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# Introducing a framework identifying stock market return determinants: A micro and macroeconomic perspectives: *An Empirical study on the Egyptian Stock Market*[1]

Dr. Silvia Adly Saweris
Lecturer In College of International transport and Logistics, AASTMT
silvia-adly@aast.edu

Dr. Svetlana Sapuric
Associate professor in Economics and Finance, University of Nicosia, Nicosia, Cyprus
sapuric.s@unic.ac.cy

Prof. Sara Hassan El Gazzar
Prof. of supply chains In College of International transport and Logistics, AASTMT
sara.elgazzar@aast.edu

Dr. Ifigenia Georgiou
Assistant professor in Economics and Finance, University of Nicosia, Nicosia, Cyprus
georgiou.i@unic.ac.cy

## ABSTRACT

*The aim of this study is to develop a framework identifying the micro and macroeconomic variables that are expected to affect stocks' return of emerging markets. For the microeconomic variables, the five variables presented in Fama and French five factor model are examined (market excess return, size, value, profitability and investment) while for the macroeconomic model, five macroeconomic variables are selected such that three variables are domestic (exchange rate, inflation rate, industrial production index) and two are global macroeconomic factors (federal fund rate and global commodity index). Time-series regression analysis is run to determine the significant variables of each model separately using monthly data from June 2010 to June 2020. The results of the microeconomic variables showed the significant impact of size, value and profitability variables. Regarding the macroeconomic variables, the results have revealed that the only significant variable is the industrial production index with a positive impact on excess-return of portfolios constructed. The value of the current study emerges from its contribution in filling the gap of the macroeconomic literature as a gap is found in the empirical studies that investigated the impact of global macroeconomic variables on the stock market of the emerging economies. Additionally, the study adds to the microeconomic literature that examines the validity of Fama and French Five factor model while using a different measure for the profitability variable.*

**Keywords:** *Domestic variables, Global variables, Fama and French Five Factors model, Emerging market, Egyptian stock market.*

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## 1. INTRODUCTION

The volatility associated with the stocks' prices provided a clue that the stock market is not a free space but it reacts to different factors, either internal or external or both. To this day, the literature used different models to study stocks' price prediction either financial ratio, macroeconomic or microeconomic which made understanding the basis on which the market participants react and make their investment decision a dilemma. This dilemma has emerged after the failure of the classical financial theories in measuring the market behavior practically, like the Capital Asset Pricing Model and the market efficiency theory. Accordingly, different notions and thoughts were developed, such as considering the macroeconomic variables presented in each respective economy as a reason for stock prices' fluctuations (Ross, 1976), while other researchers like Fama and French (1992, 1993, 1996, 2012, 2015) considered the microeconomic variables related to each firm characteristic- such as value, size, profitability and investment - are better in explaining stocks' return.

This study aims to develop a framework identifying the micro and macroeconomic variables that are expected to affect stock markets' return of the emerging markets.

The current study chooses the microeconomic variables presented in Fama and French 2015 five factor model (FF5) to study the role of firm's specific characteristics in explaining stocks' return variation. This model represents the most updated work for the microeconomic thought that is based on earlier studies' evidence. Also, a lack is noticed in the studies that examined the role of investment and profitability, which stresses the need for examining the explanatory power of FF5. As for the macroeconomic variables, the study selected the variables based on the literature and the belief that the selected variables have the most influence on the examined stock market and future cash flow of its stocks. The analysis of the macroeconomic literature showed that, most of the studies have focused on examining the effect of domestic macroeconomic variables without paying attention to the effect of global macroeconomic factors (Šimáková et al., 2019; Ramadan et al., 2016). Thus, this study will consider the impact of two prominent global factors (the federal fund rate and the global commodity prices index), in addition to the domestic variables. Studying the impact of the global variables has become of great

importance nowadays, notably after the increase in the global incorporation (Neaime, 2016; Abou-zaid, 2013).

The chosen emerging market is the Egyptian stock market as it is positioned among the top emerging markets; also, the Egyptian stock market has observed considerable progression starting from the economic reform program in 2013 (The World Bank, 2019). In addition to its similarity with some emerging markets in risk-return relationships (Lyocsa and Baumohl, 2015). These reasons encouraged the nomination of the Egyptian stock market to be the stock market under investigation in this study. Additionally, the analysis of the literature has shown a lack in the empirical work studying the asset pricing theories in the emerging markets specifically the Egyptian stock market, which increases the novelty and the originality of this study.

The aim of the study is achieved through the following objectives:

Firstly, determining the most significant microeconomic variables and their impact on stock prices of the Egyptian stock market using Fama and French five-factor model.

Secondly: determining the most significant macroeconomic variables and test their effect on the Egyptian Stock Market using preselected macroeconomic variables.

Thirdly: building a framework using the most significant micro and macroeconomic variables.

The results of these two models will add value to the financial literature by determining the macroeconomic and microeconomic variables that affect the stock market in Egypt, an emerging market economy. Furthermore, to the best of our knowledge, this study is the first to test macroeconomic variables against portfolios constructed using different sorting methods which enriches the macroeconomic literature. Although the results of this study are limited to the Egyptian stock market as the only unit of analysis, it paves the path to be applied to determine the factors that affect any developing stock markets. Also, the findings of this research will provide the most recent viewpoints in the body of knowledge of asset pricing theories for the practical use in addition to the academic value.

The remainder of the paper proceeds as follows: section two provides a review of the existing literature about the studies that have tested the micro and macroeconomic factors and examined their role in explaining stocks' return in different markets. Section three provides a description of the methodology. The results are presented in section four while section five provides the conclusion.

## 2. LITERATURE REVIEW

Researchers' interest in studying macroeconomic variables raised after Chen et al. (1986)'s work that have encouraged researchers to move from efficient theory hypothesis to Arbitrage Pricing Theory developed by (Ross, 1976). This theory moved the researchers and market participants away from the simplicity of CAPM toward considering the undetermined macroeconomic variables that are expected to explain movements in stocks' prices. The movement toward considering more than a single variable to explain stocks' price fluctuations have encouraged researchers toward considering the impact of various macroeconomic variables.

Apart from the macroeconomic variables, there is another notion that claims the ability of microeconomic variables presented by firms' specific characteristics to explain fluctuations in stocks' prices. The famous researchers that explained this approach were Fama and French. Fama and French series of contributions in asset pricing theories started by demonstrating the ability of firm's specific characteristics in capturing some anomalies that were not explained by CAPM's market beta. The researchers introduced two additional variables to the market beta in 1992: (1) size, measured by market capitalization and (2) value, measured by book to market equity, resulting in the three factors model. Many extensions were added to this model, like momentum added by Carhart, four factor model (1997), and the five-factor model extended by (Fama and French, 2015). Fama and French five factor model adds investment and profitability to the three-factor model based on evidence provided by (Novy-Marx, 2013), (Titman et al., 2004).

### 2.1 The microeconomic model

Basu (1983; 1977) was the first to examine the accounting measures in a study of the relationship between NYSE stocks' reaction and prices to earnings ratio for the period from 1956 to 1971. Basu calculated the return of five price-earning portfolios on monthly basis and found that the two portfolios of the lowest

price-earning ratio earned average return higher than the portfolios of the highest two. The results reached are the same throughout the 14 years of study. Then, it was Banz (1981) who studied market capitalization through examining its relationship with NYSE stocks' return. Banz used three market indices rather than the CAPM's market portfolio. Two of the three indices were value weighted index and the CRSP equally weighted index that are totally equity indices, while the third one is a combination of the corporate and treasury bonds' return with the value weighted CRSP index. The results retrieved from OLS and GLS regression were the same for the three indices whereas the stocks of high market capitalization achieved lower return than that of the small market capitalization stocks for all years under study.

The same results were reached by Fama and French who started their work in 1992 by analyzing the performance of 9,500 stocks. They concluded that the usage of market beta represented in CAPM as a single measure of risk is not sufficient to reflect the performance of the stocks. Fama and French (1992) based their criticism on the evidence provided by (Basu, 1983; Banz, 1981; Rosenberg *et al.*, 1985 and Bhandari, 1988). All those researchers provided evidence of additional variables that can explain return rather than CAPM's market beta.

In 1992, Fama and French took the firm specific characteristics proved by other researchers to have effect on average stock return, such as size, cash flow/price, past sales growth, earning/price, book-to-market equity, long-term past return, and short term past return. Fama and French took the criticisms found by previous researchers, tested them again with the CAPM, and ended by introducing the three-factor model by adding two variables to CAPM's market beta. The added two anomalies were the most well-known during that period and were not explained by CAPM (Fama and French, 2015). The first added variable is size (market capitalization), while the second variable is value (book to market ratio), measured as HML, which stands for high book to market ratio minus low. This model was further supported by Fama and French's studies in 1993 and 1996. Both studies proved that the anomalies that were not captured by CAPM disappeared when using the three-factor model (Coffie, 2012).

In 2015, Fama and French introduced two other variables to the already existing three-factor model, resulting in a five-factor model. The added two variables are operating profitability and investment strategy of the company. Fama and

French chose these two variables based on the results reached by Novy-Marx (2013) and Titman *et al.* (2004), whose studies proved the insufficiency of the three-factor model to explain the variation in average return. Also, the addition of these two variables was supported by "dividend discount model". Profitability is measured by $RMW_t$ (return of diversified portfolios of robust stock minus that of weak stock) while investment is measured as $CMA_t$ (return of diversified portfolio of low investment stocks minus that of high investment stocks, where low investment stocks named as conservative and high investments stock as aggressive). Fama and French work in 2017 tested the ability of Fama and Fench five-factor model in explaining the international stocks prices' variation based on size, value, profitability and investment. The researchers run their study on the period from July 1990 to October 2015, using the stocks' return of 23 developed countries located in four regions (North America, Europe, Asia Pacific and Japan) using global and local versions. The study proved the superiority of the five-factor model in capturing return variation compared to the three-factor model.

The current study tests the impact of the microeconomic variables presented in FF5 to study the role of firm's specific characteristics in explaining stocks' return variation, as a lack is noticed in the studies that examined the role of investment and profitability, which stresses the need for examining the explanatory power of FF5. Fama and French have tested the five-factor model in markets of North America, Europe, Japan and Asia Pacific and proved its power over the three-factor model; however, these results could be limited to this sample size at that time. Also, it should be highlighted that each region may have different anomalies, meaning that what fits in a particular region does not necessarily explain the other. Therefore, there is a need to study this model again in different markets under different times to examine its validity and explanatory power.

#### *2.1.1 Examining the microeconomic variables in the developing markets*

Jiao and Lilti (2017) found through their study on the Chinese stock market that profitability and investment variables have not added any explanatory power over the three-factor model, except for portfolio constructed based on size and profitability.

ElKhafagy and Abd ElRasol (2019) implemented a study on the Iraqi's stock market for the period from 2009 to 2017 to examine the role of FF5 using 34 listed companies. The results proved that the investors can get better results when establishing portfolios based on the size and profitability variables presented in the model.

Mosoeu and Kodongo (2020) implemented a study on six selected emerging markets (China, India, Malaysia, South Africa, South Korea and Egypt) and two developed markets (Australia and Singapore) for the period from 2010 to 2015 using weekly data. The results of their study proved the powerful role of the profitability factor for all the examined emerging and developed markets, when market excess return and size were detected as redundant factors.

### *2.1.2 Examining the microeconomic variables in the Egyptian Stock market*

As for the studies conducted in the Egyptian stock market& El Abd (2016) applied a study on the Egyptian stock market that compares four asset pricing models: CAPM, Fama and French three and five-factor models, and Carhart four-factor model. The period under analysis was from June 2005 to July 2016. The results of the study proved that the FF5 was the most eminent one among the tested models with the significant power for size, while rejecting the role of value and momentum variables. The researcher highlighted the need for reinvestigating the profitability and investments variables because of their missed results.

Ragab et al. (2019) compared the role of Fama and French three and five factor models in the Egyptian stock market for the period from July 2005 to June 2016 using time series regression. The results highlighted the role of size as the most significant variable, also supported the existence of investment and profitability effect however it was not of the same significant impact as size and rejected the role of value effect.

Based on the analysis of the results retrieved from the previous studies, it is expected that the microeconomic variables presented in FF5 to show significant role in explaining the variation in stocks' return. According the first hypothesis of this study is developed as follows:

$H_1$: *The microeconomic variables presented in Fama and French's five-factor model have significant effect on stocks' return.*

## 2.2 The macroeconomic model

There are two different theories that debated the effect of major macroeconomic factors on stock markets: an economic theory named "The quantity theory of money" introduced by Fisher (1930) and a financial theory named Arbitrage Pricing Theory (APT), introduced by Ross (1976), explaining that the relationship between the main risk variables and asset prices can be used to forecast these assets' movements (Adesanmi, 2018).

The analysis of the macroeconomic literature showed that most of the studies have focused on examining the effect of domestic macroeconomic variables without paying attention to the effect of global macroeconomic factors (Šimáková et al., 2019; Ramadan et al., 2016). Thus, this study will consider the impact of two prominent global factors, in addition to three of the most comprehensive domestic variables.

The global macroeconomic factors are Federal Fund Rate (FFR) and Global Commodities price index (GCI) and the domestic variables are exchange rate (EXR), inflation rate (INFR), and industrial production index (IPI). It should be highlighted that the variables selected for this study construct the main indicators of the economic condition of the Egyptian stock market, which is the stock market under investigation in this study. Also, volatility and deviations in the stock market were noticed when any announcement is made regarding these variables, while investors and other people clearly watch these variables upon any change is made related to them. The following sections are divided based on the five variables selected. A review is covered for the articles that examined the variables in markets with different degrees of development while focusing on the emerging markets.

### *2.2.1 Exchange rate*

Exchange rate is employed in this study as a domestic variable that measures the external competitiveness of the economy (Majid and Yusof, 2009). There are various approaches that discuss the relationship between exchange rate and stock market; the "goods market approach" or sometimes called the "traditional approach" is the first prominent approach that was discussed by Dornbusch and

Fischer in (1980) (El-Masry and Badr, 2020; Alshogeathri, 2011). The second approach is the "portfolio balance approach", introduced by Frankel in (1983) (Alshogeathri, 2011). This approach suggests a direct relationship between stocks' return and exchange rate. The exchange rate is directed by changes in stock market, such that the increase in the values of the stocks will direct investors toward the local stocks away from the international ones, causing an appreciation in the value of the local currency and the opposite is true in case the domestic market depreciates (Aydemir and Demirhan, 2009). There is also "Asset market approach", which indicates the existence of no relationship or a very weak one between exchange rate and stock market, depending on the fact that both are directed by several factors (El-Masry and Badr, 2020).

When using the asymmetric ARDL nonlinear cointegration technique, Ajaz et al. (2017) have proved the existence of asymmetric reaction of Indian stock prices to exchange rate, such that the depreciation of exchange rate had resulted in decreasing prices of the stocks. The researchers examined monthly intervals for the period from April 1991 to December 2015, using the BSE index as a proxy for the Indian stock prices and using average monthly Indian rupees per US dollar as a measure for exchange rate. El-Masry and Badr (2020) implemented a study to examine the causality relationship between foreign exchange market and stock market performance in Egypt before and after the 25$^{th}$ of January 2011 revolution. The study used four different Egyptian stock market indexes and stock market capitalization as proxies of stock market performance and EGP/US dollar as proxy of exchange rate. The analysis was run on daily data using VAR Granger causality test, where the results proved the existence of a significant causal relationship between the different indexes and exchange rate and between the market capitalization and exchange rate in both directions before the 25$^{th}$ revolution, while after the revolution this relationship did not exist.

From the previous studies, it can be concluded that all theories of exchange rate are supported: the portfolio balance, goods market (traditional) approaches, and the asset market approach. This means that the sign of exchange rate cannot be pre-assigned and its impact is going to be determined through an empirical test.

#### *2.2.2 Inflation rate*

Different monetary policy tools are used by different governments to establish a stable economic condition for economies' welfare. The central bank can use

some monetary policy tools to maintain prices and reach the optimal output and employment level in the country (Hojat, 2015). Tools of monetary policy adjustment could be the usage of debt instruments, such as the interest rate, consumption's adjustments and the amount of money supply (Suhaibu et al., 2017; Hojat, 2015).

It is argued that for the monetary policy tools to be of good economic effect, they have to affect the prices of the stocks, as stocks' ownership represents the future demand for output (Patelis, 1997), while Suhaibu et al. (2017) described financial markets as the connecting bond that allows transmitting the monetary policy actions to the nations' economy.

Change in inflation rate is picked to be tested in this study as one of monetary policy tools. It is expected that whenever the money supply increases, the inflation rate will increase, as the increase in the amount of money circulated in the economy will decrease the purchasing power of the currency. This means that the central bank uses money supply to control the level of inflation, such that the inflation rate is reduced when decreasing the lending rate while raising the borrowing rate (Adesanmi, 2018). The stock market is sometimes beneficial to hedge against the rise in prices caused by inflation.

Inflation is explained as the changes occurring to the prices of goods and services existing in an economy. It is expected that the increase in inflation means a raise in living costs, causing a shift away from stocks' purchase to consumable products. This decreases the demand on stocks, followed by a drop in trading volume and thus a decrease in stocks' prices (Suhaibu et al., 2017).

Previous studies that have examined inflation rate proved its significant impact on stock market as a monetary policy tool.

From the studies that tested the inflation rate impact is a study by Šimáková et al. (2019). The researchers implemented a study to examine the relationship between three macroeconomic variables: GDP, inflation and interest rate with stock markets of 12 European Union countries with different degrees of development. Their study focused on food and drinks' companies only as it argued the stability of this sector, whatever the surrounding conditions are. The countries under study were Poland, Lithuania, Italy, Spain, Ireland, Germany, Cyprus, UK, Austria, Croatia, Denmark, and Finland and were examined for the

period from the 4th quarter of 2005 till the 4th quarter of 2015. The inflation rate was measured by food price index (FPI) and proved to have an inverse relationship with the performance of food and drink companies' stock prices when using correlation analysis. Also, Jareno et al. (2019) implemented a study on the stock market of six countries with varying degrees of development (Germany, Italy, Spain, France, UK and US) to test the empirical power of the selected macroeconomic variables: Gross domestic product, consumer price index (CPI), the industrial production index and unemployment rates. The results proved the low significance of CPI.

As for the studies conducted in the emerging economies, Akbar et al. (2018) tested the long-term relationship between the inflation rate with six macroeconomic variables on the Pakistan's stock market. The period under study was from 1992 to 2012 while employing three econometric tools to evaluate the linear relationship: the OLS, the ARDL Co-integration and the Vector Error Correction Mechanism. The results proved the significance of the current and lag values for inflation rate measured by consumer price index (CPI). The inflation rate was of a negative influence during the current month and positive in the next month and negative again after two months.

Mohamed and Ahmed (2018) examined the effect of inflation rate with other five macroeconomic variables on the Jordanian stock market for the period from 1976 to 2016, whereas the examined variables were industrial production, interest rate, money supply, inflation rate, GDP and imports' prices. The results proved the significance and negative impact of the inflation rate along with import prices.

Recently & Molefhi (2021) implemented a study to test the impact of inflation rate with other macroeconomic variables on stock market development of Botswana from 2006 to 2017. The short-term analysis revealed the positive impact of inflation rate on stock market's development while in the long run, only GDP showed a positive significant influence.

Given the various empirical findings reached above and the dominant results about the inflation rate's effect on stock market, the researcher concluded that the expected sign for inflation rate effect on stock market is to be negative.

### *2.2.3 Industrial production index*

Industrial Production Index (IPI) is the most famous proxy used for measuring the economic growth of any country, while other researchers used it in case of the unavailability of the GDP, as it is able to show variation in production of short terms (Geetha et al., 2011). It is a cyclical indicator that assesses the production performance of the industrial sector within a nation (Jareno et al., 2019). The industrial production index is affected by the economic state of a nation; thus, a rise is shown in periods of economic boom while the opposite in recession periods. Also, it has a direct influence on the cash flow of companies; therefore, it is expected to have a positive impact on the prices of the stocks of the related country. When industries in a specific economy are doing well and there is a progress in their productivity and profitability; the prices of their stocks would go up. The IPI was among the macroeconomic variables that were examined in Ross's (1976) study in U.S market and proved to be significant, and it was tested by Chen et al. (1986) in their studies in the New York Stock Exchange market. Also & Fama (1990) proved through his study on New York Stock Exchange that more than half of the variation in return was explained by changes in industrial production output. Moreover & Fama (1990) concluded a positive relationship between the future industrial production growth rates and stock returns. The same is for Lazarus's (2017) study for sectorial level when using 8 sectors from Kenneth French's 17 industry portfolio data set.

Jareno et al. (2019) implemented a study to examine the potential correlation between the stock markets of six countries and some macroeconomic variables, including the industrial production index using quarterly data for the period from 2000 to 2014. The results of the study proved the existence of a positive relationship between the industrial production index and the international stock markets employed in the study, but the relationship was of low significance.

Recently & Ali (2021) examined how the volatility of industrial production and consumer price index, Treasury bill rates and foreign remittance inflow led to volatility in the Bangladesh stock market. The period of analysis was from 2005 to 2018, where the results proved that the increased volatility in the industrial production led to a decrease in the stock market volatility while the increased in volatility of the other variables led to an increase in stock market volatility. The review of the previous studies highlights the importance of the industrial

production index as a measurement of the real output and the economic growth of any nation and its expected positive impact on the stock market. Accordingly, it is nominated to be examined in this study to enrich and update the existing literature of its impact on the stocks' return.

### *2.2.4 Federal fund rate*

The economy of U.S.A is one of the biggest economies; any changes in its economic or financial policies will be transmitted to the developing nations, which were proved after the effect of the 2008 global financial crisis on the world's different nations. It is expected that the unanticipated movements in stock markets of the emerging economies is justified by changes in U.S. policies (Adesanmi, 2018).

As a result of the 2008 global crisis, the federal fund rate decreased close to zero. Decreasing the federal rate had increased the capital flow to emerging economies and attracted investors to invest in the emerging stock markets (Marwah, 2015). Despite the existence of exchange rate risk and default risk, investors are still attracted to invest in the emerging stock markets because of the high return associated with the high level of risk. This indicates the existence of an inverse relationship between the federal fund rate and the developing stock markets. After the 2008 global crisis, the emerging economies had received around 50 percent of the global capital inflows because of the low interest rates adopted in the developed economies from 2009 to 2012. Majid and Yusof (2009) explained that the developing economies have observed a huge inflow from international investors and are viewed as competitive investment alternative. Alongside the capital inflow, equity and bond prices rose higher while currencies appreciated in value as it became cheaper to borrow, and investors sought yield outside of developed countries' borders.

After getting the advantage of decreasing the Federal fund rate[1], the Chairman, Mr. Ben Bernanke announced in May 2013 the tapering of the quantitative easing. That tapering had resulted in increasing the interest rate, depreciation in currencies of the emerging countries and capital outflow from the developing

[1]The decisions about applying an expansionary or tightening money supply and changes in interest rates are made by FOMC ( Federal Open Market Committee) through buying or selling treasury securities (Hojat, 2015)

markets, while the most affected countries are those of large current account deficit and great borrowing in foreign currency (Eichengreen and Gupta, 2015). Eichengreen and Gupta (2015) found through their study on 53 countries for the period from April 2013 to August 2013 that some of the emerging countries showed depreciation in exchange rates. This depreciation was noticed from the end of April to the end of July, such that the depreciation for half of the countries was more than 5.5% while Brazil recorded the largest depreciation with 12.5%. Also, a decline was witnessed in the foreign reserve, where the Dominican Republic and Indonesia showed the greatest decline. However, the impact of this tapering on the stock markets of the examined countries was different as 40% of the countries either had not shown a decline or showed a small appreciation.

The most affected emerging countries of this tapering were the countries that had appreciated the real exchange rates and had an increase in the current account deficit in the period prior to the quantitative easing. Additionally, countries with large markets' size witnessed an increasing pressure on their stock markets, exchange rate and foreign reserve (Eichengreen and Gupta, 2015). In 2015, the U.S. Federal reserve announced that there would be another increase in interest rates as a reflection of the economic improvement that had resulted in increasing the value of the U.S. dollar. This had increased the bad impact on the banks, companies and households that get loans in dollars and spend in another currency (Kuepper, 2019).

Adesanmi (2018) implemented a study to test the impact of changes in Federal fund rate before and after the financial crisis on the MINT countries (Mexico, Indonesia, Nigeria and Turkey). Several statistical tools were used to examine the relationship, including impulse response function, Granger causality test and variance decomposition, while the period under study was monthly data from 1993 to 2014. The results revealed variations with respect to each country, such that for Indonesia there was a negative relationship on the short term, but on the long term a positive relationship was observed. For Nigeria and Mexico, the relationship was negative in both the short and long terms, while for Turkey the results were positive on the long and short terms.

Cihangir (2019) implemented a study on some emerging markets (Turkey, Brazil, Mexico, Indonesia, Russia and India) to investigate the impact of federal fund

rate in addition to gold volatility index and oil volatility index on market index of these markets. Using daily data for the period from 2010 to 2018; the results found that the change in FED rate did not affect the index of the examined stock markets,

The review of the previous studies revealed that the most frequent impact is the negative influence of the increase in federal fund rate on the stock markets of the emerging studies but the studies implemented are still inadequate to generalize this impact on all markets. The review of the literature detected limited studies that examined the impact of the US federal fund rate on the stock market of the emerging economies which stresses the need for more studies so that an appropriate policy could be developed regarding the impact of FED rate on the stock market of the emerging markets.

#### *2.2.5 Global commodities index*

Since the price of the stocks is the present value of the future expected cash flow, the prices of the stocks are affected by any event that could affect future cash flow as the prices of oil, which is considered as a basic component of most output products.

The global commodity index composes of the prices of non-fuel and fuel commodities, but the most famous commodity is the oil. The oil price represents the most examined among the other commodities because of its strategic importance and its reference to the growth level of the economies (Adesanmi, 2018). It was examined by Chen et al. (1986) against US stock market return as a measure of economic risk.

Various studies have tested the direct influence of oil price through accessing its effect on final products' cost, which could have an unfavorable effect on the stocks' prices in case an increase in its price, while the indirect impact was verified through measuring the oil effect on the discount rate, because of the latter's influence on inflation rate. There is a direct relationship between inflation and discount rate whereas the increase in oil prices is translated as an increase in inflation rate and in turn decreases the stocks' prices, ending with an ultimate inverse relationship between oil price and stocks' return (Alshogeathri, 2011).

Also, it should be highlighted that the effect of oil prices depends on whether the nation is an exporter or an importer of oil whereas the effect on stock markets for

the importing economies is expected to be negative and positive for the exporting ones.

Singhal et al. (2019) tested the impact of oil in addition to gold on the Mexican stock market index. The study employed daily data for the period from January 2006 to April 2018, while using ARDL bound testing co-integration approach. The result proved that international gold prices had a positive relationship with the Mexican stock prices; as for oil prices, it was of an inverse relationship, which could be justified by the fact that Mexico is an exporting country of gold, but for oil it exports its original form and then imports the petroleum products.

Adesanmi (2018) tested the impact of the whole commodity index as a global factor on the stock market of four emerging economies. The analysis of the long- and short-term relationships has revealed that all the examined countries had a positive relationship with GCI in the short and long terms.

Akkoc and Civcir (2019) examined the spillover from the international oil and gold prices to the stock market in Turkey after the financial crisis, using structural VAR-DCC-GARCH approach. The results of the analysis proved the significant spillover effect from the international crude oil to the BIST100 return, whereas the correlation between the oil and stocks' return was low and more volatile than the relationship between gold and stocks' return while international gold prices had a powerful and a positive relationship with the stocks' return.

After the analysis of the literature, the inadequately of the studies that studied the impact of changes in global commodities index on the emerging economies stock market is viewed. Moreover, the implemented empirical studies were more concerned with the oil and gold prices, ignoring other commodities. This has raised the concern toward studying the impact of other commodities on the emerging stock market. This is important nowadays, especially when oil prices have decreased and the majority of countries that depend on oil are trying to move toward non-fuel commodities, like agriculture, food products and metals. It should also be highlighted that most of the developing countries that are food importers have doubled their food imports since 2000 (Adesanmi, 2018). Thus, it is important to consider the impact of both fuel and non-fuel prices in this study.

To conclude, the previous studies showed that the macroeconomic variables have a significant effect on the stock return, but what differs is the degree of significance of each variable. Also, it is proved that there is more than one significant factor explaining stocks' return and that the factors selected in each study were based on the economic theory and the conditions of each market. Additionally, the empirical studies revealed variation in results; this variation could be justified by the sample or period under study, the economic cycle of the country, the methodology or the statistical tool used. Consequently, more studies are still needed to show the effect of different macroeconomic factors on each stock market. This study will add value to the literature of the developing countries as they constitute half of the top 20 economies of the world in the global investment opportunities (Graham *et al.*, 2016). This leads to the development of the second hypothesis in this study:

$H_2$: *The selected five macroeconomic variables have a significant effect on stocks' return.*

## 3. METHODOLOGY

This section will present thoroughly the methodology followed to test the research hypotheses.

### 3.1 Testing the microeconomic model

The model that will be used to test the microeconomic variables' impact on the stock market return is represented in the following equation:

$$R_{pt} - Rf_t = \beta_0 + \beta_1(Rm_t - Rf_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \Upsilon_{it} \quad (3.1)$$

Where: $SMB_t$ measures size as the historical difference between return on small stocks portfolio and return on large stocks portfolio (SMB), $HML_t$ measures value as the historical difference between return of high book to market value portfolios and return of low book to market value portfolios. $RMW_t$ measures profitability variable as return of diversified portfolios of robust stock minus that of weak stock, while $CMA_t$ measures investment as the return of diversified portfolio of low investment stocks minus that of high investment stocks, where low investment stocks are named as conservative and high investment stocks as aggressive. The variable $\beta_0$ is the intercept, whereas the variable $\gamma_{it}$ is the error

term. As for $\beta_1$ to $\beta_5$, they represent the sensitivity (slope) of each microeconomic variable to portfolio excess return. The microeconomic variables will run against portfolio excess return to get the most significant variables among the employed ones.

The measurements of the right-hand side variables: (RM-RF, SMB, HML, RMW and CMA) presented in the above equation are described below:

RM-RF: is market portfolio's rate of return minus risk free rate.

SMB and HML will be calculated based on the following steps. Firstly, stocks will be arranged ascendingly at the end of June for each year under study (which is the end of the fiscal year for most companies) based on their market capitalization. Secondly, the median of market capitalization will be used as a break point to divide the stocks into two size groups: "Big" and "Small". Thirdly, stocks will be independently arranged again ascendingly, according to their BE/ME[1] ratio (Book Equity to Market Equity ratio). Following Fama and French (1993) approach, stocks whose BE/ME ratio that is less than the 30th percentile are labeled "Low", stocks whose BE/ME ratio are more than the 70th percentile will be labeled "High", and stocks that are in-between will be labeled "Neutral". As a result of the intersection of the two size groups and the three BE/ME groups, six portfolios will be constructed: "SL", "SN", "SH", "BL", "BN", and "BH"; (Small Low, Small Neutral, Small High, Big Low, Big Neutral, Big High). Fourthly, for each one of these portfolios, monthly value-weighted returns are calculated from July of year t to June of year t+1, whereas the return of every stock within the portfolio is calculated as the percentage change in price using the following equation

$$R_{i,t} = \frac{P_t - P_{t-1}}{P_{t-1}} * 100 \quad (3.2)$$

Where; $R_{i,t}$ is the return on individual stock July(t), $P_t$ is the closing price of the stock at the end of the month (t), and $P_{t-1}$ is the closing price of stock at the end of month (t-1).

[1] Market Equity (ME) will be used to measure size in this study; it is calculated by multiplying the adjusted closing price on the last trading day of the month by the number of outstanding shares. As for Book Equity (BE) is the book value of common equity (El Abd, 2016).

Then, the return of every portfolio is calculated as the weighted average return of the stocks forming that portfolio, such that the SMB factor is calculated as difference between average return of small stocks portfolios from (SL, SN, and SH) and the average return of the big stock portfolios from (BL, BN, and BH). The same for the HML factor, the average returns on portfolios with the high B/M (SH and BH) minus portfolios with the low B/M (SL and BL) (Czapkiewicz and Wójtowicz, 2014). The reason for having two size groups and three B/M groups is based on the results provided by Fama and French (1992) which explained that size had minor role in demonstrating average return for stocks relative to the B/M.

To calculate the profitability factor (RMW); firstly, stocks will be sorted into three groups based on their operating profit ratio: stocks whose OP ratio that is below the 30th percentile will be labeled as "Weak", stocks whose OP ratio that is above the 70th percentile will be labeled as "Robust", and those with OP ratio that is in between the 30th and the 70th percentile will be labeled as "Neutral". Six portfolios will be constructed at the intersection of the two size groups and the three operating profitability groups: "SW", "SN", "SR", "BW", "BN", and "BR" (Small Weak, Small Neutral, Small Robust, Big Week, Big Neutral, and Big Robust, respectively). Secondly, for each one of these portfolios, monthly value-weighted returns are calculated from July of year t to June of year t+1. Thus, two additional factors will be calculated: $SMB_{OP}$ and RMW, where the $SMB_{OP}$ factor is the difference between the arithmetic mean of the three small stocks portfolios and the arithmetic mean of the three big stocks portfolios, while the RMW factor is the difference between the arithmetic mean of the two High OP/BE stock portfolios and the arithmetic mean of the two Low OP/BE stock portfolios (El Abd, 2016).

The CMA[1] factor will be calculated using the following steps: (1) Firstly, stocks will be arranged into three groups according to their asset growth. Consequently, stocks with asset growth that is below the 30th percentile will be labeled "Conservative", stocks with asset growth that is above the 70th percentile will be labeled "Aggressive", and stocks whose asset growth between the 30th and the

[1] The Investment ratio that will be used for portfolio construction in June of year (t) will be calculated as the percentage of change in total assets from December of year end t-2 to December of year end t-1.

70th percentile will be labeled "Neutral". At the intersection point of the two size groups with the three asset growth groups, six portfolios will be constructed: "SC", "SN", "SA", "BC", "BN', and "BA" (Small Conservative, Small Neutral, Small Aggressive, Big Conservative, Big Neutral and Big Aggressive respectively). Secondly, two factors are then calculated: $SMB_{INV}$ and CMA. The $SMB_{INV}$ factor is calculated as the difference between the arithmetic mean of the three small stocks portfolios and the arithmetic mean of the three big stocks portfolios, while the CMA factor is the difference between the arithmetic mean of the two Conservative asset growth stock portfolios and the arithmetic mean of the two Aggressive asset growth stock portfolios.

Finally, the SMB factor is the arithmetic average of the three previously calculated SMB factors: $SMB_{BM}$, $SMB_{OP}$, $SMP_{INV}$.

The Left-Hand Side (LHS) portfolios are more precise versions of the Right-Hand Side (RHS) portfolios, which represent the dependent variables. It will be calculated using 2x3 construct described in Fama and French (2015) in which three different groups of 2X3 portfolios will be used as described below:

The first group involves portfolios that are built based on size-BE/ME, the second group involves portfolios based on size-profitability, and the third group is for portfolios based on size-investment. The value weighted return of each portfolio is then calculated from July of year t to June of year t+1, and then the excess returns of each one of the portfolios over the risk-free rate will be calculated and used in the regression. The stocks used in constructing the portfolios are stocks that constitute EGX100- one of the Egyptian indices that involves the largest number of companies compared to EGX30 and EGX70. The study selected companies from this index such that the selected stocks are classified as common equity a kind of A-shares stocks (Jiao and Lilti, 2017) after excluding the banking sector as recommended by literature (Foye, 2018; Jiao and Lilti, 2017) because of the different characteristics of their financial statement that differs from the financial statements of other listed firms. Accordingly, the stocks that are listed in foreign markets as well as types of investments other than common equity will be excluded like the exchange traded fund and American depositary receipts (El Abd, 2016). The period under analysis is from June 2010 to June 2020; hence, the stocks included in this study are those that are listed for the period under study, and in order to avoid survivorship bias while ensuring

the quality of the companies included in the study and the availability of their data; the study included the stocks that got out of this index and returned again. This resulted in having 47 stocks used in the construction of portfolios. In some years, the number of stocks employed to build the portfolios decreased to 46 or 45 stocks, due to specific filtering criteria, such as excluding stocks with negative BE/ME and stocks with investment rate of change greater than 100% or less than 50%, according to the methodology of (Fama and French, 1993; Erdinc, 2017).

It worth mentioning that the portfolio construction steps for both the dependent and independent are done on yearly base at the end of June of each year for the period under examination while portfolios' return is calculated on monthly base using equation (3.2).

### *3.1.1 The microeconomic model variables*

Several methods were used to measure the variables, specifically for countries other than U.S.A. Other countries have markets with very small numbers of stocks, and there is a great difficulty in finding a proxy for stocks that have high market capitalization similar to the NYSE. Also, there are differences among countries due to the different accounting methods, the fiscal year end dates with respect to each country and the difference in variables definitions (Bhayo, 2015).

Based on the literature, the stock market index can be used as an indicator for the stock market performance in a specific country, as it represents a group of selected stocks for companies that can act as representative for the entire market or a particular industry (Ramadan et al., 2016). The market return is calculated using the following equation:

$$R_{m,t} = \frac{MI_t - MI_{t-1}}{MI_{t-1}} * 100 \qquad (3.3)$$

Where: $R_{m,t}$ is the return on the Market index at the end of the month (t), $MI_t$ is the price of the Market index at the end of month (t), and $MI_{t-1}$ is the price of the market index at the end of month (t-1).

EGX30 is the market index employed in this study. It involves the most active 30 stocks listed in the Egyptian stock market in terms of liquidity and activity (Sakr, 2015). It is most appropriate index as the inclusion and exclusion of the Egyptian companies in the bigger indices is more frequent. Moreover, it is the best indicator used in previous studies to capture the performance of the Egyptian

stock market as it tracks the performance of the most liquid 30 stocks traded in the Egyptian stock market (Kamal, 2018; Ramadan *et al*, 2016). The risk-free rate is calculated using the rate of change of the monthly weighted average yield on the three- months Egyptian treasury bills.

As for the variables used for portfolio construction, the book to market ratio is calculated using two steps. Firstly, the book ratio is measured using book value of common equity plus deferred taxes (El Abd, 2016), companies whose book ratio is less than zero will be excluded from the calculation. Secondly, the market ratio which stands for size is measured by multiplying the adjusted closing price on the last working day of the month by the number of outstanding shares.

This study will use earnings before interest, taxes, depreciation and amortization divided by Book Equity: (EBITDA)/Book Equity as the measure of profitability. EBITDA is suggested to be used in measuring profitability as it provides fair analysis when comparing between companies of different size, structure, tax and depreciation and it was suggested as a better measure for profitability in emerging markets (Leite et al., 2018; Martins and Eid Jr, 2015).

The total growth in assets will be employed as a proxy for the investment variable as suggested by most empirical studies (Jiao and Lilti, 2017; El Abd, 2016). However it should be taken into consideration that the asset pricing tests are not sensitive to how profitability and investment are measured (Foye and Valentinčič, 2020).

### *3.1.2 The microeconomic model sampling technique and data collection*

The sampling technique implemented in this study is the purposive one, since a specific period is selected to be under investigation. The period under analysis is 10 years, starting from June 2010 until June 2020. The reason for starting the analysis from 2010 is justified by the fact the Egyptian stock market started publishing EGX100 from August 2009 and since the companies employed in this study are picked from the companies that constitute EGX100, thus the study started the analysis from the financial year following the inception of the EGX100 which is June 2010 in order to be able to get the name of the companies that are listed in this index. Also, a change in the number of the Egyptian listed firm is witnessed before 2010 such that, the number of the Egyptian listed firms

before 2010 was completely far from the numbers shown after 2010. The number of the listed firms in 2008 was 373 and in 2009 was 306, while in 2010 the number of the listed firms dropped to 212 and remained steady till 2022, which showed 218 listed companies (EGX, 2021). The type of data used for the microeconomic model is secondary data, whether for the microeconomic variables or for the stocks' return.

The time interval used in this study depends on the frequency of change and the availability of data. The study follows the monthly interval, ending up with approximately 120 observations for each variable. Using Green's (1991) formula to calculate the essential number of observations (N> 50+8K), the appropriate number of observations for this study should not be less than 90 (50 + (8*5)), where N refers to the number of observations and K is the number of the independent variables, which is 5 based on this study. Since the number of observations of this study is 120, greater than 90, this allows the implementation of the analysis based on this rule.

Since the data are analyzed over time, the time series analysis is employed. Time series is the most appropriate in Econometrics since the past can be used to predict the effects on the future and the wide spread of the behavioral lag (Asteriou and Hall, 2015).

Table 1 summarizes the microeconomic variables used in this study with their proxies and the way of measuring each variable. All the data used in building the microeconomic variables are in Egyptian pound extracted from Reuters DataStream.

**Table 1: The microeconomic variables, their proxies and calculation method**

| The microeconomic models' variable | Its calculation |
|---|---|
| The Market return | $R_{m,t} = \frac{MI_t - MI_{t-1}}{MI_{t-1}} * 100$ |
| Risk Free rate | Rate of change of the monthly weighted average yield of three months treasury bills. |
| Size | Multiplying the adjusted closing price on the last working day of the month by the number of outstanding shares |
| Value (BE/ME) | BE = book value of common equity plus deferred taxes |
| | ME = multiplying the adjusted closing price on the last working day of the month by the number of outstanding shares |

| The microeconomic models' variable | Its calculation |
|---|---|
| Profitability | EBITDA / Book Equity |
| Investment | Percentage change in total assets from year end on December (t-2) to year end on December (t-1) |

Source: The authors

### 3.2 Testing the macroeconomic model

As there are differences among countries and among their economies, the results reached for a specific economy cannot be generalized to the other, thus increasing the necessity of adopting an adequate amount of country specific studies.

Some researchers have stated that testing the impact of five variables is enough (Chen et al., 1986; Chen, 1983; Roll and Ross, 1980). Also, Brown and Weinstein (1983) stated that the number of the employed factors should not exceed five, and Adesanmi (2018) added that the use of few variables will prevent the contradictory effect. This study followed the methodology of Chen et al. (1986) in selecting the macroeconomic variables.

Time series regression analysis is run between the dependent and the five independent variables shown in the following equation:

$$R_{pt} - R_{ft} = \beta_0 + \beta_1 EXR_t + \beta_2 INFR_2 + \beta_3 IPI_3 + \beta_4 FFR_4 + \beta_5 GCI_5 + \varepsilon_t \quad (3.4)$$

Where $R_{pt} - R_{ft}$ represents portfolios' excess return, $\beta_0$ is the intercept that should be constant and equal to the mean expected value of the dependent variable in case the independent variables are equal to zero. Variables $\beta_1$ to $\beta_5$ represent the sensitivity of each independent macroeconomic variable used against the dependent variable, while $\varepsilon_t$ measures the error term that represents the existence of other indicators other than the used independent variables. EXR is the rate of change in exchange rate of the national currency against U.S dollar, INFR is the inflation rate measured as the rate of change in Core CPI, IPI is the industrial production index measured as the rate of change in IPI, FFR is the Federal Fund Rate, which is the overnight borrowing rates in percentages, and the GCI is the global commodity price index measured as rate of change.

The steps for constructing the portfolios, the sampling technique and period under study used in the macroeconomic model are the same as what is employed for the microeconomic model. Table 2 shows a description of each macroeconomic variable employed in this study in addition to the data sources.

**Table 2: The macroeconomic variables with their sources and description**

| Macroeconomic Variables | Description/ interval | Source |
|---|---|---|
| Exchange rate | EGP/U.S. Dollar/ monthly data | World bank |
| Inflation rate | Core CPI, not-seasonally adjusted/ monthly data | World bank |
| IndustrialProduction index | industrial production index, constant 2010, not seasonally adjusted / monthly data | World bank |
| Federal fund rate | Effective Federal Funds Rate, Percent, not seasonally adjusted/ monthly data | Federal Reserve Bank of St. Louis |
| Commodity price index | Global Price Index of All Commodities, not seasonally adjusted/ monthly data | Federal Reserve Bank of St. Louis |

Source: The authors

## 4. RESULTS AND DISCUSSION

In this section, the results of running the time-series regression analysis for the micro and macroeconomic models are examined.

### 4.1 The results of regression analysis of the microeconomic model

This section presents the results of testing the impact of microeconomic variables presented in FF5 on portfolio excess return presented by 18 portfolios. The portfolios used as dependent variables are constructed based on 2x3 sorts: size-BE/ME, size-profitability and size investment. The analysis is conducted on time-series data collected on monthly basis using Ordinary Least Square (OLS) regression. In order to get reliable statistical results, the time series must be covariance stationary, i.e., mean and variance are stationary over time. The most common test for non-stationarity is the Augmented Dickiey-Fuller (ADF) test, which is used to test whether there is a unit root in the variables. Finally, diagnostics tests of autocorrelation, heteroscedasticity, and residual normality tests are applied to examine the specification of the models. The following sections introduce the analysis conducted according to the mentioned techniques using EVIEWS software version 10.

### *4.1.1 Unit Root Test – Stationarity test*

This section shows the results of the stationary tests using Augmented Dicky-Fuller test (ADF) for the five independent variables and the 18 constructed portfolios to represent the dependent variables of the microeconomic model. ADF is used to examine the suitability of the data for model estimation. The null hypothesis of the test indicates the existence of unit root while the alternate hypothesis indicates that there is no unit root, (i.e., stationarity in variables).

Table 3 shows the results of ADF test; it could be observed that all the variables are stationary at level and has no unit root at level (P-value < 0.05), which indicates the rejection of the null hypothesis; hence, the results are satisfactory to apply OLS regression.

**Table 3: Augmented Dickey-Fuller test of the microeconomic model variables**

The table shows the results of ADF test of the microeconomic model variables. Rm-Rf is market factor, SMB is size, HML is value, RMW is profitability while CMA is investment.

| Augmented Dickey-Fuller test | | t-statistics | Prob. |
|---|---|---|---|
| RM-RF | | -10.95299 | 0.0000 |
| SMB | | -2.002218 | 0.0438 |
| HML | | -4.620346 | 0.0002 |
| RMW | | -4.048693 | 0.0017 |
| CMA | | -9.209734 | 0.0000 |
| Size- BM portfolios | SL | -11.96669 | 0.0000 |
| | SN | -9.704171 | 0.0000 |
| | SH | -9.733338 | 0.0000 |
| | BL | -10.59910 | 0.0000 |
| | BN | -10.52865 | 0.0000 |
| | BH | -8.013301 | 0.0000 |
| Size-profitability portfolios | SW | -11.82489 | 0.0000 |
| | SN | -11.18300 | 0.0000 |
| | SR | -11.10792 | 0.0000 |
| | BW | -7.723675 | 0.0000 |
| | BN | -10.99127 | 0.0000 |
| | BR | -9.100709 | 0.0000 |
| Size-investment portfolios | SC | -10.95298 | 0.0000 |
| | SN | -11.74709 | 0.0000 |
| | SA | -11.87829 | 0.0000 |
| | BC | -6.611628 | 0.0000 |
| | BN | -10.70045 | 0.0000 |
| | BA | -10.87153 | 0.0000 |

Source: The authors

### *4.1.2 Time series regression results of the microeconomic model*

This section introduces the results of time series regression using least square method to estimate the parameters of the regression model. Table 4 presents the results of the regression when size-BM, size-profitability and size-investment portfolios are used in the construction of the dependent variable in Panels A, B and C, respectively. Each panel shows the coefficient, the t-statistics and p-values of every factor, in addition to the intercept, $R^2$ and adjusted $R^2$ to measure the percentage of variation in the dependent variable as a result of the independent variables. Also, the results of F-test are presented to test the significance of each model, in addition to the standard error.

As observed in the three panels, the market excess return is insignificant with negative coefficient when constructing all of the portfolios. This could be due to the fact that EGX30 used as a proxy for market index is heavily weighted by stocks of financial institutions (such as Commercial International bank and others), while the negative coefficient might be due to the increase in the treasury-bills rates more than the market return for the period under study (EGX, 2021). Also, the intercept of the 18 constructed portfolios is insignificant and almost zero, which means that there is not pricing error for the 18 regression models (Acaravci and Karaomer, 2017).

Panel A shows the time-series regression results when portfolios are constructed based on size-BM portfolios, the most significant variable is profitability (RMW) for the six portfolios with negative coefficient indicating the negative impact of profitability and its importance, regardless of the market capitalization (size) of the company. It is noticed that given the same value (BE/ME) level, the coefficient of RMW decreases with the increase in firms' size, from small capitalization companies with low value (SL) to big capitalization companies with low value (BL) and from small capitalization companies with high value (SH) to big capitalization companies with high value (BH). Then, it is the size factor (SMB) that shows significant impact for all portfolios except for the big size companies with low BE/ME (BL). Also, it is noticed that the significance of SMB is high for small sized companies compared to the big sized ones. The coefficient of SMB is positive for the small sized companies and negative coefficient for the big sized companies. This indicates a decrease in the coefficient with the increase in size while holding BE/ME constant. Also, it indicates the

positive relationship between small sized portfolios' return and size factor and the negative relationship between big sized portfolios' return and size factor. Jiao and Lilti (2017) reached the same results for size factor when implementing a study on the Chinese stock market. Additionally, the coefficient of SMB shows a decrease with the increase in BE/ME for the big sized companies; however, there is not a clear pattern for the small sized companies. HML is only significant for the small capitalization with low value (SL) and big capitalization with low value (BL) i.e., low BE/ME companies regardless of the company size; additionally, the coefficient is showing an increase with the increase in the value of the company. CMA is significant for only two portfolios: small capitalization companies with low value (SL) and big capitalization companies with high value (BH). The highest explanatory power ($R^2$) is for the big companies with high BE/ME (BH) with three significant variables size (SMB), profitability (RMW) and investment (CMA). Belimam et al. (2018) reached the same results for RMW factor and for CMA, whereas the latest variable showed significance for only one out of the six portfolios when conducting a study in Shanghai stock market. Dhaoui and Bensalah (2017) found a positive significant impact for SMB for the six portfolios and a negative statistical impact for RMW for the small portfolios when implementing a study using US stock market (NYSE). Alrabadi and Alrabadi (2018) reached the same result regarding the negative impact of RMW while a positive and significant impact got for the other four variables when implementing a study in Amman Stock Exchange (ASE).

There are limited differences noticed when size-profitability portfolios are used to construct the dependent variable. As presented in panel B, profitability (RMW) is showing to be the most significant variable except for portfolio constructed of big capitalization companies with robust profit (BR) while having negative coefficient for the six portfolios. Also, the coefficient of RMW is increasing with the increase in the profitability of the companies across the same size group similar to the results of Jiao and Lilti (2017) in both the Chinese and the US markets. Size (SMB) is showing the same impact as when using the Size-BM construction; it is having a positive coefficient for small sized companies (SL, SN, SR) and negative for the big sizes (BL, BN, BR); however, there is a difference in the significance level; this shows that when holding profitability constant, the coefficient decreases with the increase in the market capitalization of the company. HML is having a negative coefficient for the six portfolios with

significant impact for only four portfolios, while CMA is showing a significant impact for only the big capitalization companies with weak profitability (BW) portfolio, which indicates the weak impact for investment on portfolios formed on profitability, the same results reached by (Belimam et al., 2018). The highest explanatory power is for the big sized companies with weak profitability (BW) as $R^2$ is 60% with four significant variables: size (SMB), value (HML), profitability (RMW) and investment (CMA).

**Table 4: The results of the microeconomic model regression**

The table shows the results of running the regression analysis between the variables presented in Fama and French five factor model (2015) using 2x3 sorting method.

| Port. | | RM-RF | | SMB | | HML | | RMW | | CMA | | Adj R2/R2 | F-stat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inter. | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | | Prob |
| SL | 0.006 | -0.0463 | -0.4672 (0.6414) | 0.2055 | 3.051077 (0.0029)*** | -0.9415 | -4.807 (0.000)*** | -0.607 | -3.8949 (0.00)*** | 0.3335 | 1.8961 (0.0608)* | 0.29/0.32 | 0.00 |
| SN | 0.003 | -0.0567 | -0.5127(0.6092) | 0.288 | 3.845626 (0.000)*** | -0.1865 | -0.854 (0.3951) | -0.857 | -4.9353 (0.000)*** | -0.0478 | -0.2435 (0.8081) | 0.24/0.27 | 0.00 |
| SH | 0.001 | -0.0431 | -0.4575 (0.6482) | 0.2618 | 4.092299(0.000)*** | -0.1685 | 0.9055 (0.3673) | -0.462 | -3.1245 (0.0023)*** | -0.0025 | -0.0150 (0.9880) | 0.17/0.21 | 0.00 |
| BL | 0.004 | -0.0413 | -0.4126 (0.6807) | -0.0862 | -1.267678 (0.2078) | -0.9091 | -4.598 (0.000)*** | -0.703 | -4.4726 (0.000)*** | 0.0136 | 0.0764 (0.9392) | 0.19/0.23 | 0.00 |
| BN | 0.002 | -0.0072 | -0.0716 (0.9431) | -0.1207 | -1.772 (0.0793)* | -0.3239 | -1.635 (0.1051) | -0.555 | -3.5214 (0.000)*** | -0.2137 | -1.2013 (0.2324) | 0.09/0.13 | 0.00 |
| BH | 0.005 | -0.0496 | -0.4926 (0.6233) | -0.1462 | -2.139194 (0.0348)** | -0.0320 | -0.161 (0.8725) | -0.866 | -5.477 (0.000)*** | 0.3370 | 1.888 (0.0618)* | 0.41/0.44 | 0.00 |
| SW | -0.002 | -0.0235 | -0.2361 (0.8138) | 0.1679 | 2.482501 (0.0147)** | -0.4735 | -2.407 (0.0179)** | -1.095 | -6.998 (0.000)*** | -0.1063 | -0.6018 (0.5486) | 0.32/0.35 | 0.00 |
| SN | -E-7.5305 | 0.0285 | 0.2667 (0.7902) | 0.2408 | 3.320622 (0.0012)*** | -0.3155 | -1.496 (0.1377) | -0.916 | -5.4637 (0.0000)*** | -0.0051 | -0.0269 (0.9785) | 0.26/0.29 | 0.00 |
| SR | 0.011 | -0.1115 | -1.1323 (0.2601) | 0.1125 | 1.682514 (0.0955)* | -0.4141 | -2.130 (0.0355)** | -0.288 | -1.8594 (0.0658)* | 0.1283 | 0.7345 (0.4641) | 0.05/0.10 | 0.045 |
| BW | 0.010 | -0.0766 | 0.7874 (0.4329) | -0.1757 | -2.660309 (0.0091)*** | -0.323 | -1.683 (0.0954)* | -1.384 | -9.064 (0.000)*** | 0.2968 | 1.7209 (0.0883)* | 0.58/0.60 | 0.00 |
| BN | -E-2.6605 | -0.0415 | -0.4035 (0.6874) | -0.0739 | -1.059442 (0.2919) | -0.3261 | -1.607 (0.1112) | -0.686 | -4.2483 (0.000)*** | -0.194 | -1.0639 (0.2898) | 0.12/0.16 | 0.00 |
| BR | E-1.89 | 0.0102 | 0.1069 | - | -1.754344 | - | -2.017 | - | -1.260 | 0.0812 | 0.4808 | 0.015/0.06 | 0.25 |
| | 05 | | (0.9151) | 0.1134 | (0.0823)* | 0.3791 | (0.0463)** | 0.188 | (0.2105) | | (0.6317) | | |
| SC | -0.002 | -0.005 | -0.47 (0.963) | 0.238 | 3.284 (0.001)*** | -0.494 | -2.340 (0.021)** | -0.607 | -3.616 (0.000)*** | 0.597 | 3.150 (0.002)*** | 0.24/0.27 | 0.00 |
| SN | 0.004 | -0.029289 | -0.2843 (0.7767) | 0.1497 | 2.1412 (0.0346)** | -0.456 | -2.243 (0.0271)** | -0.837 | -5.1755 (0.000)*** | -0.0216 | -0.1181 (0.9062) | 0.21/0.24 | 0.00 |
| SA | 0.003 | -0.0371 | -0.3976 (0.6917) | 0.2206 | 3.4779 (0.0007)*** | -0.1842 | -0.999 (0.3202) | -0.874 | -5.959 (0.0000)*** | 0.3758 | -2.2691 (0.023)** | 0.29/0.32 | 0.00 |
| BC | 0.008 | -0.045157 | -0.4981 (0.6195) | -0.1801 | -2.9255 (0.0042)*** | -0.1602 | -0.895 (0.3729) | -0.935 | -6.5699 (0.000)*** | 0.6169 | 3.8376 (0.002)*** | 0.56/0.58 | 0.00 |
| BN | -0.000 | -0.0608 | -0.553 (0.5815) | -0.0683 | -0.9153 (0.3622) | -0.3880 | -1.788 (0.0767)* | -0.573 | -3.3186 (0.0013)*** | -0.0455 | -0.233218 (0.8161) | 0.067/0.11 | 0.03 |
| BA | 0.004 | -0.0144 | -0.1415 (0.8878) | -0.1637 | -2.3697 (0.0197)** | -0.4706 | -2.343 (0.0210)** | -0.659 | -4.122 (0.0001)*** | -0.4162 | -2.307 (0.0230)** | 0.15/0.19 | 0.00 |

*** significance at 1%, ** significance at 5%, and * significance at 10%.

Source: The authors.

The same results are closely reached for the size-investment construction shown in Panel C, whereas profitability (RMW) is still the most significant variable for the six portfolios at 0.01 significance level with negative coefficient. Size (SMB) is having the same impact as when using the Size–BE/ME and Size-profitability constructions. Also, value (HML) is having results equivalent to when using the size-profitability portfolio construction with closely the same significance power. Investment (CMA) is showing more significant power for four out of six portfolios; this could be due to the way used in constructing the portfolio. The portfolio of big sized companies with conservative investment (BC) is having the highest $R^2$ 58%, which means this portfolio has the highest explanatory power.

The probability of the F-Statistics is also investigated to check the predictive power of the 18 portfolios and the overall fitness of the model through comparing the fitness of the model with and without the independent variables. The null hypothesis of the F- test indicates the fitness of the model with the intercept only while the alternate hypothesis indicates that the fitness of the model with the used independent variables is greater than the fitness of the model with just the intercept. The results indicated the significance and the fitness of the established models with variables as p-values are less than 0.05, except for one model of big market capitalization companies with robust profit (BR) in panel (B).

### *4.1.3 Diagnostics test*

Diagnostic tests are applied to check for the adequacy of the model. This involves autocorrelation test, heteroscedasticity test, and residual normality test. Table 5 presents the results of these tests. A serial correlation test is done among the estimated variables, using Breusch-Godfrey Serial Correlation LM test to examine the existence of correlation between the residuals, where the null hypothesis indicates no serial correlation. The p-value column of the serial correlation test shows that the values are all greater than 5% ($p > 0.05$). This indicates that the residuals are not correlated and the null hypothesis cannot be rejected.

A heteroscedasticity test is employed to check whether the variance of the residual is constant or not using Breusch-Pagan-Godfrey test. The null hypothesis indicates that residuals have constant variance and are homoscedastic. The p-values are greater than 0.05, except for 8 models out of the 18 presented

based on the 18 constructed portfolios; hence, the null hypothesis cannot be rejected and reflects the constant variance of the residual.

Additionally, a normality test for the residual is examined using Jarque-Berra test, where it is observed that all the p-values are less than 0.05, which indicates that the residual distribution is not normal. The results of regression are reliable despite the non-normality of the residual as long as the sample used in the analysis is quite large (120 observations) (Habib and Islam, 2017; Talla, 2013).

**Table 5: Serial Correlation, Heteroscedasticity test and residual normality tests of the microeconomic model.**

The table shows the results of serial correlation, heteroscedasticity test and residual normality tests of the 18 microeconomic models based on the 18 constructed using 2x3 sorting method.

| | | Correlation test (Breusch-GodFrey | Heteroscedasticity test (Breusch-Pagan-Godfrey) | Residual normality (Jarque-Bera) |
|---|---|---|---|---|
| | | Prob. F | Prob. F | Prob. |
| Size- BM portfolios | SL | 0.9566 | 0.0199 | 0.0000 |
| | SN | 0.0701 | 0.1065 | 0.0000 |
| | SH | 0.1275 | 0.0682 | 0.0000 |
| | BL | 0.2008 | 0.1806 | 0.0000 |
| | BN | 0.2925 | 0.1196 | 0.0000 |
| | BH | 0.9433 | 0.0411 | 0.0000 |
| Size-profitability portfolios | SW | 0.1675 | 0.0536 | 0.0000 |
| | SN | 0.3203 | 0.0103 | 0.0000 |
| | SR | 0.5218 | 0.1259 | 0.0000 |
| | BW | 0.4557 | 0.0662 | 0.0000 |
| | BN | 0.5403 | 0.1930 | 0.0000 |
| | BR | 0.1514 | 0.0288 | 0.0000 |
| Size-investment portfolios | SC | 0.6475 | 0.0359 | 0.0000 |
| | SN | 0.5986 | 0.1164 | 0.0000 |
| | SA | 0.6128 | 0.0279 | 0.0000 |
| | BC | 0.4202 | 0.0172 | 0.0000 |
| | BN | 0.6284 | 0.4490 | 0.0000 |
| | BA | 0.4589 | 0.0308 | 0.0000 |

Source: The authors

## 4.2 The results of the regression analysis of the macroeconomic model

This section discusses the results of testing the macroeconomic variables on portfolio excess return. The analysis is conducted using the same way as used with the microeconomic model.

**Table 6: Augmented Dickey-Fuller test for the macroeconomic variables**

The table shows the results of Augmented Dickey-Fuller test of the macroeconomic model variables. EXR is the exchange rate, INFR is the inflation rate, IPI is the industrial production index, FFR is the federal fund rate, GCI is the global commodity index.

| Augmented Dickey-Fuller test | t-statistics | Prob. |
|---|---|---|
| EXR | -8.360611 | 0.0000 |
| INFR | -5.348494 | 0.0000 |
| IPI | -4.193113 | 0.0011 |
| FFR | -8.005651 | 0.0000 |
| GCI | -7.550637 | 0.0000 |

Source: The authors.

### *4.2.1 Time series regression results of the macroeconomic model*

Table 6 presents the results of the regression when using three groups of the dependent variables (size-BM, size-profitability and size-investment portfolios) as shown in panels A, B and C, respectively. Panel (A) shows the regression results of the macroeconomic variables against portfolios constructed based on Size-BM. It is observed that the only significant variable is the Industrial Production Index (IPI), which showed a positive coefficient at different significance level. This indicates the powerful role of IPI in affecting the return of the portfolio constructed based on size-BM. The IPI coefficient of SH portfolio is 0.50778, which indicates that 1% increase in IPI will result in an increase in the return of SH portfolio by about 50%. The coefficient of IPI shows an increase with the increase in the value of the firms for the small sized companies from (SL) to (SH) and a decrease in value for the big sized ones, while when holding value constant, it is observed a decrease in the coefficient with the increase in market capitalization of the firms. Inflation rate (INFR) and Federal Fund Rate (FFR) have not shown any significant role, which indicates their weak impact on portfolios constructed based on value. As for Exchange rate (EXR) and Global Commodity Index (GCI), each variable showed a significant impact with only one portfolio, which is the big sized companies with neutral value

(BN), which is also reflected in $R^2$ value of that portfolio (15%), which showed to be the highest one compared to the other portfolios. The coefficient of EXR is positive while GCI is negative for the six portfolios. The F-statistics is also examined to check for the overall fitness of the model; it is observed that three out of the six models are significant: SL, SH and BN. This means that the macroeconomic variables in these models have a significant impact jointly on the return of the constructed portfolios (Habib and Islam, 2017).

Panel B shows similar results to those reached in Panel A as IPI is still the only most significant variable for five out of the six portfolios with positive impact. The coefficient is showing an increase with the increase in profitability level of the firms for both the small and big sized companies. INFR and FFR have not showed any significant impact while having the same coefficient sign as in the previous construction; this indicates their weak impact on portfolios constructed based on firms' profitability. EXR and GCI are also showing similar patterns to those shown in Panel A, whereas EXR is only significant for only one portfolio (BR) with positive coefficient. GCI is showing the same negative impact with 0.05 significance level for two portfolios that are (SW) and (BR). The highest explanatory power ($R^2$) is 15% for the big sized companies with high profitability (BR), which has three significant variables EXR, IPI and GCI and a significant probability for F-statistics.

**Table 7: The results of the macroeconomic model regression**

The table shows the results of running the regression analysis between the five macroeconomic variables employed in the current study and portfolios' excess return using 2x3 sorting method.

| Port. | | EXR | | INFR | | IPI | | FFR | | GCI | | Adj $R^2$ / $R^2$ | F-stat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Int. | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | | Prob |
| **Panel A: size-BE portfolios** | | | | | | | | | | | | | |
| SL | -0.0046 | 0.1800 | 1.1957 (0.235) | 0.238 | 0.20 (0.84) | 0.44 | 2.45 (0.0156)* | 0.0428 | 0.6544 (0.514) | -0.44 | -1.535 (0.1279) | 0.06/0.10 | 0.047 |
| SN | -0.0020 | 0.016 | 0.096 (0.9236) | 0.12799 | 0.0977 (0.9224) | 0.382 | 1.917 (0.058)* | 0.062775 | 0.8656 (0..887) | -0.3625 | -1.1323 (0.2599) | 0.014/0.06 | 0.26 |
| SH | 0.0065 | 0.0812 | 0.61895 (0.5373) | -0.4105 | -0.39919 (0.6906) | 0.50778 | 3.2457 (0.0016)*** | 0.0779 | 1.36899 (0.1740) | -0.287228 | --1.1435 (0.2555) | 0.087/0.13 | 0.01 |
| BL | -0.0026 | 0.13899 | 0.986 (0.3263) | -0.5849 | -0.5295 (0.5976) | 0.3579 | 2.12998 (0.0356)** | 0.01089 | 0.178 (0.8589) | -0.3859 | -1.430 (0.1557) | 0.029/0.07 | 0.15 |
| BN | -0.0009 | 0.332 | 2.511 (0.014)** | -0.86 | -0.830 (0.408) | 0.411 | 2.607 (0.011)** | 0.021 | 0.373 (0.710) | -0.499 | -1.969 (0.052)* | 0.109/0.15 | 0.00 |
| BH | 0.015 | 0.241 | 1.405 (0.163) | -1.300 | -0.965 (0.337) | 0.457 | 2.231 (0.028)** | 0.022 | 0.290 (0.772) | -0.473 | -1.437 (0.154) | 0.044/0.09 | 0.086 |
| **Panel B: Size-profitability portfolios** | | | | | | | | | | | | | |
| SW | -0.009 | 0.093 | 0.601 (0.549) | 0.015 | 0.012 (0.990) | 0.409 | 2.203 (0.030)** | 0.022 | 0.325 (0.746) | -0.623 | -2.087 (0.039)** | 0.052/0.096 | 0.06 |
| SN | -0.010 | 0.008 | 0.051 (0.960) | 0.385 | 0.306 (0.761) | 0.450 | 2.351 (0.021)** | 0.093 | 1.340 (0.183) | -0.302 | -0.981 (0.329) | 0.039/0.08 | 0.1 |
| SR | 0.011 | 0.206 | 1.566 (0.121) | -0.6799 | -0.659 (0.511) | 0.363 | 2.310 (0.023)** | 0.018 | 0.313 (0.755) | -0.316 | -1.256 (0.212) | 0.043/0.088 | 0.09 |
| BW | 0.011 | 0.204 | 1.029 (0.306) | -0.676 | -0.433 (0.666) | 0.377 | 1.590 (0.115) | 0.069 | 0.802 (0.425) | -0.309 | -0.812 (0.419) | 0.003/0.05 | 0.38 |
| BN | 0.002 | 0.21 | 1.486 (0.140) | -1.234 | -1.115 (0.267) | 0.423 | 2.513 (0.014)** | 0.0201 | 328 (0.743) | -0.425 | -1.575 (0.118) | 0.064/0.10 | 0.03 |
| BR | -0.006 | 0.222 | 1.840 (0.069)* | -0.437 | -0.462 (0.645) | 0.414 | 2.879 (0.005)*** | 0.024 | 0.463 (0.644) | -0.514 | -2.227 (0.028)** | 0.110/0.15 | 0.004 |
| **Panel C: Size-Investment portfolios** | | | | | | | | | | | | | |
| SC | -0.002 | 0.095 | 0.603 (0.548) | -0.03 | -0.025 (0.980) | 0.377 | 2.014 (0.047)** | 0.036 | 0.535 (0.594) | -0.738 | -2.453 (0.016)** | 0.065/0.11 | 0.036 |
| SN | 0.002 | 0.091 | 0.600 (0.550) | -0.378 | -0.317 (0.752) | 0.374 | 2.059 (0.042)** | 0.014 | 0.223 (0.824) | -0.37 | -1.284 (0.202) | 0.017/0.06 | 0.24 |
| SA | -0.012 | 0.065 | 0.458 (0.648) | 0.50 | 0.454 (0.651) | 0.488 | 2.899 (0.005))*** | 0.0696 | 1.136 (0.259) | -0.1996 | -0.738 (0.462) | 0.059/0.10 | 0.048 |
| BC | 0.019 | 0.205 | 1.145 (0.255) | -1.296 | -0.921 (0.359 | 0.451 | 2.108 (0.038)** | 0.044 | 0.567 (0.572) | -0.429 | -1.250 (0.214) | 0.033/0.078 | 0.13 |
| BN | 0.000 | 0.223 | 1.524 (0.131) | -1.057 | -0.921 (0.359) | 0.456 | 2.611 (0.010)*** | 0.039 | 0.608 (0.545) | -0.416 | --1.485 (0.141) | 0.067/0.11 | 0.033 |
| BA | -0.005 | 0.26 | 1.864 (0.065) | -0.408 | -0.367 (0.714) | 0.429 | 2.534 (0.013)** | 0.000 | -0.002 (0.998) | -0.462 | -2.307 (0.0230)** | 0.071/0.11 | 0.02 |

*** significance at 1%, ** significance at 5%, and * denotes the significance at 10%.

Panel C shows the results of regression for the six portfolios sorted based on size-investment. The results are similar to those reached in the other two sorting methods. IPI is the most significant variable with positive impact on portfolios sorted based on size and investment. The coefficient of IPI is showing an increase with the increase in the investment from conservative to aggressive strategy, whether the size of the firm is small or big. EXR, INFR and FFR show insignificant impact, which indicates that they are not able to explain the variation in return related to size and investment. GCI is specifically significant

for two portfolios out of the six with negative coefficient; this indicates its limited role in capturing variation in return with its negative impact.

### *4.2.2 Diagnostics test*

Table 8 presents the results of the diagnostics tests. The p-value column of the serial correlation test illustrates that the values are all greater than 5% (p> 0.05). This indicates the absence of correlation in the residual, and the null hypothesis is not rejected except for three models: BH, BW and BC. As for the heteroscedasticity test, Breusch-Pagan-Godfrey test has been used and shows that the p-values are greater than 0.05 for all portfolios; hence, the null hypothesis cannot be rejected and indicates that the residual are homoscedastic. Finally, normality test for the residual is examined using Jarque-Berra. The p-values are insignificant for six portfolios out of the 18 portfolios at 0.05, which indicates that the residual distribution is not normal for the other portfolios and the null hypothesis cannot be accepted. However, the t-statistics can be reliable as the sample size is large enough (120 observation) (Islam and Habib, 2017). Accordingly, the diagnostics test results can conclude that the residual are pure white noise.

**Table 8: Serial Correlation, Heteroscedasticity test and residual normality tests of the macroeconomic model**

The table shows the results of serial correlation, heteroscedasticity test and residual normality tests of the 18 macroeconomic models based on the 18 constructed using 2x3 sorting method.

| | | Correlation test (Breusch-GodFrey | Heteroscedasticity test (Breusch-Pagan-Godfrey) | Residual normality (Jarque-Bera) |
|---|---|---|---|---|
| | | Prob. F | Prob. F | Prob. |
| Size- BM portfolios | SL | 0.733 | 0.6 | 0.033 |
| | SN | 0.57 | 0.8488 | 0.0000 |
| | SH | 0.525 | 0.711 | 0.58 |
| | BL | 0.3373 | 0.95 | 0.106 |
| | BN | 0.8792 | 0.8706 | 0.0000 |
| | BH | 0.0134 | 0.9798 | 0.0000 |
| Size-OP portfolios | SW | 0.6954 | 0.6335 | 0.0815 |
| | SN | 0.5009 | 0.7984 | 0.1968 |
| | SR | 0.9787 | 0.8063 | 0.0000 |
| | BW | 0.0028 | 0.9836 | 0.0000 |
| | BN | 0.9522 | 0.5787 | 0.0000 |
| | BR | 0.3412 | 0.7492 | 0.017 |

| | | Correlation test (Breusch-GodFrey | Heteroscedasticity test (Breusch-Pagan-Godfrey) | Residual normality (Jarque-Bera) |
|---|---|---|---|---|
| | | Prob. F | Prob. F | Prob. |
| Size-investment portfolios | SC | 0.9442 | 0.9421 | 0.0698 |
| | SN | 0.4093 | 0.5089 | 0.0266 |
| | SA | 0.7226 | 0.8260 | 0.5633 |
| | BC | 0.000 | 0.9975 | 0.0000 |
| | BN | 0.7794 | 0.7559 | 0.0000 |
| | BA | 0.7826 | 0.7936 | 0.0299 |

## 5. DISCUSSION

The test of the microeconomic variables presented in FF5 model has revealed that profitability has the most important role in explaining the variation in portfolios' return and rejected the role of market excess return beside the weak explanatory power of investment. The limited role of investment could be due to the reasons explained by Lin (2017) who explained that the companies in emerging markets possess powerful ownership concentration, such that investment can be employed as a tool that benefit controlling shareholders accordingly, investors do not view the past investment as a guidance to forecast future return. The negative and positive role of investment found in this study were justified by Titman et al. (2004). Titman et al. (2004) explained that the increase in investment can be illustrated in favorable or unfavorable ways. The favorable way happens when the increase in investment can be viewed as an increase in investment opportunities while the unfavorable way is explained when the increase in investment could mean that the companies are managed by individuals who act in an over-investing manner and there is not a logical justification behind this increase in investment expenditure. As for size, it is found across the three sorting methods that the coefficient of SMB is positive for the small-sized companies and negative coefficient for the big-sized companies. This implies the same to what was found by Banz (198) who found that high market capitalization got lower return relative to low market capitalization companies. The negative role of value means that the constructed portfolios act more like growth stock portfolio (Jareno et al., 2018), while the negative role of profitability were found by Janero et al. (2018) in the Spanish stock market also by Erdin (2017) in the Turkish stock market.

As for the macroeconomic model; The positive role of IPI observed in this study is supported by economic theory as the increase in the industrial production index means a boost in several industries and an increase in the economic growth of the country. The increase in firms' production level will result in an increase in their stock prices.

The negative impact of inflation rate is also supported by literature. It is explained that the increase in inflation rate is accompanied by an increase in cost of living causing a deviation away from the purchase of stocks, a decrease in their demand and accordingly a decrease in firms' stock prices. It also implies that the Egyptian stock market cannot be used to hedge against inflation and that the investors should search for other investment opportunities. The increase in inflation is associated with an increase in interest rate and cost of borrowing, which will affect the profit of the companies traded in Egyptian stock market and their desire to expand negatively. However, the observation of INFR coefficient in the three panels revealed its positive impact on SL, SN portfolios in Panel A and SW and SN in Panel B and SA in Panel C. The common denominator about these portfolios is that they are all constructed of firms with small market capitalization. This means that with the increase in inflation rate, there is a shift toward small sized companies with different characteristics regarding their value, profitability and investment.

Regarding exchange rate, the positive coefficient found in this study means that the depreciation in the value of the Egyptian currency will have a positive impact on the firms' return and the opposite in case of currency appreciation. This could be explained by the fact that the depreciation of the national currency makes the products of country's firm cheaper, resulting in higher profits that foster the economy and have a positive impact on the stock market.

Empirical results reached in this study regarding the FFR are different from what is illustrated by the economic theory. It is expected that the increase in FFR would affect the emerging economies negatively by drawing the capital away from these markets. However, this is not the case for the Egyptian stock market as a positive insignificant impact of FFR is noticed. This indicates the limited role of FFR in explaining the variation in the return of the constructed portfolios. The positive relationship could be justified, as the period under study witnessed depreciation in the value of the Egyptian pound, making investing in the Egyptian stock

market more profitable regardless of the increase in FFR; this is supported by the positive relationship found between the depreciation of the Egyptian pound and the portfolios' return. Also, the depreciation of the Egyptian pound made it costly to withdraw the capital to outside markets.

As for GCI, which is composed of both fuel and non-fuel prices together in this study, the results revealed its negative insignificant impact on the return of the constructed portfolios. This moves in line with what is explained by the economic theory as the increase in the commodities' prices, which include oil, agricultural products and metals, will cause an increase in the cost of living and a shift away from the stock market and causing a decrease in stocks prices. The negative response also explains that most of the Egyptian companies are importers for these commodities; that is why an increase in commodities' prices affects them negatively, while the insignificant impact could be due to the limited dependence of the Egyptian economy on importing natural resources, along with the depreciation of the Egyptian pound, which makes the imported products more expensive. Most of the Egyptian economy imports are minerals and chemical products, followed by agricultural products, livestock and foodstuff like (maize, wheat and meat).

The weak response of the Egyptian stock market to the global macroeconomic variables (FFR and GCI) indicates its segmentation and supports the idea that emerging markets provide a better diversification opportunity than developed markets because of their weak correlation with global changes.

Based on the results reached above for the micro and macro models, an augmented framework is built as shown in figure 1. The macroeconomic model is reduced to include the industrial production index (IPI) as the only variable among the selected five macroeconomic variables. The microeconomic model is reduced to include size, value and profitability. The reached applied micro and macro model is customized for the Egyptian stock market as it represents the most significant micro and macroeconomic variables in the Egyptian market. This means that different significant variables can be reached in different stock markets. Accordingly, the financial analyst and policy maker within each market can build a customized model when running the same regression analysis.

Moreover, this reached augmented model can be examined in further studies to validate its fitness for the Egyptian stock market.

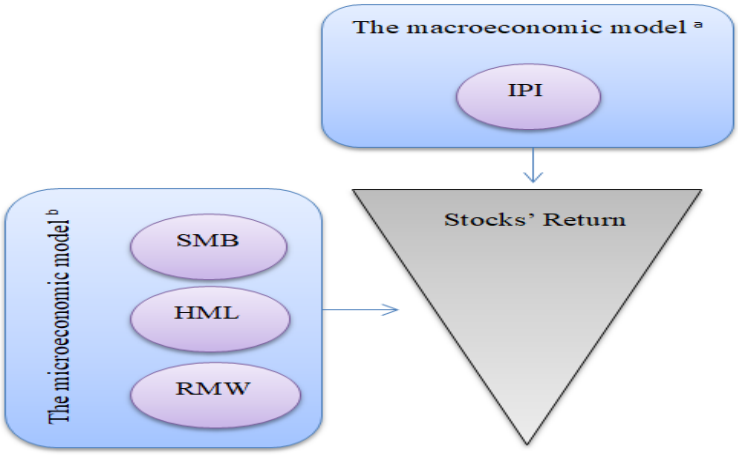


**Figure 1: The micro and macroeconomic significant variables.**

Source: The authors

a: IPI = Industrial Production Index.

b: SMB = small minus big, HML= High minus low, RMW= robustness minus weak.

Table 9 shows the decisions regarding the developed hypotheses based on the reached results.

**Table 9: Supported/ not-supported research hypotheses**

| Research hypotheses | Supported / not-supported hypotheses | Previous studies in line with the research findings. |
|---|---|---|
| The microeconomic variables presented in Fama and French five-factor model have a significant effect on the stocks' return. | Partially accepted, as only size, value and profitability are of significant impact on portfolio's excess return of the Egyptian stock market. | Acaravci and Karaomer (2017).<br>De la O González and Jareno (2019).<br>Mosoeu and Kodongo (2020) |
| The selected five macroeconomic variables have a significant effect on the stocks' return. | Partially accepted, as only the industrial production index showed a significant impact on portfolio's excess return of the Egyptian stock market. | Ross (1976)<br>Ibrahim and Aziz (2003)<br>Amarasinghe (2016)<br>Lazarus (2017)<br>Mohamed and Ahmed (2018)<br>Jareno *et al.* (2019) |

This study has both theoretical and practical implications. Indeed, the study tested comprehensively the effect of the micro and macroeconomic variables on the Egyptian Stock Market, using the most recent financial and accounting data, as the study used monthly data for the period from June 2010 to June 2020. This can help in understanding what affects stocks' prices in other similar capital markets. The microeconomic results highlighted the prominent role of profitability variable in addition to size and value, which should attract financial managers' concern to the importance of these variables as the most examined variables by the investors. The result of the macroeconomic model contributed toward determining the sources of systematic risk that cannot be diversified away. This broadened the focus to include the global variables, beside the domestic ones, when aiming to determine the macroeconomic variables affecting stocks' return, especially in the emerging countries. The positive significant impact of the industrial production index, sheds light toward the importance of the industrial production index in flourishing the stock market and indicates that the Egyptian government should focus on its industrial production levels for the stock market development. The results of this study are beneficial to brokerage companies, financial analysts, policy makers and individual investors. Also, it enriched and updated the existing literature specially for the Egyptian stock market a class of the emerging markets.

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# تطوير إطار يحدد محددات عائد سوق الأوراق المالية: منظور الاقتصاد الجزئي والكلي

د. سيلفيا عدلي ساويرس
د. سفيتلانا سابوريك
أ.د. سارة حسن الجزار
د. إيفيجينيا جورجيو

## ملخص البحث باللغة العربية

تهدف هذه الدراسة إلى تطوير إطار عمل يحدد متغيرات الاقتصاد الجزئي والكلي التي من المتوقع أن تؤثر على عائد الأسهم في الأسواق الناشئة. بالنسبة لمتغيرات الاقتصاد الجزئي، تم فحص المتغيرات الخمسة المعروضة في Fama and French Five Factor model (فائض السوق والحجم والقيمة والربحية والاستثمار) بينما بالنسبة لنموذج الاقتصاد الكلي، يتم اختيار خمسة متغيرات للاقتصاد الكلي بحيث تكون ثلاثة متغيرات محلية (معدل الصرف، ومعدل التضخم ، ومؤشر الإنتاج الصناعي) واثنان من عوامل الاقتصاد الكلي العالمية (معدل الصندوق الفيدرالي ومؤشر السلع العالمي). يتم إجراء تحليل انحدار السلاسل الزمنية لتحديد المتغيرات المهمة لكل نموذج على حدة باستخدام البيانات الشهرية من يونيو 2010 إلى يونيو 2020. وأظهرت نتائج متغيرات الاقتصاد الجزئي التأثير الكبير لمتغيرات الحجم والقيمة والربحية. فيما يتعلق بمتغيرات الاقتصاد الكلي، أظهرت النتائج أن المتغير المهم الوحيد هو مؤشر الإنتاج الصناعي مع تأثير إيجابي على فائض عوائد المحافظ التي تم إنشاؤها. تنبثق قيمة الدراسة الحالية من مساهمتها في سد فجوة أدبيات الاقتصاد الكلي حيث تم العثور على فجوه في الدراسات التجريبية التي بحثت في تأثير متغيرات الاقتصاد الكلي العالمية على سوق الأوراق المالية في الاقتصادات الناشئة. بالإضافة إلى ذلك، تضيف الدراسة إلى أدبيات الاقتصاد الجزئي التي تبحث في صحة نموذج Fama and Frecnh Five factor model بينما تم استخدام مقياس مختلف لمتغيرات الربحية.

**الكلمات الدالة:** المتغيرات المحلية، المتغيرات العالمية، Fama and French Five Factor Model، الأسوق الناشئة، البورصة المصرية.

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