

Progress Made towards Consensus on Arbitrage Pricing Theory Macroeconomic Factors: A Brief Review of Literature

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Abstract

Purpose: The study aims to develop insights on the progress made in agreeing upon the set of macroeconomic factors to be included in the arbitrage pricing theory (APT). **Theoretical Framework:** The paper is a brief review of relevant literature focusing on studies that have tested different macroeconomic factors for possible relationship with stock returns. **Design/Methodology/Approach:** A brief overview of the literature was performed to determine the macroeconomic factors with a positive relationship with stock returns to be used in the APT from studies on the cost of capital evaluations. **Findings:** The article contributes to the relevant literature by showing that there is consensus on interest rate as the macroeconomic factor that strongly explains the relationship with stock returns. Other microeconomic factors such as inflation, exchange rates, money supply and industrial production showed strong prospects but require more tests. **Research, Practical & Social Implications:** The article identifies the macroeconomic factors that need further studies based on the prospects shown in the studies reviewed. Practically, the article contributes to narrowing the research gap on macroeconomic factors to be used in the APT. **Originality/Value:** The article adds value to the body of knowledge by showing that only interest rate has been agreed upon as the macroeconomic factor with a positive relationship with stock returns. The article also narrows the gap of the set of macroeconomic factors that need further testing thereby hastening the process leading to the use of the APT.

Keywords

Macroeconomic Factor, Stock Return, Arbitrage Pricing Theory

1. Introduction

Organizations exist to create value for the owners of the factors of production. The resultant value from the economic activities is also deemed as return on stock. [Hiransha et al. \(2018\)](#) surmised that stocks also known as shares are traded on the stock market. In the process of generating value, organizations interact with the external environments and as such the bearing of macroeconomic factors on the return on stock cannot be avoided.

In a bid to evaluate the returns on stocks, scholars developed models that incorporate external factors obtaining in the market and the economy as a whole. The first such model which evaluates the return on stocks while incorporating external factors is the capital asset pricing model (CAPM) initially advanced by Sharpe in 1964 and supported by Lintner in 1965 and later by Black in 1972 ([French, 2017](#)). Due to dissatisfaction with the fact that CAPM only accounted for systematic risk factor termed as beta ([Reza et al., 2018](#)), scholars sought to introduce models capable of including multiple factors.

In 1976, a model capable of using multiple macroeconomic factors in evaluating the returns on stock aptly named the arbitrage pricing theory (APT) was advanced by one of the critics of CAPM named Stephen Ross ([Elshqirat, 2019](#)). Ever since the development of the APT, there arose a huge debate regarding the type and number of factors to be universally used in the model. Many scholars have alluded to the fact that no consensus has so far been reached on factors and number of factors to be used in the APT ([Tursoy et al., 2008](#); [Benaković & Pose-del, 2010](#); [Reza et al., 2018](#); [Amtiran et al., 2017](#)).

The aim of this article is to show the progress made in arriving at the set of macroeconomic factors to be used in the APT Model. This paper is a must read for researchers and students alike as it evaluates the progress made over the last 45 years and narrows the knowledge in terms of the macroeconomic factors that have so far shown strong prospects in explaining the relationship with stock returns. The article clearly pinpoints the macroeconomic factors which have been commonly agreed by researchers and are ready to be included in the APT model. The article starts with a brief historical background showing the series of events and timelines from CAPM to APT and brings to the fore some of the microeconomic factors that have been found to explain the relationship with stock returns. The article ends with a summary that shows the macroeconomic factors that have so far been commonly agreed upon by inference and those that still further testing.

2. Methodology

A brief overview of the literature was performed to determine the macroeconomic factors with a positive relationship with stock returns to be used in the APT from studies on the cost of capital evaluations. A search for peer reviewed articles on the APT was conducted using SCOPUS and Google Scholar.

3. Literature Review

Stock valuation seems to have always fascinated scholars and as a result, several views have been expressed. There is compelling evidence to believe that earlier reasoning on stock valuation did not make famous models. For instance, [Duffie \(2010\)](#) attributed the general equilibrium model of security markets to the work of Arrow in 1953 and traced it back to Walras in 1877. While the ground had been laid for scholarly debate on valuations of security markets, the real interest was only seen 11 years later with the introduction of the CAPM.

The CAPM was devised by Sharpe in 1964 and was supported by Lintner in 1965 and later by Black in 1972 and subsequently, the single-factor model got the name of the SLB model after the names of the contributing authors ([French, 2017](#)). Arguably, CAPM is one of the oldest theories that explain risk analysis, stock returns and movements in prices of stocks and accounts only for systematic risk factor termed as beta ([Reza et al., 2018](#)).

Despite earning the alternative term of SLB in 1972, the reasoning contained in the CAPM model was questioned by scholars as other macroeconomic factors were found to explain stock returns other than the market beta. Since CAPM was a one-factor model, several models with multiple were later developed aimed bringing to the fore different other macroeconomic factors:

1) Fama and French (1993, as cited in [Ekaputra & Sutrisno, 2020](#)) developed the three-factor (FF3) model which included market, size and book-to-market factors as an extension to CAPM. The model was found to explain the cross-section stock returns;

2) Carhart (1997, as cited in [Ahmed et al., 2018](#)) developed four-factor (FF4) model that added momentum to FF3;

3) Fama and French (2015, as cited in [Sarwar et al., 2017](#)) developed a five-factor (FF5) model, comprised of the market, profitability, size, value, and investment factors;

4) Barillas and Shanken (2018, as cited in [Ahmed et al., 2018](#)) later crafted the six-factor (BS6) model made up of the market, size, and momentum factors of the FF5 model to which profitability, investment and the value factors were added.

In 1976, one of the renowned critic of CAPM and its assumptions, by the name of Stephen Ross introduced the APT which is an equilibrium theory viewed by all intents and purposes as an alternative to CAPM and employed many more macroeconomic factors each with its risk factor (beta) to denote the stock expected rate of return ([Elshqirat, 2019](#)). [Amtiran et al. \(2017\)](#) further observed that APT is capable of using a single factor, multifactor and the market portfolio model determine the relationship between macroeconomic factors and stock returns. The APT provided a strong case for ensuring that stock returns are tied to macroeconomic factors.

From the time that APT was crafted, a whole new debate arose in terms of the macroeconomic factors to be included. The reasoning for the lack of specifica-

tion for the APT Model is supported by Elshqirat (2019). Scholars cannot however be possibly faulted for having gone all out to test all sorts of macroeconomic indicators in search of relevant factors. To a large extent, the excitement was due to the APT being premised on the understanding that stocks should be the main indicator of economic activity since stock markets reflect the fundamentals of the economy (Reza et al., 2018).

As a result of scholarly frenzy, several studies to establish the relationship between macroeconomic factors and stock prices were conducted in several countries including Jordan, the USA, Arabic countries, Pakistan, Nigeria, south Asia and African countries (Elshqirat, 2019). At its best, studies of the relationship between macroeconomic factors and stock returns have been around the world in every continent (Table 1).

4. Analysis

The analysis focuses on the macroeconomic factors that showed a positive causality relationship with stock returns. Of the 18 studies reviewed covering the period from 1986 and 2019, 10 macroeconomic factors showed a positive relationship with stock returns and these include interest rates, inflation, exchange rates, GDP, industrial production, CPI, money supply, reserves, market index and oil prices. The 10 macroeconomic factors that showed a positive relationship with stock returns represent a 59% score against all the variables considered in the studies reviewed in the article.

In Table 2 below, the 10 macroeconomic indicators that showed a positive relationship with stock returns were analyzed against the total number of studies reviewed to measure dispersion and against the total number of studies that featured the variable to show the measure of significance. Table 2 also has a column of weighted scores specifically included to harmonize the absolute scores of macroeconomic indicators with a positive relationship with stock returns but included in few studies.

Table 2 shows how different studies have tested different factors and how, in the absence of weighted average scores, the results can be misinterpreted. Studies reviewed indicate that not only has interest rate been tested the most, it is also leading in terms of being the most positively related macroeconomic factor to stock returns at 61% followed by inflation and exchange rate at 39%. While out of the studies reviewed, industrial production scored 33% followed by money supply at 28%, it was interesting to note that market index and reserves were at the bottom with 6%.

The results in Table 2 also shows that even macroeconomic factors that show a positive relationship with stock returns also suffered setbacks. For instance, despite leading in scores, 27% of studies that featured interest rate show that the macroeconomic factor is negatively related to stock returns. Similarly, 42% and 36% of studies that featured inflation and exchange rates respectively show that the macroeconomic factors are negatively related to stock returns. The results

Table 1. Studies that established the relationship between stock returns and macroeconomic factors.

Author(s)	Countries in which the study was conducted	Macroeconomic factors studied	Microeconomic factors with significant relationship with stock returns
Chen et al. (1986 as cited in Naik, 2013)	USA	Industrial production, inflation (anticipated and unanticipated), long- and short-term government bond yield	All the factors were found to be significant
(Elshqirat, 2019)	Jordan	Exports, unemployment rate, Gross domestic product (GDP), and industrial producers price index (IPPI)	None
Al-Abdallah & Aljarayesh (2017)		interest rate, inflation and exchange rate	Interest rate and inflation
Gan et al. (2006, as cited in Reza et al., 2018)	New Zealand	interest rates, inflation, and exchange rates	None
Barakat et al. (2016, as cited in Reza et al., 2018)	Greece and Tunisia	CPI, exchange rate, money supply, and interest rates	CPI, exchange rate, money supply, and interest rates were positive for Greece and Tunisia. CPI was not applicable for Tunisia
Zulfa and Tan (2009, as cited in Reza et al., 2018)	Indonesia	Inflation and interest rate	Inflation
Reza et al. (2018)	Indonesia	Exchange rate, inflation and GDP	Exchange rate
Amtiran et al. (2017)	Indonesia	GDP, Interest rate, inflation rate and the exchange rate	GDP, Interest rate, exchange rate
Paavola (2006)	Russia	Inflation, oil prices, money supply, exchange rates, and production industry	All the factors were found to be significant
Tursoy, Günsel, & Rjoub (2008)	Turkey	Oil prices, money supply, consumer price index, industrial production, import, export, gold prices, exchange rate, interest rates, economic growth, foreign reserve, unemployment rate and market pressure index	None of the factors had a significant relationship with stock returns
Benakovic & Posedel (2010)	Croatia	inflation, industrial production, interest rates, market indices and oil prices	market index, Interest rates, oil prices and industrial production
Olorunleke (2014)	Nigeria	output growth, interest rate and inflation rate	inflation rate, interest rate and real GDP
Rashid (2008)	Pakistan	Consumer prices, industrial production, exchange rate and the market rate of interest	All macroeconomic variables tested significant
Wongbampo and Sharma (2002, as cited in Olorunleke, 2014)	Philippines, Malaysia, Thailand, Indonesia and Singapore	interest rates	Interest rates was significant only for Malaysia and Indonesia

Continued

Rahman et al. (2009)	Malaysia	money supply, interest rate, exchange rate, reserves and industrial production index	All macroeconomic variables tested significant
Issahaku et al. (2013)	Ghana	interest rate, inflation and money supply and Foreign Direct Investment (FDI)	In the short-term, interest rate, inflation and money supply tested significant. while inflation, money supply and Foreign Direct Investment (FDI) were significant in the long run
Naik (2013)	India	industrial production index, inflation, money supply, short term interest rate exchange rates and stock market index	money supply and industrial production
Hunjra et al. (2014)	Pakistan	Interest rate, exchange rate, and GDP and inflation rate	All factors tested significant only in the long run

Table 2. Scoring of macroeconomic factors that explain the relationship with stock returns.

Macroeconomic Factor with positive for relationship with stock returns	Studies	Positive score of factor out of 18 studies reviewed (A)	Positive score out of studies that featured factor (B)	Weighted average score (C)
Interest rate	Amtiran et al. (2017); Benaković & Posedel (2010); Olorunleke (2014); Rashid, (2008); Wongbampo and Sharma (2002, as cited in Olorunleke, 2014); Rahman et al. (2009); Hunjra et al. (2014); Issahaku et al. (2013); Al-Abdallah & Aljarayesh (2017); Barakat et al. (2016, as cited in Reza et al., 2018); Chen et al. (1986 as cited in Naik, 2013)	61%	73%	45%
Inflation	Chen et al. (1986 as cited in Naik, 2013); Al-Abdallah & Aljarayesh (2017); Zulfa and Tan (2009, as cited in Reza et al., 2018); Paavola (2006); Olorunleke (2014); Issahaku et al. (2013); Hunjra et al. (2014)	39%	58%	23%
Exchange rates	Barakat et al. (2016, as cited in Reza et al., 2018); Reza et al. (2018); Amtiran et al. (2017); Paavola (2006); Rashid, (2008); Rahman et al. (2009); Hunjra et al. (2014)	39%	64%	25%
GDP	Amtiran et al. (2017); Olorunleke (2014); Hunjra et al. (2014)	17%	75%	13%
Industrial production	Chen et al. (1986 as cited in Naik, 2013); Paavola (2006); Benaković & Posedel (2010); Rashid (2008); Rahman et al. (2009); Naik (2013)	33%	75%	25%
CPI	Barakat et al. (2016, as cited in Reza et al., 2018); Rashid (2008)	11%	67%	7%

Continued

Money supply	Barakat et al. (2016, as cited in Reza et al., 2018); Paavola (2006); Rahman et al. (2009); Issahaku et al. (2013); Naik (2013)	28%	83%	23%
Oil prices	Benaković & Posedel (2010); Paavola (2006)	11%	66%	7%
Market index	Benaković & Posedel (2010)	6%	33%	2%
Reserves	Rahman et al. (2009)	6%	50%	3%

also showed that macroeconomic factors which have been least featured in studies tend to have a higher score of positive relationship with stock returns. For instance, 25% of studies reviewed showed that GDP and industrial production were negatively related to stock returns.

Despite the assumption that macroeconomic factors and stock returns are linearly related, the evidence from the table above shows that there is no agreement on the factors to comprise the APT model. When conducting a study on the relationship between stock returns and macroeconomic variables, the most prominent limitation of the APT model that one is faced with is that the types and numbers of factors are not known upfront. The observation has made a prominent feature in literature as observed by Benaković and Posedel (2010), Reza et al. (2018), Amtiran et al. (2017) and Tursoy et al. (2008). The failure to agree on factors and the number of factors to comprise the APT model 45 years down the line while is probably supposed to show a conducive debate amongst scholars unfortunately shows how complex the global economy tend to be. While the linearity of the relationship between the assumption of the relationship between the macroeconomic variables and stock returns is not a bone of contention, it is self-evident that national economies vary.

From the weighted average results in **Table 2** above, there is a common consensus on the interest rate at 45%. Although the average weighted score is below 50%, interest rate has been featured the most in the studies reviewed at 61% and the positive scores in the articles that tested the macroeconomic factor is impressive at 73%. The weighted average score seems to have been dampened by the studies that were outliers.

Macroeconomic factors such as Industrial production and exchange rates showed great positivity in relation to stock returns at 75% and 64% respectively. Despite the industrial production and exchange rates macroeconomic factors not having been tested by many studies as seen by the weighted average score of 25%, it would be interesting to see the results of the variables if multiple studies are conducted. Despite getting weighted average score of 23%, money supply and inflations scored 83% and 58% respectively.

Weighted average scores in this study were used to even out the extreme ends of the result in the context of the 18 studies reviewed. Despite the strong significant relationship between macroeconomic factors namely Industrial production,

exchange rates, money supply and inflation and stock returns, the number of tests done were too few to support a conclusion. Out of the 18 studies reviewed, the macroeconomic factors were featured by less than half of the articles. The author is of the considered view that there is a need for further testing of the four macroeconomic factors in both developing and developed economies before adding them to the APT model.

5. Summary

This study is an endeavor to develop insights on the progress made in agreeing upon the set of macroeconomic factors to be used in APT. The brief review of literature has shown that there is a on consensus interest rate as one of macroeconomic factors with a positive relationship with stock returns. Even though it has taken 45 years of testing different macroeconomic factors to find the variables that can be used in the APT, there is still work to be done. APT is a multi-factor model which needs additional macroeconomic factors over and above the interest rate. The article thus recommends that four more macroeconomic factors namely industrial production, exchange rates, money supply and inflation that showed strong prospects be subjected to further testing across economies.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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