomalies will also be talked about. The chapter will end with a discussion on the technical and fundamental analysis in the usage of efficient market hypothesis as the basis of investment policies and an application part, where the stock market prices of the 24 identified emerging economies of the world are analysed using an augmented Dickey-Fuller (ADF) test to observe whether they contain a unit root or not. All of these parts will be explained in relation to information efficiency of emerging economies. There are specific characteristics of these markets that make them attractive for analysis and for investors, such as lower than average income per capita, high volatility, rapid growth, higher than the average return and less-mature capital markets [5]. These characteristics which make emerging economies unique in the study of market efficiency will also be incorporated within the chapter.

## 2. Efficient market hypothesis

Efficient market hypothesis states that prices of financial assets reflect all information that is available [6]. Although the idea goes all the way back to Bachelier (1900), its development can be pointed mainly to two scientists, Paul A. Samuelson and Eugene F. Fama, who have independently made leading contributions in the 1960s [2]. Samuelson's focus was on temporal pricing models of storable commodities, mechanics of pricing and linear-programming solutions. He stated that if prices contain all the relevant information and participant expectations, then they could not be forecasted [7]. On the other hand, Fama focused more on the measurement of statistical properties of stock prices as well as technical and fundamental analyses, which will be discussed in the last section of the chapter. Fama was the first researcher to use the term 'efficient market' [3] and briefly explained it as 'prices fully reflect all available information' [8–10].

According to EMH, predicting the change in prices and turning them into profit are near impossible and highly unlikely. What drives these changes in price is the new information

that is arriving. A particular market, under the theory, can be deemed as efficient if stock prices immediately react to this new-coming information. The information coming in must be unpredictable, by definition, because if future information can be predicted now, then this information would be reflected in today's prices and not in future prices. Adjustment of stock prices to its fair market value in reaction to the new information will cause them to either increase or decrease. It will hence make the stock price movements random and unpredictable [11]. This is also referred to as a **Random Walk Hypothesis**.

The idea of a 'random walk' is closely related to the EMH as it is a financial theory and focuses on investments and claims that present-day stock prices increase or decrease, and this happens randomly and has nothing to do with past stock prices. Thus, the idea is that prices immediately capture the information as was said by the EMH. In this situation, even the most inexperienced investor will obtain a rate of return similar to that of his experienced colleagues [12]. Investors have no chance of achieving gains in these markets without taking on themselves many additional risks. The higher the gains, the higher the risk will be [3, 13].

Therefore, it could easily be said that studying past stock prices (technical analysis) or analysing company's financial information (fundamental analysis) would not benefit the investor. This is important in the case of investors as they look for securities that are undervalued, ones they predict to increase in value in the future. For them the higher the gains, the better it is. However, as we have mentioned, EMH shows that no profits can be made if the market is found efficient because the information about the price changes already would have been captured [12, 14]. But what happens if the market is found to be inefficient? This makes markets in emerging economies more attractive as majority of previously conducted research shows that these stock markets do not follow a random walk and are not efficient [15–20]. The absence of a random walk will mean the inappropriate pricing of stocks away from the fair value and higher risk. This can lead investors to predict future stock prices and gain higher returns [3]. It is expected that stock prices in these markets will increase more than the others because capital allocation in the economy is distorted and the overall economic development of the market is affected [21].

## 2.1. Principles of EMH

If we want to shortly summarise the points mentioned above, we can say the following as the basic characteristics of an efficient market [22] under the efficient market hypothesis:

- Random walks determine changes in stock prices.
- All new information immediately is reflected within the stock prices. Also, these information cannot be used in order to earn excess profits.
- Not much use can be obtained through a technical analysis.
- Outperforming the market is near impossible, even for the fund managers.
- Economic fundamentals determine and fix the levels of stock prices.

## 2.2. Forms of efficiency

### 2.2.1. *Weak form of market efficiency*

Weak form of market efficiency involves past information and past prices. According to the weak form of efficiency under the EMH, current stock prices fully reflect all of the available past information [11]. All other information such as profit forecasts or announcements of mergers and so on will not have any effect on the current stock prices [13]. This means that no one can analyse past prices of stocks and be able to beat the market.

Under the EMH, there is a reason that this form is named 'weak'. The strength of the efficiency, i.e. degree of weakness, symbolises the type of information available. Historical information plus information on stock prices can be classified as the most easily obtained and costless information. Therefore, it is classified as weak in the efficiency scale by Fama in the EMH [10]. In the weak form of efficiency, investors cannot make a profit from using information that everyone knows [14].

### 2.2.2. *Semi-strong form of market efficiency*

In the semi-strong form of efficiency, besides the past information, all the publicly known and available information are also reflected on the price of the financial assets/stocks. This can be the quality information, financial statements, patents as well as information provided by media, investment advisors, annual reports and other information that can be publicly accessible. An important point to note here is that public information does not have to be just financial information [13]. To give an example, consider the cosmetics industry. When analysing cosmetics companies, the relevant information can be the new, published research regarding cosmetics testing.

From the moment these public information that are mentioned above are published, prices of financial assets will immediately adjust itself to become higher or lower according to the nature of the information. Then, it can be deduced that if all investors have access these publicly information, then none of them have an advantage over the other. Therefore, they cannot make excess profit by using a fundamental analysis [11].

Semi-strong and weak forms of market efficiency can be related to each other as the weak form includes past and the semi-strong form includes both past and the public information. It can be deduced that, if one market is found to be efficient in the semi-strong form, then it also must be efficient in the weak form [13].

### 2.2.3. *Strong form of market efficiency*

This can be said to be as the strictest version of market efficiency because it not only contains the past and public information but also involves private information. Private information in studies can also be referred to as the inside or insider information. According to the EMH, the strong form of market efficiency can be defined as a market where the prices of financial assets reflect all of the available public and private information. In other words, stock prices in this market reflect all information that exists [23].

If a market is efficient in the strong form, it leaves no room for investors or even insiders from generating profits using information that is not publicly known. For example, let us take the cosmetics company to analyse once more; imagine that its research and development department came up with a breakthrough and they know that this piece of information will cause the company shares to increase by a large amount in the near future. By the time one of the members of this R&D team goes out and buys few of the company's stocks, if strong form of efficiency holds, this information would have already been reflected on the stock price. Hence, that person with insider information would not be able to use this for his/her benefit [11, 13].

It is debateable whether the strong form of market efficiency even exists. The results are contradicting, and research points out that evidence regarding the strong form is inconsistent. Some argue that it is quite impossible for an insider not to benefit from the private information they hold. But, some argue that there is no possibility of keeping secrets. Most countries, today, have certain laws and regulations to prevent insider trading such as the establishment of the Securities and Exchange Commission in the USA. This commission requires owners, directors or corporate officers to report to them in order to limit their harmful activities [23].

#### *2.2.4. Inefficient markets*

Efficient market hypothesis classifies efficiency into three categories as previously explained. However, when the subject is emerging economies, it would not be correct if we neglect one more important situation: when a market is not found efficient in any of these three forms. We can refer to these markets as **inefficient markets**. Inefficiency, neglecting the random walk, is not a desirable situation. Recent studies point out different techniques to try and solve any mis-assessments. There are studies which show that some markets are inefficient and do not fall under any of the efficiency forms, and the majority of these were observed as to be either developing, emerging or transition economies [15–17]. This will be further mentioned in the following section.

Study conducted by Grossman and Stiglitz argues that it is quite impossible for markets to be perfectly efficient as there will be no reason left for investors to trade in these markets if there were no profits to be made [24]. However, this is a serious situation as, in the long run, it will lead to the collapse of these markets. Also, we all know that trading stocks incur costs, so it is important whether the gains made is sufficient enough to compensate for these costs. This is another question that needs to be kept in mind regarding inefficiencies [7].

### **2.3. EMH and emerging economies**

There are varieties of definitions of emerging economies, but we must be careful in defining it correctly. First of all, a country is classified as emerging when its GDP per capita decreases under a certain level [25]. Then, generally there is low income, frequent economic and political change and rapid growth in these countries. Some other characteristics include high volatility, higher than average return and being less mature capital markets [5]. There is a reason why these countries are named emerging as the basic principle behind them indicates that

they try to 'emerge' from their current underdeveloped position and move towards being part of the developed countries, the process which is called **convergence** [25].

Emerging economies can be divided into two groups: developing and transition economies. Transition economies are countries with economies moving towards a market economy from the existing centrally planned economy, such as the Former Soviet Union and China. Developing economies, on the other hand, are countries with economies that are growing and are in the process of becoming industrialised, such as Turkey, Poland, Indonesia, Bangladesh and many more [26].

Especially in the last couple of decades, research on the emerging economies around the world started gaining importance. The reason for this can be attributed to few different factors. Firstly, countries with emerging economies are highly populated and make up a great portion of the world's population as well as land. Secondly, growth in these countries is far more than its developed counterparts. They are beginning to be seen as having diverse environments, whether it is the business, cultural, economic, legal financial or political environments. Researchers want to focus on these diverse environments; analyse, assess and come up with new theories and evidence to understand; and, therefore, improve the welfare of these countries [5]. Application of the EMH is one of them.

It is clear why we keep on stressing the importance of studies conducted on emerging markets in each section. There is an ocean full of information that is yet to be discovered. We can also consider the effects of pull and push factors in the increasing importance. Lack of opportunities and lower returns for investments make up the push factors which are associated with developed stock markets. It pushes investment towards emerging economies. On the other hand, emerging economies tend to have pull factors which attracts these investments. These are reforms (structural and economic), international equity offerings and exchange-rate stabilisation programmes [27].

History is an important concept when assessing market data and the EMH. There needs to be sufficient data in order for us to be able to analyse the efficiency of these stock markets. But the problem with emerging economies is that they are relatively new markets and have very little data. This makes it difficult to obtain healthy results and maybe one of the reasons that majority of these results come up as inefficient. Evidence shows that stock prices take its time when adjusting to information; it may be much better to look over a longer time period in order to obtain results of whether these markets are efficient or not rather than focusing on the short run [28].

### *2.3.1. Reviewing past research*

EMH has made tremendous contribution to the area of finance in the past few decades. Among the three forms of market efficiency, probably the weak form is the most commonly tested form. We can see that research on emerging economies (including developed and transition economies) mainly focuses on the weak form and in some the semi-strong form [29]. Strong form of market efficiency is very difficult to test [23], and there is hardly any evidence of its test on emerging economies. In emerging economies, returns of stocks are said to be highly predictable and the stock markets less efficient than those of emerging economies [30].

For example, Lee et al. investigated the efficiencies of 26 developing countries using panel data stationarity tests between 1999 and 2007, which showed inefficiency of these markets [31]. Kim and Shamsuddin looked at the weak form of efficiency of a group of Asian stock markets using both daily and weekly data from 1990 to 2005. They have found that stock markets in Hong Kong, Japan, Korea, Singapore and Taiwan were efficient in the weak form. But stock markets in Indonesia, Malaysia and the Philippines were found to be inefficient [32]. It is interesting as Korean stock market has been tested for weak form of efficiency by others and found inefficient [15–17]. Istanbul Stock Exchange [currently called Borsa Istanbul (BIST)] was tested for the weak form of efficiency by many and was also found both efficient [30, 33, 34] and inefficient [18–20].

It is important to remember that the data presented in this chapter on the efficiency of emerging economies comprises only an extremely small sample of the entire population of studies. Therefore, we can say that there are many studies, with many different results. The results can show variations among each other, where a study can indicate efficiency, whereas the other shows inefficiency. The reason can be attributed to data being collected from different time periods, whether daily, weekly or monthly data that is being used, or even can be due to the tests that are used. Only recently, studies have pointed out that nonlinearity in stock prices is very important and that they should be taken into account in the tests to prevent the misleading results [35].

### *2.3.2. Emerging economies and liberalization*

Liberalization can be defined as a decision made by governments to increase foreign investment and trade. Its aim is for the removal of barriers, lessening of regulations and government controls towards foreigners giving them the right to purchase shares and trade within that country. It is crucial that the impact of liberalization be measured and assessed because it results in both financial and economic changes within the market [36]. To gain the benefits of liberalization, from the second half of the 80s onwards, countries with emerging economies started modifying their laws and allowed foreigners into their markets. The changes of financial liberalization in these emerging economies have been great and led researchers' interest to the area [37].

Some of the research on the liberalization of emerging economies looked at the issue of efficiency of their stock markets. Their point was that if these markets are being opened to foreign investment, are they now more efficient? [38]. According to the EMH, the market's efficiency increases as it becomes more liberalized because liberalization means the market will be made open to the public [37]. Although theoretically true, the effect of liberalization on the efficiency of emerging country's stock market should be further investigated.

### *2.3.3. Emerging economies and financial crisis*

One more topic that must be mentioned under emerging economies and EMH is the effect of a financial crisis or a crash of a market to the efficiency of the stock market of that particular country. Financial crisis is counted by researchers as the possible factor of inefficiency. But, yet



again, there is not much evidence yet to fully support this theory. A study conducted by Garas and Argyrakakis showed a relationship between financial crisis and market efficiency. They have looked at the Athens Stock Exchange stock prices between the years 1987 and 2004 and concluded that during the crisis, the stock market became less efficient, i.e. market showed lower efficiency [39]. However, at the same time, Hoque et al. looked at pre- and postcrisis periods and pointed out that there was no relationship between the crisis and market efficiency [40]. Therefore, it is an area that can be exploited in the near future.

### 3. Market anomalies

Some stock markets show deviations from the known principles of EMH. These deviations can take place sometimes just once but sometimes can take place repeatedly and are usually referred to as 'anomalies' [14]. Dictionary definition of anomaly is an occurrence that is irregular, is not usual or is strange, and it is usually used to explain scientific issues or technological matters [41]. They reflect inefficient markets. Therefore, this section of the chapter will focus on market anomalies and show if there is a possibility of identifying gaps in the stock market. Gaps, where opportunities for investors are created, allow them to earn above normal profits.

To make it easier to analyse, we can categorise anomalies into three groups (calendar, fundamental and technical). As the name suggests, calendar anomalies focus on a certain time period. Calendar anomalies include anomalies such as day-of-the-week, turn-of-the-year and January effects. Fundamental anomalies include book-to-market ratio, value anomaly, high dividend yield and many more. Lastly, technical anomalies involve a technical analysis to predict future prices. Examples can be moving averages and trading range break anomalies [14]. We will explain few types of market anomalies which are more apparent in emerging economies and more experimented.

#### 3.1. Day-of-the-week effect

Day-of-the-week anomaly, developed originally by French, states that stock returns are not always the same during the week, and different days generate different returns [42]. Majority of the studies show that returns earned on Mondays are usually much lower than the rest of the days, whereas returns generated on Fridays are the highest [43, 44]. Using this knowledge, an investor can buy stocks on a day when the prices are the lowest and sell it when the prices are at the highest point, hence, showing the inefficiency found in the stock market.

Besides the ones that accept the day-of-the-week effect, the remaining are divided into two thoughts: the ones that argue that there is such thing as the day-of-the-week effect, but it is not an anomaly (such as the difference in the trading days and the non-trading problems), and the others (such as econometric methodology, calendar time vs. trading time and the offsetting effect of liquidity hypotheses) who say that it never existed [45].

This anomaly has taken interest of researchers when studying emerging economies because, probably, together with other types of anomalies, it provides an explanation for why these

markets are generally inefficient. Let's consider the following studies as examples to the day-of-the-week effect on emerging economies. They provide evidence to both views. Poshakwale studied the Bombay Stock Exchange for the years between 1987 and 1994, to see if the day-of-the-week effect exists within the market. Results of the study showed that the weak form of efficiency did not hold for this market and that the day-of-the-week effect existed [46]. But, to present a different view, Basher and Sadorsky looked at 21 emerging stock markets from around the world. Data was taken from the period between 1992 and 2003. Their results indicated that majority of the emerging markets did not show signs of the day-of-the-week effect except for the Philippines, Pakistan and Taiwan [47].

### **3.2. January effect**

January effect anomaly states that returns generated vary according to the months within the year. In January, the highest returns are expected when compared to the rest of the year. Therefore, January effect is classified under seasonality and, like the day-of-the-week anomaly, has a big impact on the investor's decisions. If seasonality is found, then this means that the EMH will not hold. Investors will then be able to use available information to gain profits over others in the market [27].

However, these are a debate over whether this anomaly still exists or not. According to one view, January effect still exists, whereas another view says that it has lost its momentum and might even have become extinct. But, there is a third view, saying that it might have become extinct in countries like the USA, but it still holds for others, such as in the countries with emerging economies. Study by Patel looked at whether January effect existed in international stock returns, by examining stock returns from 1997 to 2014. Results indicated that this anomaly did not exist in international markets [48]. There were other studies that supported this finding [49, 50]. However, Guler examined data from five emerging economies: Brazil, China, India, Argentina and Turkey. Data was taken from a period between the first trading day of the stock market in each country and the end of 2012. Results, this time, showed the existence of the January effect in China, Argentina and Turkey [51]. Therefore, it could be understood that there are many studies conducted with varying results. This area needs to be deeply investigated as it has a great impact on investment decisions.

### **3.3. Small-firm effect**

The previous two types of anomalies mentioned were part of the calendar anomalies. Small-firm effect, however, is considered to be part of the asset pricing anomalies. It was first put forward by Banz and states that the stock returns are related to the size of the firm [52]. According to the anomaly, the smaller the firm, the higher the expected returns will be. Knowing these will, again, have implications for investors and also relates to the efficiency of the market.

There are few reasons why researchers believe that small firms generate unusually high returns. One of the reasons is that smaller firms have smaller stocks, which contain systematic risks. These risks cannot always be measured correctly. Since they are more prone to risk, small firms will try to compensate it by reflecting it as higher returns. Secondly,

when compared to larger firms, they are more focused on increasing their market shares and expanding. Research points out that smaller firms are more likely to reinvest its earnings back into the company and cause the value of its common stock to increase; hence, means increase in returns in the future [53].

Small-firm effect and the January effect are anomalies that actually go hand in hand with one another. Research shows that stock prices of smaller firms were observed to be more affected by the January effect than larger firms [54]. Rogalski and Tinic also stated that returns of smaller firms were much higher in January than any the other months in the year [55]. This can be referred to as an 'anomaly within an anomaly' [56].

It is indicated in research that people who live in countries with emerging economies tend to experience more behavioural biases which makes it more interesting to search for anomalies in the markets of these countries [56]. For example, Chui and Wei examined the size effect in Hong Kong, Korea, Malaysia, Taiwan and Thailand using monthly data from 1977 to 1993. Their results showed that the small-firm effect (size effect) was present in all of the analysed countries except for Taiwan [57]. The effects of these anomalies are important to know, and there is lack of information. Therefore, this particular area in research should be considered and focused more by researchers.

### 3.4. Other anomalies

As part of the calendar anomalies, we can mention two more: turn-of-the-month effect and turn-of-the-year effect. According to the turn-of-the-month effect, on the last trading day of the month plus the first three days of the next month, an increase in the stock prices is expected. With the same principle, turn-of-the-year effect is about the increase in the stock prices in the last week of December.

Under the fundamental anomalies identified, low price-to-book anomaly states that the lower the price-to-book ratio, the higher the returns will be. Value anomaly takes place when investors over or under estimate the stock returns in the market. Low price-to-earnings (P/E) ratio, which is a common studied anomaly, states that the lower the P/E ratio, the more returns will be [14].

## 4. Using EMH in investing decisions

For a long time, researchers have tried to understand the behaviour behind stock price movements. Efficient market hypothesis and the random walk theories have surfaced as a result of this search to test these behaviours as Fama mentions in his article [58]. In general, however, there are two common methods for stock price prediction which also helps investor decisions: technical analysis and fundamental analysis. They will be individually explained in the following part.

### 4.1. Technical analysis

Technical analysis is a theory about past behaviour and deals with the patterns found in stock prices. The theory behind the analysis goes back to Charles Dow, who is the founder of

*The Wall Street Journal* [59]. His theory, named Dow theory, looks at stock prices and tries to observe the long-term trends in it. Technical analysts, who are also referred to as 'chartists', believe that past information can be used to predict future stock prices as the patterns tend to repeat themselves. This, clearly, shows that technical analysis and random walk theory support opposite views. According to the chartists, information is not as valuable as it was thought in the past. Because, now, the classic demand and supply factors come into the picture. Reaction of stock prices can be so slow that during this time, an investor can have a chance to exploit the situation [11]. Technical analysis can therefore be used by investors to beat the market and exploit the resources in the emerging economies.

#### 4.2. Fundamental analysis

Fundamental analysis is a method used to determine the prices of stocks using both macro-economic and microeconomic factors, such as the earnings and dividend information of the firm, expected future interest rates and the risk evaluations. Decisions are made according to whether a particular stock is undervalued or overvalued [58].

The problem with fundamental analysis is to choose the correct firm to analyse. For example, in countries with emerging economies, majority of the firms have the potential to generate high returns. However if, as an investor, you want to achieve more, identifying good firms is not enough as everyone else will already have that information. That investor has to be better than its rivals, has to have a better estimate and finds firms that have more potential for higher returns. Therefore, if efficient market hypothesis holds and all the available information is incorporated into the prices, then fundamental analysis becomes even trickier [11].

### 5. Application: testing the weak form of efficiency of emerging economies

To put the theory in perspective, we have selected 24 countries which have emerging economies, from around the world, based on the MSCI Emerging Markets Index. These markets were classified into three groups within the Index. These are being Americas (Brazil, Chile, Columbia, Mexico and Peru); Europe, Middle East and Africa (the Czech Republic, Egypt, Greece, Hungary, Poland, Qatar, Russia, South Africa, Turkey and the United Arab Emirates); and, lastly, Asia (China, India, Indonesia, South Korea, Malaysia, Pakistan, the Philippines, Taiwan and Thailand).

To test whether the markets within these countries are weak form efficient or not, stock prices need to be analysed. It needs to be checked whether the prices are independent from each other or contain a unit root. Therefore, monthly stock price data was collected from the stock markets of these countries, from their major indices. Data covered the time period between February 2008 and May 2017, which signifies a time from the major 2008 global financial crisis until the current date. These stock prices were placed in the WinRATS programme to test the following hypothesis:

$H_0$ : contains unit root (efficient market) (i.e.  $H_0: \gamma = 0$ ).

$H_a$ : stationary (inefficient market) (i.e.  $H_a: \gamma < 0$ ).

If the null hypothesis holds, then it is said that the data contains a unit root and the market is efficient. However, if the null hypothesis is rejected, meaning that the alternative hypothesis holds, then the data is stationary and the market is not efficient.

There are many tests (linear or nonlinear) that can be used to test for the existence of a unit root. Although nonlinear tests being the most recent ones developed and supported by many researchers, in this application we have used the traditional augmented Dickey-Fuller (ADF) test to look for a unit root within our sample [60].

Dickey-Fuller (DF) test was developed particularly to observe the stationarity of the data and whether it contains a unit root. Augmented Dickey-Fuller test was developed after this classic DF test, and it is said to be more powerful and can even solve more complex models. There are three regression models in the DF test, such as

$$\text{Model 1: } \Delta y_t = \gamma y_{t-1} + \varepsilon_t$$

$$\text{Model 2: } \Delta y_t = a_0 + \gamma y_{t-1} + \varepsilon_t$$

$$\text{Model 3: } \Delta y_t = a_0 + \gamma y_{t-1} + a_{2t} + \varepsilon_t$$

For ADF test, the 'Dickey-Fuller test is augmented by the logs of  $\Delta y_t'$  [61]:

$$\text{Model 1: } \Delta y_t = \gamma y_{t-1} + \sum_{i=1}^k \Delta y_{t-k} + \varepsilon_t$$

$$\text{Model 2: } \Delta y_t = a_0 + \gamma y_{t-1} + \sum_{i=1}^k \Delta y_{t-k} + \varepsilon_t$$

$$\text{Model 3: } \Delta y_t = a_0 + \gamma y_{t-1} + a_{2t} + \sum_{i=1}^k \Delta y_{t-k} + \varepsilon_t$$

In these models, Model 1 has no constant and no trend, whereas Model 2 has a constant but again no trend. Model 3, however, has both constant and a trend. In this test the error terms are assumed to be homoscedastic and are serially independent from each other [61].

Results obtained from the WinRATS programme is presented in **Table 1** below. These results signify the tau values of the model. There will be higher chance to reject the null hypothesis when this obtained tau value is more negative, because it indicates a unit root at the confidence level [62]. Again, using the work of Dickey and Fuller, the resulting values for each country with a sample size of 112 were compared to the critical values provided by them [60]. The identified critical value at the 10% significance level was observed to be 2.73. Any result, after taking its absolute value, found to be above the critical value of 2.73, indicated the rejection of the null hypothesis, and hence the market observed was not efficient.

As mentioned in the previous sections, there are many contradicting results for market efficiency of countries. The reasons can be due to the time period used within the sample, sample size, type of tests used, etc. The general thought behind emerging markets was that these markets are mainly inefficient and therefore offer many opportunities for investors allowing them to generate above average returns. However, our results indicated that out of these 24 economies, only 7 of them were found to be stationary and hence inefficient at the 10% significance level. These economies were from Brazil, the Czech Republic, Egypt, Hungary, Poland, Russia and Taiwan. The rest of the economies were found to contain a unit root and therefore

| Country            | ADF test results | Country                  | ADF test results |
|--------------------|------------------|--------------------------|------------------|
| Chile              | -1.4892          | Mexico                   | -1.23757         |
| Brazil             | <b>-2.80201</b>  | Pakistan                 | -1.51115         |
| China              | -1.84112         | Peru                     | -2.33717         |
| Columbia           | -0.61411         | The Philippines          | -0.80674         |
| The Czech Republic | <b>-3.80316</b>  | Poland                   | <b>-3.19045</b>  |
| Egypt              | <b>-3.15722</b>  | Qatar                    | -1.67703         |
| Greece             | 0.68877          | Russia                   | <b>-2.97182</b>  |
| Hungary            | <b>-2.80057</b>  | South Africa             | -1.20598         |
| India              | -1.62649         | Taiwan                   | <b>-2.78856</b>  |
| Indonesia          | -1.27022         | Thailand                 | -1.22127         |
| South Korea        | -2.00885         | The United Arab Emirates | -1.55542         |
| Malaysia           | -1.06921         | Turkey                   | -0.77993         |

**Table 1.** ADF test results of the 24 emerging economies. Note: The bold figures represent significance at 10% level.

can be said to be efficient in the weak form of information efficiency. These results provided an interesting ground for comparison to information efficiency literature, especially focusing on the post-crisis period.

There are many studies in the field and many different results. Looking at previous studies, we can see that when some support our evidence, some does not. For example, Zahid et al. tested the Karachi Stock Exchange (Pakistan) for the weak form of efficiency using various parametric and non-parametric tests, including ADF test, from period 13 March 2000 to 31 October 2011. Their results indicated that the market did not follow a random walk and, therefore, was not efficient [63]. However, our result does not support this and shows efficiency in the weak form. This example shows how using different dates and monthly data can cause the outcome to change.

Phiri, on the other hand, looked at the Johannesburg Stock Exchange to observe whether a unit root exists. Weekly data was collected from five indices, from the period between 31 January 2000 and 16 December 2014. Results of the study showed that, when applying the linear tests such as the ADF test, there was evidence showing the existence of weak form of efficiency, which supports our finding. However, when nonlinear tests were used, such as the Enders and Granger Test, then the results indicated a stationarity and showed inefficiency [29]. This example, now, indicates how the new methods for testing unit roots can be more powerful than the conventional linear tests.

Another interesting result obtained is from China. Our results indicate that the Chinese stock market, although it is perceived as highly speculative and driven by market rumours, is weak form efficient. Studies by Laurence et al., Liu et al. and Lima and Tabak show supporting evidence to our findings, whereas studies conducted by Mookerjee and Yu showed opposing results [64–67].

So, how do these results contribute? First of all, these results clearly break the idea that emerging markets are not efficient, even in the weak form. And, secondly, they specifically indicate a time period as of the financial crisis and are good reference point for researchers if they want to analyse the effects of the crisis on the stock markets.

## 6. Conclusion

Throughout the chapter we have defined and discussed the possible issues relating to both emerging economies and the information efficiency of their markets. In summary, when analysing financial markets, whether from a developed or from an emerging economy, the term 'efficiency' refers to the informational efficiency of the market, which is about the degree of information reflected in the prices of financial assets. The efficient market hypothesis is one of the most popular theories in this area and states that all existing information is somehow quickly incorporated into the stock prices. In this way everyone will have access to the same information, and no investor can be able to 'beat the market'. This theory has gained more popularity in the recent years with its application to the emerging economies.

But, why studies conducted on emerging economies important? There are specific characteristics of these markets that make them attractive for analysis and for investors, such as lower than average income per capita, high volatility, rapid growth, higher than average return and less mature capital markets. These characteristics actually make emerging economies unique and interesting in the eyes of investors. In emerging economies, returns of stocks are said to be highly predictable and the stock markets less efficient than those of developed economies, giving a chance for investors to exploit the situation and increase their profits.

Studies also point out that not all markets follow the principles of EMH and there exist inefficient markets, i.e. markets that are not efficient in all three forms of efficiency: weak, semi-strong and strong forms, as can be seen from the results of our study in the previous section. These deviations, which are generally referred to as 'anomalies', can take place just once or repeatedly. There are different types of anomalies known. They can be classified under three categories: calendar, technical and fundamental anomalies. All of them point out to the fact that there could be opportunities to exploit by investors.

At the end of the chapter, we have analysed the stock prices given on the major indices of the 24 emerging markets located all around the world in order to see if they are weak form efficient and if there are opportunities that can be exploited. Using the ADF test, data from February 2008 to May 2017 were analysed. The results indicated that out of the 24 markets only 7 of them were inefficient and the rest were weak form efficient, which contradicts the generalised view that emerging economies are inefficient. These results provided an interesting ground for comparison to information efficiency literature, especially focusing on the postcrisis period.

However, knowing that the amount of resources and opportunities are still much higher in emerging economies, it is important to gather as much information about these markets. Whether we use technical analysis to look at past behaviour and sources or we use fundamental analysis to focus on the macro- and microeconomic factors, there is an ocean of information and knowledge waiting to be discovered.

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