CAPITAL MARKETS REVIEW

Volume 30, No. 2, 2022

Published by: MFA Malaysian Finance Association

Sponsored by: BURSA MALAYSIA

E-ISSN: 2805-430X

MALAYSIAN FINANCE ASSOCIATION
Founded in 1998

EXECUTIVE COMMITTEE 2021/2023

President.....Mansor Ibrahim, *INCEIF*
Vice President.....Chee-Wooi Hooy, *Universiti Sains Malaysia*
Honorary Secretary.....Wai-Ching Poon, *Universiti Teknologi PETRONAS*
Honorary Assistant Secretary.....Jason Kian-Tek Lee, *Sunway University*
Honorary Treasurer.....Wahida Ahmad, *Universiti Teknologi MARA*
Committee Member.....Ahmad Hakimi Tajuddin, *Taylor's University*
Committee Member.....Gary John Rangel, *Universiti Sains Malaysia*
Committee Member.....Maran Marimuthu, *Universiti Teknologi PETRONAS*
Committee Member.....Mohd Edil Abd Sukor, *Universiti Malaya*
Committee Member.....Siong-Hook Law, *Universiti Putra Malaysia*
Committee Member.....Woei-Chyuan Wong, *Universiti Utara Malaysia*

PRESIDENTS

1998/1999.....Muhamad Muda, *Universiti Kebangsaan Malaysia*
1999/2000 – 2003/2004.....Mansor Md. Isa, *University of Malaya*
2004/2005 – 2010/2011.....Fauzias Mat Nor, *Universiti Kebangsaan Malaysia*
2011/2012 – 2016/2017.....Obiyathulla Ismath Bacha, *INCEIF*
2017/2018 – 2019/2021.....Catherine Soke-Fun Ho, *Universiti Teknologi MARA*
2021/2023 – Present.....Mansor Ibrahim, *INCEIF*

ABOUT MFA

The Malaysian Finance Association (MFA) was officially established in September 1998 and is currently registered under the Faculty of Business Management, Universiti Teknologi MARA (UiTM). It was formed through the initiative of a group of finance academicians from various public higher learning institutions in Kuala Lumpur who feels the need to consolidate effort in promoting awareness and interest in the field of finance.

Objectives: The objectives of MFA are to stimulate public interest in finance related studies, to encourage the research and discussion of finance related issues with special reference to Malaysia, to issue Malaysian finance Journals and other publications with the prior approval of the relevant authorities, to promote and organize conferences, forums, dialogues and activities between private and public sectors on current finance issues of national and international concerns; and to undertake such management, economic, and other activities as the Association deems appropriate for the furtherance, promotion and execution of its aforesaid objectives.

Membership: Membership is open to academicians, professionals and students in the area of Finance, Banking, Economics, Insurance, Real Estate, Accounting and other finance related area. There are three types of membership: Ordinary Membership, Associate Membership and Life Membership.

Ordinary Membership (RM100 per year): The Ordinary Membership is open to all academicians and working person in the field of Accounting, Banking, Business Administration, Economics, Finance, Financial Engineering, Actuarial Science, Data Science, Insurance and other finance related area. Ordinary member is eligible to attend and vote at all general meetings of the Association.

Associate Membership (RM100 per year): The Associate Membership is open to foreign professionals / scholars / postgraduates in the field of Finance, Banking, Economics, Insurance, Real Estate, Accounting and other finance related area. The associate members are entitle to all general meetings, but are not eligible to hold an office and to vote.

Life Membership (RM600): The Life Membership is open to Malaysian academicians, an extension of ordinary membership and entitles to all the rights and privileges of ordinary members.

Capital Markets Review

Vol. 30, No. 2, 2022

Capital Markets Review

Vol. 30, No. 2, 2022

Published by:
Malaysian Finance Association (MFA)

MFA is currently registered under below address:
Faculty of Business and Management,
Universiti Teknologi MARA,
40450 Shah Alam, Selangor, Malaysia.
Tel: 603-5544 4792
Fax: 603-5544 4693
Email: cmr@mfa.com.my

Sponsored by:
Bursa Malaysia (previously known as Kuala Lumpur Stock Exchange)

The Latest Information
For the latest information about our association, membership, journal, conference and activities, please visit our website at http://www.mfa.com.my/

Advertising in the Journal
For advertising information, please contact the editorial assistant at cmr@mfa.com.my

Abstracting and Indexing
CMR is listed and indexed in ABDC Journal Quality List, Research Papers in Economics (RePEc), and MyJurnal by Citation and Infometrics Centre (formerly known as Malaysia Citation Centre (MCC)).

E-ISSN: 2805-430X

Capital Markets Review

Vol. 30, No. 2, 2022

Publication Ethics Policy

Capital Markets Review (CMR) is a peer reviewed journal which adheres to the Committee on Publication Ethics (COPE) standards on publication ethics to prevent any publication malpractice. It is expected that all parties involved in the act of publishing article(s) in CMR, including authors, reviewers and editors, are fully committed to the following ethics statements documented based on the Ethical Code of COPE.

i. Author's Obligations

- Author(s) should ensure that their work has not been published previously except in the form of an abstract or as part of a published lecture or academic thesis.
- Author(s) should ensure that their work is not under consideration for publication elsewhere before they submit their work to this journal.
- The article(s) submission and publication in this journal must be known and approved by all Authors.
- The work must be original and entirely owned by Author(s). Author(s) should ensure that there is no falsification, fabrication of data or plagiarism including duplicate publication of the Author's own work without proper citation.

ii. Reviewer's Obligations

- Every manuscript that is sent to the appointed reviewers should be kept as a confidential document and reviewers should not reveal or communicate the work to others unless authorized by the editor.
- Reviewers are required to judge the credibility and feasibility of the manuscript.
- It is the duty of appointed reviewers to offer unbiased, detailed and constructive comments with supporting arguments.
- Reviewers should ensure that there is no conflict of interests between the reviewers and the authors, author's research work or author's research funding. If any, reviewers should communicate with editors.
- Reviewers should complete their review within the stipulated time. If reviewers require more time or unable to complete their review within the stipulated time, they should communicate with editors.

iii. Editor's Obligations

- Editors are liable to uphold the integrity of the publication review process.
- Editors should keep all information related to the manuscript received as confidential, including the identity of the author(s) and reviewer(s).
- Editors should ensure that each manuscript received by the journal is evaluated for its intellectual content regardless of gender, race, ethnic, religion or citizenship of author(s).
- It is the duty of editors to make the final decision whether to accept the manuscript to be published in the journal.
- The responsibilities of editors are guided by the policies set by the editorial board and shall be constrained by its legal requirements.

The editorial board has complete authority to accept or reject a manuscript. If libel, copyright infringement, plagiarism or any unethical publishing behaviour is found, the editorial board has complete authority to amend or withdraw the manuscript if necessary. The published manuscripts would not represent the stand or opinion of the Editorial Board of Malaysian Finance Association. Any cases of serious ethical misconduct will be dealt with using the guidelines issued by COPE.

Capital Markets Review

Vol. 30, No. 2, 2022

CONTENTS

Capital Markets Review Vol. 30, No. 2, pp. 1-18 (2022)

Malaysian Domestic Bond Market Experience: Lessons for Emerging Economies

Meng-Wai Lee[1], Michael Meow-Chung Yap[2] & Kim-Leng Goh[3*]
[1]*Faculty of Business and Economics, University of Malaya, Malaysia.*
[2]*Business School, University of Nottingham Malaysia, Malaysia.*
[3]*Faculty of Business and Economics, University of Malaya, Malaysia.*

Abstract: Research Question: Are there effects of crowding-out from persistent fiscal deficits and what are the role of the banking sector on development of the government and corporate bond markets in Malaysia? **Motivation:** This paper revisits the aftermath of the 1997-98 Asian financial crisis that led to challenging years for Malaysia when its running balanced budgets switched to fiscal deficits. A policy option is to develop the domestic bond market to raise funds, but this is not without challenges. **Idea:** Raising long-term government bonds through the domestic bond market to cover the fiscal shortfall may crowd-out the corporate bond market. An already established banking sector is also likely to compete with the domestic bond market to provide financing to the economy. **Data:** To focus on the Asian financial crisis for policy lessons, this paper uses quarterly data on the Malaysian government and corporate bond markets based on the old categorization of Bank for International Settlements from Q4 1993 up to Q4 2011. The sample includes observations up to the period before the categorization was changed beginning from 2012. **Method/Tools:** Regression analyses are conducted to examine the effects of government debt and the growth of banking sector on the development of the domestic bond market. The ARDL approach is used to screen for possible long-run relationships between the variables. **Findings:** We find that a dominant banking sector complements development of the government bond market. It, however, impacts the corporate bond market negatively. Over-concentration of power in large banks does not augur well for both bond markets, but this impact disappears as the bond markets develop. Persistent fiscal deficits, resulting in the growth of the government bond market, do not result in crowding-out of the corporate bond market. **Contributions:** Our findings suggest that efforts to boost domestic bond market development must take cognizance of the possible complementary and competing roles between the two bond markets and the banking sector.

Keywords: Government bond, corporate bond, banking sector, government debt, fiscal deficits.
JEL Classification: H62, G10, G20

* Corresponding author: Kim-Leng Goh. Tel.: +603-79673667. Fax: +603-79567252.
Email: klgoh@um.edu.my
Acknowledgements: We wish to thank the anonymous referee for providing insightful comments that improved the quality of the paper.

Received 1 Sept 2021; Final revised 5 March 2022; Accepted 1 May 2022; Available online 15 August 2022.
To link to this article: https://www.mfa.com.my/cmr/v30_i2_a1/

1. Introduction

Thus far in 2020, the Covid-19 pandemic has affected many emerging and advanced economies, to the extent that the International Monetary Fund (IMF) has projected a global recession of -3% in 2020, much worse than the -1% contraction in 2009 following the global financial crisis (IMF, 2010; 2020). In the current global scenario, after various degrees of lockdown in numerous countries, many economic activities have slowed down significantly or ground to a halt. This has necessitated governments of both advanced and emerging economies to unveil substantial stimulus measures to support employment and economic activities. In line with past major global shocks, many economies will be grappling with burgeoning fiscal deficits as they deal with the fall-out from the Covid-19 pandemic. For example, past studies (Borio *et al.*, 2016; Hauner, 2009; Reinhart and Rogoff, 2013) showed that severe financial crises, where output, asset prices and currency values plummeted, have resulted in soaring public expenditure and government debt to finance economic revival and bank recapitalization. Also, the more severe the crisis, the more adversely affected is the fiscal position of the government.

During the 1997-98 Asian financial crisis and its aftermath, Malaysia faced a similarly difficult situation. The economy shrank by 7% in 1998 with its currency depreciating by some 50% and the loss of some three quarters of its stock market value during the worst of the Asian financial crisis (Ariff and Yap, 2001). To finance its recovery efforts, Malaysia raised long-term domestic government and corporate bonds to fund its fiscal deficits, revive the economy and recapitalize its banks.

To what extent was Malaysia successful in this endeavour? While the domestic government bond market can be boosted by growing fiscal deficits, can a developing corporate bond market avoid crowding-out effects from the same fiscal deficits? Importantly, can the government and corporate domestic bond markets co-exist successfully alongside an already established banking sector? Historically, the banking sector in many Asian economies, including Malaysia, was usually established much earlier than the bond market, which can only be viewed by the banking sector as an unwanted competitor. Accordingly, how well Malaysia performed in this endeavour should provide valuable insights to other emerging economies when faced with economic challenges such as burgeoning fiscal deficits while needing to boost employment and economic activities. Other events in Malaysia help to underscore the importance and relevance in studying its experience. Firstly, Malaysia was running balanced budgets for some years before increasing public expenditure, thus incurring continuous fiscal deficits as a result of the 1997-98 Asian financial crisis. Secondly, in the wake of this crisis, its central bank, Bank Negara Malaysia, moved to restructure the dominant local banking sector in 2000-01, which resulted in bigger banks and possibly greater market share concentration among the country's top banks (Bank Negara Malaysia, Annual Report, various issues).

To address issues highlighted above, this paper empirically examines the potential determinants of the government and corporate bond markets, focussing on possible crowding-out effects and the role of the banking sector in Malaysia. As Malaysia is a developing country with sizeable government and corporate bond markets, the findings shall be relevant to other emerging economies seeking to develop their domestic bond markets and diversify their financial systems. This paper comprises the following. Section 2 reviews the relevant literature on benefits of domestic bond markets as well as interaction between domestic bond markets and established banking sectors. It covers the loanable funds theory underlying the risks of crowding-out on the corporate bond market from fiscal deficits and includes anecdotal evidence on crowding-out. Section 3 covers data and methodology while Section 4 analyzes the empirical findings. Section 5 sets out important policy implications for Malaysia and other emerging economies, with Section 6 concluding.

2. Literature Review

This section reviews the loanable funds theory and empirical evidence on the benefits of bond markets as well as their interaction with banks.

2.1 Loanable Funds Theory and Anecdotal Evidence on Crowding-out

We examine the theoretical underpinnings of the crowding-out phenomenon by considering the loanable funds theory for a single financial market in an open economy (Mankiw, 2018). Households, firms and the government make up the savers and borrowers. All savers will have to deposit their saving into a lone financial market while all borrowers can only borrow from the same financial market. Only one interest rate prevails, i.e., the return to saving and the cost of borrowing.

The savings of households and the government are sources of supply of loanable funds. Hence, private and public saving constitute national saving (S). Demand for loanable funds comes from households and firms borrowing to invest domestically (I). In addition, in an open economy, the second component of demand comes from net capital outflows (NCO). NCO is the purchase of foreign assets by domestic residents (capital outflow) less purchase of domestic assets by foreigners (capital inflow). Hence, a dollar saved can be invested in either domestic or foreign assets (S=I+NCO). A higher interest rate will increase the quantity of loanable funds supplied (upward sloping supply curve). It makes borrowing more costly, which reduces the demand for domestic investment (I), and also reduces NCO as domestic assets become relatively more attractive compared with foreign assets (downward sloping demand curve).

In this model, a fiscal deficit lowers public saving, thereby reducing national saving and shifting the supply curve leftward. Given the demand for loanable funds, the equilibrium interest rate rises, and this will make investments more costly. It will also reduce net capital outflows. The fall in investment is referred to as the crowding-out effect of the private sector.

The above is based on the assumption that all else remain constant or *ceteris paribus*. However, all else may not be constant. Hence, it is possible that fiscal deficits may not eventually lead to crowding-out in some situations. For example, in response to an adverse shock, the government initiates fiscal stimulus measures, resulting in a fiscal deficit and public saving declines. Private saving can rise to off-set this if households decide to do so for contingency purposes. As an example, the global financial crisis in 2008-09 led to a rise in private savings in the UK while its loans growth slumped (Begg *et al.*, 2014). Hence, the supply curve may shift less to the left, remain at the same position, or even shift to the right compared to its original position. This means that the interest rate may stay the same or even become lower. There can also be a similar effect on the interest rate from the demand side of loanable funds. A shock can result in firms reducing investment. Also, in an open economy, there can be a reduction in NCO (other than due to a change in interest rate). Both these events will cause the demand for loanable funds curve to shift leftward.

As to whether there is a trade-off between the size of government bond markets and crowding-out in corporate bond markets in the real world, McCauley and Remolona (2000) noted that in 1998, Japanese corporate bond issuance reached a record high despite the top global ranking of its government bond market in terms of size. Burger and Warnock (2006), and Eichengreen and Luengnaruemitchai (2004) reported that growth of government bond markets was propelled by an increase in budget deficits, but such deficits had no impact on private bond market development.

Malaysia's challenging years in the 1990's and 2000's – when the country switched from running balanced budgets to fiscal deficits – present this paper with a unique backdrop for analyzing any occurrence of crowding-out.

2.2 Bond Markets and Banks

Essentially, both bond markets and banks provide finance in the economy. In this respect, banks and bond markets are competitors since they serve a similar function. In fact, the Malaysian government promoted corporate bonds as a cheaper source of funding compared to Malaysian banks (National Economic Action Council, 1998). Nevertheless, there are benefits of having well-developed bond markets, such as providing a more stable source of financing to firms. In helping to develop a corporate bond market, banks also stand to gain as they are often among the most important issuers, holders, dealers, advisers, underwriters, and guarantors in this market (Harwood, 2000; World Bank and IMF, 2001).

However, there is still on-going debate about how domestic bond markets interact with the banking sector. Studies by Bentson (1994), Lee *et al.* (2019), Rajan and Zingales (2003), and Schinasi and Smith (1998) have suggested that banks would negatively affect domestic bond market development since the banking sector, in many Asian countries, has the "first-mover" advantage and is the traditional force behind the development of financial markets.

Various cross-country studies (e.g. Bhattacharyay, 2013; Eichengreen and Luengnaruemitchai, 2004), some of which included Malaysia, have found that countries with better developed banking sectors also had better developed bond markets (that is, both public and private bonds). In fact, Bae (2012) highlighted that a well-developed banking sector contributed positively to development of government bond markets and especially to corporate bond markets. Overall, their findings lent support to banks and bond markets complementing each other. However, in their studies on Malaysia, Lee *et al.* (2019) and Lee and Goh (2019) found that the local banking sector exerted a negative impact on growth of the local bond market, especially the private segment.

Nevertheless, bond markets and banks may not be purely competitive nor do they have a wholly synergistic relationship. Song and Thakor (2010) suggested that there has been no strong empirical evidence that capital markets, including bond markets, and banks always competed. By reviewing existing literature on the relationship between capital markets and banks, they found that in developed countries during the period 1960 to 2003, capital markets and banks mostly complemented each other, with the exception of "occasional spurts of competition" (p. 1022).

Besides the banking sector's size, the market share held by the top banks may also have an impact on the development of bond market. The study by Eichengreen and Luengnaruemitchai (2004) showed that countries with concentrated banking sectors tended to have bond markets that are smaller. This finding supports other studies (e.g. Bae, 2012; Bentson, 1994; Rajan and Zingales, 2003) that argued a highly concentrated banking sector could impede the development of corporate bond markets by making it more costly for firms to get financing from bond markets through manoeuvrings of loan and deposit rates.

3. Data and Methodology

This paper used secondary data from the Bank for International Settlements (BIS) website (https://www.bis.org/statistics/secstats.htm), where quarterly data on the Malaysian domestic bond market, for the government and corporate debt segments, are available. Important studies such as the ones by Bae (2012) and Eichengreen and Luengnaruemitchai (2004) also used BIS data. As discussed earlier, this paper needs to look into the years before the 1997-98 Asian financial crisis and the years after 2000-01 (when the bank merger programme was implemented) to analyze the impact and outcome on the government and corporate bond markets from fiscal deficits and bank concentration in Malaysia.

For the paper's findings to be material and meaningful in its analysis of the Malaysian domestic bond market, the sample period should ideally cover the following:

(a) Period of active development in the domestic bond market;

(b) Asian financial crisis of 1997-98 and post-crisis years in Malaysia; and
(c) Malaysian central bank's restructuring programme of the local banking sector after the 1997-98 crisis.

To fulfil the above criteria, this paper used data based on the old BIS categorization. This data series on Malaysian bonds provide data from Q4 1993 up to Q4 2011, which is the full sample period. Data according to the new BIS categorization for Malaysia is only available beginning from 2005. This change by BIS was undertaken as of January 2012 as a result of the 2008-09 subprime or global financial crisis (Gruic and Woodbridge, 2012).

With the old data series from BIS, the full sample period covers the periods in 1993 to 1997 when Malaysia ran balanced government budgets as well as 1998 to 2004 when Malaysia switched to expansionary fiscal policies, thus incurring budget deficits. Furthermore, under the old BIS categorization, government or public sector bonds comprised those issued by governments and central banks. This earlier BIS definition is the same as the definition used by Malaysia to-date (Bank Negara Malaysia and Securities Commission, 2009). In fact, BIS data as per the previous categorization was used in a major study on bond markets in 45 developing countries (Burger *et al.*, 2015). The authors expressed concerns that the "more recent data" from the BIS "may not be consistent with the historical data" (p. 4).

The sub-sample period (Q2 2001 to Q4 2011) was chosen for analysis. This is based on the consolidation of Malaysia's largest bank, Malayan Banking Berhad. The bank concentration ratio for this paper was estimated from Malayan Banking Berhad's assets over total assets of commercial banks. The consolidation of the commercial banks, which began in 1999, was spearheaded by Bank Negara Malaysia following the 1997-98 Asian financial crisis. Bank Negara Malaysia moved quickly with its merger programme in 1999 to strengthen the fragmented banking sector (Bank Negara Malaysia, Annual Report 2002). Under its merger programme, Malayan Banking Berhad was merged with two smaller banks and the new entity began its operation from Q2 2001 (Malayan Banking Berhad, 2001).

This paper used publicly available data from Bank Negara Malaysia, CEIC (a provider of economic data) and IMF. The secondary data of quarterly frequency on Malaysian bonds, banking sector and government debt were deseasonalized.

The lack of studies on bond markets that encompass both government and corporate bonds could be due to the fact that corporate bond markets in many countries including Germany and Japan "were virtually non-existent in 1980" (Schinasi and Smith, 1998, p. 15). In Japan, data from Asian Bonds Online (*asianbondsonline.adb.org*) showed that corporate bonds made up under 10% of Japan's aggregate domestic bond market as recently as 2015. In contrast, corporate bonds have become a key segment of the Malaysian domestic bond market and, in the 2000's, accounted for about half of total outstanding bonds (Bank Negara Malaysia, Annual Report, various issues).

Alluding to numerous bond market studies, especially those covering Asian economies, the Malaysian domestic government and corporate bond markets should be linked to various macroeconomic factors as follows:

(a) Economic growth, represented by the annual growth rate of real Gross Domestic Product (GDP) (Bae, 2012; Eichengreen and Luengnaruemitchai, 2004; Garcia and Lin, 1999; La Porta *et al.*, 1997; Mihaljek *et al.*, 2002). Higher economic growth should boost bond market development.
(b) Openness of the economy, measured by the ratio of total trade to nominal GDP. This trait is expected to boost bond market development (Bae, 2012; Eichengreen and Luengnaruemitchai, 2004; Essers *et al.*, 2015; Rajan and Zingales, 2003).
(c) Size of the banking sector, measured by the ratio of loans outstanding to nominal GDP. For Malaysia, the large amount of loans outstanding of the banking sector

reflected its dominance in the local economy and extent of financial market sophistication and development (Bae, 2012; Burger and Warnock, 2006; Eichengreen and Luengnaruemitchai, 2004; Essers *et al.*, 2015; Garcia and Lin, 1999). As the local banks were set up much earlier than the Malaysian domestic bond market, they likely competed with the domestic bond market to provide external financing to the public and private sectors (Bentson, 1994; Burger and Warnock, 2006; Essers *et al.*, 2015; Harwood, 2000; Herring and Chatusripitak, 2000). However, some cross-country studies also discovered a symbiotic relationship between both parties, indicating complementarity (e.g. Bae, 2012; Eichengreen and Luengnaruemitchai, 2004).

(d) Market share concentration within the banking sector, represented by the bank concentration ratio (Beck *et al.*, 2003; Eichengreen and Luengnaruemitchai, 2004). This ratio is calculated from the assets of the top Malaysian bank over total assets of commercial banks in Malaysia. Beck *et al.* (2003) used share of assets of the three largest banks in a country as a measure of bank concentration. However, Malaysia's second largest commercial bank, Bank Bumiputra Berhad, was unlisted and its balance sheet figures unavailable to the public until it was merged with another local commercial bank in 2000 (Bank Negara Malaysia, 2001). Since Malayan Banking Berhad holds about one-fifth of total assets of the commercial banking sector in Malaysia or possibly close to half of the assets of the top three banks in Malaysia, it should be an adequate proxy for bank concentration in Malaysia. The larger this ratio, the greater the market share held by top bank(s) in the country and this concentration of power in the top banks may be used by them to make bond issuance burdensome and costly for potential bond issuers (Bentson, 1994; Eichengreen and Luengnaruemitchai, 2004; Rajan and Zingales, 2003; Schinasi and Smith, 1998).

(e) Size of the equity market, measured by the ratio of equity market capitalization to nominal GDP. This is the proxy for the local equity market, which may also be competing with the domestic bond market (Bae, 2012; Burger and Warnock, 2006; Eichengreen and Luengnaruemitchai, 2004; Mihaljek *et al.*, 2002; Mohanty, 2002). In addition, the equity market proxy may reflect the overall development of the capital market (e.g. Garcia and Lin, 1999).

(f) Exchange rate, represented by the logarithm (log) and standard deviation of exchange rate of ringgit Malaysia against US dollar. Currency stability should boost domestic bond market growth in Malaysia (Bae, 2012; Eichengreen and Luengnaruemitchai, 2004; Turner, 2002).

(g) Interest rate, represented by the three-month interbank rate in Malaysia. Low and stable interest rates are conducive to development of domestic bond markets (Bae, 2012; Eichengreen and Luengnaruemitchai, 2004; Essers *et al.*, 2015).

(h) Inflation, represented by the percentage change in the Consumer Price Index. Inflation is expected to negatively affect the Malaysian bond market (Burger *et al.*, 2015; Burger and Warnock, 2006; Essers *et al.*, 2015). Nevertheless, long-term inflation in Malaysia was fairly stable. Average inflation rate for the full period of analysis (Q4 1993 – Q4 2011) was 2.7%, and 2.3% for the sub-sample period (Q2 2001 – Q4 2011) (calculated using data from Bank Negara Malaysia).

(i) Government debt and fiscal balance, represented by the ratio of government debt to nominal GDP and the ratio of fiscal balance to nominal GDP respectively. As government bonds are issued to finance government development expenditure, rising government debt is likely to boost the local bond market. However, if the ratio of fiscal balance to nominal GDP is used as a proxy, it is likely to negatively

affect growth of the local bond market as fiscal surpluses will have a dampening effect on growth of domestic bond issuance and vice versa (Burger and Warnock, 2006; Eichengreen and Luengnaruemitchai, 2004; Harwood, 2000; Mihaljek *et al.*, 2002; Turner, 2002).

To examine the relationship between the government bond market and corporate bond market with the variables stated above, an autoregressive distributed lag (ARDL) model was fitted (Pesaran *et al.*, 2001) as below:

$$\Delta y_t = \beta_0 + \beta_1 y_{t-1} + \sum_{i=1}^{m} \beta_{2i} x_{i,t-1} + \sum_{i=1}^{p} \propto_i \Delta y_{t-i} + \sum_{i=0}^{p_1} \gamma_i \Delta x_{1,t-i} + \cdots + \sum_{i=0}^{p_m} \theta_i \Delta x_{m,t-i} + u_t \quad (1)$$

where x and y are the independent and dependent variables, respectively, m is the number of potential determinants, u_t is the error term, and p, p_1, …, p_m are number of lags. The ARDL modelling approach was used due to a small number of observations and the estimation involves a mixture of $I(0)$ and $I(1)$ variables (see Section 4).

The ARDL F-bounds test was conducted to examine if long-run relationships between the variables in level are present. In the absence of long-run relationship, the following multivariate regression model was estimated:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \propto_i \Delta y_{t-i} + \sum_{i=0}^{p_1} \gamma_i \Delta x_{1,t-i} + \cdots + \sum_{i=0}^{p_m} \theta_i \Delta x_{m,t-i} + u_t \quad (2)$$

Studies on bond or debt markets using the multivariate ordinary least squares approach include Bhattacharyay (2013) that involved identifying major determinants of the development of bond markets in Asia. Using a similar approach, La Porta *et al.* (1997) looked at the legal determinants of capital markets to study equity and debt markets, the latter comprising bonds and bank loans.

4. Empirical Findings

The ARDL model (Equation (1)) was estimated for both government and corporate bond markets for the full sample period (Q4 1993 to Q4 2011). In the government bond market, the dependent variable is the ratio of government bond to nominal GDP (GB_t) while in the corporate bond market, the dependent variable is the ratio of corporate bond to nominal GDP (CB_t). The explanatory variables include annual GDP growth rate, ratio of trade to nominal GDP, ratio of bank loans to nominal GDP, bank concentration ratio, ratio of equity market capitalization to nominal GDP, interest rate, inflation, exchange rate, and ratio of government debt or fiscal balance to nominal GDP, as listed in (a) to (i) in Section 3. Before the estimation, the stationarity properties of all these variables were established using the ADF test. Economic growth and inflation are stationary. A breakpoint test was considered for the size of the equity market (ratio of equity market capitalization to nominal GDP) that displayed a break following the Asian financial crisis. The series is found to be stationary. All the other variables are integrated of order one and they are stationary at first difference. It should be noted that both the dependent variables of interest, GB_t and CB_t, are $I(1)$. Together with this, the mixture of $I(0)$ and $I(1)$ variables in the model justifies the use of the ARDL modelling approach.

The ARDL F-bounds test was conducted, and it failed to establish level relationships between the government bond market (F = 2.3447) and corporate bond market (F = 2.3803) with the other variables. The outcome of no long-run relationship could be attributed to the following:

(a) The Malaysian government reduced its borrowings significantly between 1988 and 1997;
(b) Malaysia switched from running balanced budgets for the period 1993 to 1997 to expansionary fiscal policies with fiscal deficits beginning 1998 onwards;
(c) The severity of the 1997-98 Asian financial crisis;
(d) The Malaysian government and private sector raised funding from its domestic bond market (Bank Negara Malaysia, Annual Report, various issues) especially after the Asian financial crisis; and
(e) The conduct of monetary policy in the low interest rate environment in the post-crisis period meant that interest rates, in their traditional role as policy instruments, became less effective (Goh and Yong, 2007).

Since the results do not support the existence of any long-run relationship, the variables in level were dropped. Equation (2) was then estimated for both the government and corporate bond markets. The variables, which are *I*(0) in level, were included directly in Equation 2 while first differences were taken for the variables which are *I*(1) in level. All the variables were firstly entered into the model. The final estimated models reported below retain only the variables that are significant.

Table 1 lists all dependent and independent variables, and their abbreviations. 'D' in front of a variable indicates first difference while 'DV' indicates a dummy. As the period of this study covered various events and developments that need to be taken into consideration, four dummy variables were introduced to account for them. These are (i) DVBPGD (1 for Q1 1998, and 0 otherwise), the dummy variable for breakpoint in government debt when fiscal surpluses first changed to fiscal deficits; (ii) DVAFC (1 from Q3 1997 to Q3 1999, and 0 otherwise), the dummy variable for the Asian financial crisis; (iii) DVPEG (1 from Q3 1998 to Q3 2005, and 0 otherwise), the dummy variable for Malaysia's currency peg and partial capital controls; and (iv) DVGFC (1 from Q1 2008 to Q2 2008, and 0 otherwise), the dummy variable for the global financial crisis. The dummy variables for breakpoint in government debt and global financial crisis are significant and the other two are not.

Table 1: List of Variables

Variables	Abbreviations
Dependent Variables	
Ratio of Government Bonds to Nominal GDP	DGB
Ratio of Corporate Bonds to Nominal GDP	DCB
Independent Variables	
Bank Concentration Ratio	DBANCON
Ratio of Loans Outstanding to Nominal GDP	DLOAN
Ratio of Government Debt to Nominal GDP	DGDEBT
Ratio of Fiscal Balance to Nominal GDP	DFISC
Logarithm of Exchange Rate	DLEXR
Interest Rate	DIBR
Ratio of Equity Market Capitalization to Nominal GDP	EQMKT
Dummy Variables	
Dummy Variable for Global Financial Crisis	DVGFC
Dummy Variable for Breakpoint in Government Debt	DVBPGD

Notes: 'D' in front of a variable indicates that first difference is used to achieve stationarity while 'DV' indicates a dummy variable.

The two proxies for government debt are $DGDEBT_t$ and $DFISC_t$. These proxies were used alternatively in four pairs of models, shown in Tables 2 to 5. Tables 2 and 3 show the results for the estimated regression models for government bonds for the full and sub-sample periods respectively. Tables 4 and 5 show the results for corporate bonds in the full and sub-sample periods. For these models, diagnostic tests included serial correlation LM test, variance inflation factor, recursive residuals, CUSUM test, and CUSUM of squares test. Except for the serial correlation LM test, the results for the other tests are not reported to conserve space (they are available on request). The tests do not indicate any estimation problems.

4.1 Domestic Government Bond Market (Full Sample Period)

In Table 2, we have Models 1A and 1B. Here, the dependent variable is first difference of the ratio of government bond to nominal GDP (DGB_t). In Model 1A, in addition to the proxy for government debt ($DGDEBT_t$), six other explanatory variables are significant. Both the bank concentration ratio ($DBANCON_t$) and dummy variable for the global financial crisis (DVGFC) negatively affected the dependent variable i.e. domestic government bond market (DGB_t). The proxy for the banking sector ($DLOAN_{t-1}$) affected the domestic government bond market positively. Likewise, both the proxy for government debt ($DGDEBT_t$) and the dummy variable for the break in government debt (DVBPGD) also positively affected the domestic government bond market. The proxies for exchange rate stability ($DLEXR_t$) and equity market ($EQMKT_{t-1}$) negatively affected the domestic government bond market (DGB_t).

Since exchange rate stability is conducive to domestic bond market development, the negative impact of its proxy ($DLEXR_t$) on government bond market development is expected. The negative impact of the size of the equity market on government bond market development suggests that both markets may have competed to provide financing for the Malaysian government. Burger and Warnock (2006) found a negative relationship between domestic bond and equity markets. The Malaysian equity market was well-established, and the more popular avenue for raising funds within the capital market (Bank Negara Malaysia, Annual Report, various issues).

In Model 1B, the proxy used for government debt is first difference of the ratio of fiscal balance to nominal GDP ($DFISC_t$). It is significantly negative, that is, a rise in fiscal balance negatively affects the growth of the government bond market. The remaining significant variables in Model 1B are the same as in Model 1A, namely bank concentration ratio ($DBANCON_t$), dummy variable for the global financial crisis (DVGFC), banking sector ($DLOAN_{t-1}$), dummy variable for the break in government debt (DVBPGD), exchange rate stability ($DLEXR_t$), and equity market ($EQMKT_{t-1}$).

The impact of the bank concentration ratio ($DBANCON_t$) is significant and negative on the government bond market over the full sample period. The power exercised by the big banks in Malaysia negatively impacted the government bond market. These big banks may have made bond issuance difficult or costly, thereby discouraging potential bond issuers, including from the government sector (e.g. Bentson, 1994; Rajan and Zingales, 2003; Schinasi and Smith, 1998). However, it appears that the banking sector proxy (DLOAN), contributed positively to the development of the government bond market. This suggests that a growth in the banking sector in Malaysia has boosted development of the government bond market.

Table 2: The Results for Estimated Regression Models for Government Bonds (Full Sample Period)

Variable	Model 1A	Model 1B
Constant	0.0155**	0.0241***
	(0.0071)	(0.0045)
Bank Concentration Ratio, $DBANCON_t$	-1.0365***	-1.1307***
	(0.3726)	(0.3763)
Dummy Variable for Global Financial Crisis, $DVGFC_t$	-0.0238***	-0.0286***
	(0.0057)	(0.0053)
Ratio of Loans Outstanding to Nominal GDP, $DLOAN_{t-1}$	0.2231**	0.1310*
	(0.0842)	(0.0727)
Ratio of Government Debt to Nominal GDP, $DGDEBT_t$	0.4304*	-
	(0.2214)	
Ratio of Fiscal Balance to Nominal GDP, $DFISC_t$	-	-1.1526*
		(0.5892)
Dummy Variable for Breakpoint in Government Debt, DVBPGD	0.0604***	0.0521***
	(0.0082)	(0.0067)
Logarithm of Exchange Rate, $DLEXR_t$	-0.1596**	-0.1647**
	(0.0626)	(0.0621)
Ratio of Equity Market Capitalization to Nominal GDP, $EQMKT_{t-1}$	-0.0084**	-0.0136***
	(0.0039)	(0.0023)
R-squared	0.5570	0.5490
Adjusted R-squared	0.5078	0.4989
Number of observations	71	71
Breusch-Godfrey Serial Correlation LM Test – Chi-squared statistic	4.8419[0.3039]	6.8892[0.1419]

Notes: Dependent variable for both models is first difference of the ratio of government bonds to nominal GDP; figures in parentheses are White heteroscedasticity-consistent standard errors; ***, **, * indicate significance at 1%, 5% and 10% level, respectively. 'D' in front of a variable indicates first difference while 'DV' indicates a dummy variable.

4.2 Domestic Government Bond Market (Sub-Sample Period)

Table 3 shows Models 2A and 2B for the sub-sample period, where the dependent variable is still DGB_t. In Model 2A, the proxy for government debt is first difference of the ratio of government debt to nominal GDP ($DGDEBT_t$) and it is significant. Besides $DGDEBT_t$, there are four other significant explanatory variables. Even though the proxy for the banking sector ($DLOAN_{t-1}$) is still significantly positive, the other banking-related variable ($DBANCON_t$) is no longer significant and has been dropped from Model 2A.

The proxy for government debt in Model 2B is first difference of the ratio of fiscal balance to nominal GDP ($DFISC_t$). In this model, $DFISC_t$, and four other explanatory variables are significant. These four were also significant in Model 2A.

The sub-sample period begins after the bank consolidation programme implemented by Bank Negara Malaysia. Here, the findings show that $DBANCON_t$ and $EQMKT_{t-1}$ are no longer significant in affecting growth of the government bond market. There is a possibility the government bond market has grown sufficiently such that it is now able to compete with the big banks and equity market on a more equal footing. According to Song and Thakor (2010), over the longer term, banks and capital markets, encompassing bond and equity markets, mostly complemented each other.

We find that increased interest rates will impact the growth of the government bond market negatively, as shown by its proxy being first difference in interest rate (DIBR). In view of the expansionary fiscal budgets beginning 1998, this negative relationship between interest rates and growth of the government bond market is not unexpected despite the accommodating monetary policy stance. That is, interest rate hikes may adversely influence

the timing and size of government bond issuance as the impact of interest rate differentials grows in tandem with the size of fiscal deficits and cost of servicing government bonds.

Table 3: The Results for Estimated Regression Models for Government Bonds (Sub-Sample Period)

Variable	Model 2A	Model 2B
Constant	0.0026	0.0044**
	(0.0023)	(0.0020)
Dummy Variable for Global Financial Crisis, DVGFC	-0.0168***	-0.0222***
	(0.0052)	(0.0042)
Ratio of Loans Outstanding to Nominal GDP, $DLOAN_{t-1}$	0.5071***	0.3997***
	(0.0986)	(0.0959)
Ratio of Government Debt to Nominal GDP, $DGDEBT_t$	0.4354**	-
	(0.1817)	
Ratio of Fiscal Balance to Nominal GDP, $DFISC_t$	-	-1.7125**
		(0.7121)
Logarithm of Exchange Rate, $DLEXR_t$	-0.6050***	-0.6301***
	(0.0750)	(0.0684)
Interest Rate, $DIBR_t$	-0.0149**	-0.0160***
	(0.0059)	(0.0042)
R-squared	0.6507	0.6559
Adjusted R-squared	0.6022	0.6081
Number of observations	42	42
Breusch-Godfrey Serial Correlation LM Test – Chi-squared statistic	3.9161[0.4175]	4.8151[0.3068]

Notes: Dependent variable for both models is first difference of the ratio of government bonds to nominal GDP; figures in parentheses are White heteroscedasticity-consistent standard errors; ***, **, * indicate significance at 1%, 5% and 10% level, respectively. 'D' in front of a variable indicates first difference while 'DV' indicates a dummy variable.

4.3 Domestic Corporate Bond Market (Full Sample Period)

As corporate bonds in Malaysia are issued by corporations from many different industries or sectors, their determinants may be more diverse when compared with government bonds. Accordingly, the adjusted R-squared values for the selected models of corporate bonds are noticeably lower than those for the final models of government bonds for both full and sub-sample periods.

In Table 4, for Models 3A and 3B, the dependent variable is the first difference of the ratio of corporate bonds to nominal GDP (DCB_t). For Model 3A, with first difference of the ratio of government debt to nominal GDP ($DGDEBT_t$) as the proxy for government debt, a total of six explanatory variables are significant.

In Model 3A, with the exception of $DGDEBT_t$ and DVBPGD, the other four explanatory variables impacted the dependent variable, DCB_t, negatively. That is, increases in $DBANCON_t$, $DLOAN_{t-3}$ and $DLEXR_t$ will result in falls in the domestic corporate bond market (DCB_t) expansion rate. The dummy variable (DVGFC) results in a downward shift of the curve. The impact from global financial crisis has negatively affected corporate bond market capitalization.

For Model 3B, the proxy for government debt is first difference of the ratio of fiscal balance to nominal GDP ($DFISC_t$). However, the variable, $DFISC_t$, is not significant. The other explanatory variables remain significant in Model 3B.

Both proxies for bank concentration ratio ($DBANCON_t$) and banking sector ($DLOAN_{t-3}$) negatively affect corporate bond market growth over the full sample period. This suggests the banking sector and corporate bond market in Malaysia were competitors. This negative relationship is not unexpected, especially as its government actively encouraged the conglomerates to issue corporate bonds as a cheaper way to raise funds after the country's

first rating agency was set up in 1990 and, again, in the aftermath of the 1997-98 Asian financial crisis (Bank Negara Malaysia and Securities Commission, 2009; National Economic Action Council, 1998).

We find that $DGDEBT_t$ as a proxy for government debt is significantly positive in Model 3A while fiscal deficits as the alternative proxy for government debt ($DFISC_t$) is not significant in Model 3B. That is, unlike fiscal balances, government debt is a suitable proxy for capturing the effect of the government bond market serving as the necessary pre-requisite for corporate bond market development in the country. This is in line with an earlier study by Bae (2012). In addition, the results suggest that growth of the Malaysian government bond market has not caused crowding-out in the country's corporate bond market (see also Lee and Goh, 2019).

4.4 Domestic Corporate Bond Market (Sub-Sample Period)

Table 5 shows the results for corporate bonds in the sub-sample period. All four explanatory variables in Model 4A are significant, including the proxy for government debt, $DGDEBT_t$. In Model 4B, First Difference of the ratio of Fiscal Balance to Nominal GDP ($DFISC_t$) is used as the proxy for government debt. However, unlike $DGDEBT_t$ in Model 4A, it is not significant. The three explanatory variables i.e. $DLOAN_{t-3}$, $DLEXR_t$ and $DIBR_{t-4}$ remain significantly negative.

Table 4: The Results for Estimated Regression Models for Corporate Bonds (Full Sample Period)

Variable	Model 3A	Model 3B
Constant	0.0028**	0.0027**
	(0.0014)	(0.0013)
Bank Concentration Ratio, $DBANCON_t$	-0.7548***	-0.8269***
	(0.2341)	(0.2314)
Dummy Variable for Global Financial Crisis, DVGFC	-0.0117**	-0.0150***
	(0.0053)	(0.0052)
Ratio of Loans Outstanding to Nominal GDP, $DLOAN_{t-3}$	-0.0676***	-0.0730***
	(0.0217)	(0.0237)
Ratio of Government Debt to Nominal GDP, $DGDEBT_{t-1}$	0.4447**	
	(0.1927)	-
Ratio of Fiscal Balance to Nominal GDP, $DFISC_t$	-	-0.8260
		(0.6987)
Dummy Variable for Breakpoint in Government Debt, DVBPGD	0.0248***	0.0277***
	(0.0037)	(0.0034)
Logarithm of Exchange Rate, $DLEXR_t$	-0.1119***	-0.0995***
	(0.0277)	(0.0277)
R-squared	0.3626	0.3589
Adjusted R-squared	0.3009	0.2968
Number of observations	69	69
Breusch-Godfrey Serial Correlation LM Test – Chi-squared statistic	0.9141[0.9225]	0.9161[0.9222]

Notes: Dependent variable for both models is first difference of the ratio of corporate bonds to nominal GDP; figures in parentheses are White heteroscedasticity-consistent standard errors; ***, **, * indicate significance at 1%, 5% and 10% level, respectively. 'D' in front of a variable indicates first difference while 'DV' indicates a dummy variable.

Table 5: The Results for Estimated Regression Models for Corporate Bonds (Sub-Sample Period)

Variable	Model 4A	Model 4B
Constant	0.0004	0.0002
	(0.0016)	(0.0016)
Ratio of Loans Outstanding to Nominal GDP, $DLOAN_{t-3}$	-0.0634***	-0.0645***
	(0.0224)	(0.0224)
Ratio of Government Debt to Nominal GDP, $DGDEBT_{t-1}$	0.5035***	-
	(0.1806)	
Ratio of Fiscal Balance to Nominal GDP, $DFISC_t$	-	-0.2003
		(0.5586)
Logarithm of Exchange Rate, $DLEXR_t$	-0.3498***	-0.3464***
	(0.0809)	(0.0791)
Interest Rate, $DIBR_{t-4}$	-0.0012***	-0.0014**
	(0.0004)	(0.0005)
R-squared	0.5136	0.4680
Adjusted R-squared	0.4563	0.4055
Number of observations	39	39
Breusch-Godfrey Serial Correlation LM Test – Chi-squared statistic	2.2491[0.6900]	3.6621[0.4537]

Notes: Dependent variable for both models is first difference of corporate bonds of the ratio of nominal GDP; figures in parentheses are White heteroscedasticity-consistent standard errors; ***, **, * indicate significance at 1%, 5% and 10% level, respectively. 'D' in front of a variable indicates first difference.

As was the case with the government bond market in the sub-sample period, the proxy for interest rate movements ($DIBR_{t-4}$) is significant here too, with higher interest rates negatively affecting corporate bond market expansion. The difference in lags between government and corporate bonds for DIBR may stem from the shorter time needed for the government to issue bonds while corporates require a longer time period, including time needed to obtain approvals from the relevant authorities. With interest rates mostly accommodating in the years following the Asian financial crisis, potential bond issuers in the domestic bond market would very likely view any interest rate hikes as a deterrent in their consideration to issue bonds.

Findings for the sub-sample period are in line with the theoretical underpinnings as discussed in Section 2. That is, even with fiscal deficits reducing the country's total savings, crowding-out will not happen to the corporate bond market if national investments fall and the equilibrium interest rate is lower (which would be so with Malaysia's easy monetary policy in the years after the Asian financial crisis). For this reason, interest rate hikes in the sub-sample period are now influential in adversely affecting the issuance of corporate bonds.

5. Policy Implications for Malaysia and Other Emerging Economies

The findings of this paper on potential determinants of Malaysian domestic bond market development can provide insights and serve as input for future policies to add greater depth and breadth to financial markets in Malaysia and other emerging economies.

Findings for the full sample period show that the relationship between the government bond market and banks is positive. This positive relationship may reflect the benefits a well-established banking sector can provide in developing the government bond market (Bae, 2012; Eichengreen and Luengnaruemitchai, 2004). Also, the sizeable Malaysian government bond market may be able to interact with the dominant banking sector on a more equal footing (Song and Thakor, 2010). In contrast, results show that the local banking sector has a dampening effect on the corporate bond market in both sample periods. This negative relationship may result from the tussle between the former and latter to be the

preferred source of financing for Malaysian corporates (Bentson, 1994; Rajan and Zingales, 2003; Schinasi and Smith, 1998).

For the period after the bank merger programme (sub-sample period), findings show that the equity market no longer has a negative impact on development of the government bond market. Also, the bank concentration ratio is no longer significant in negatively affecting the government or corporate bond markets in the sub-sample period. Sahay *et al.* (2015) said in their assessment of the Malaysian banking sector for the period 1980 to 2013 that it was large and concentrated. Furthermore, the bank concentration ratio used in this paper did not exhibit any declining trend in the sample period in this study (which is unlikely given the 2001 merger exercise). As such, it is possible that the government and corporate bond markets (both of which were growing robustly in the full sample period) are able to interact with the local banking sector on a more equal footing in the sub-sample period. In fact, the diminished role of the banking sector in providing external financing to large corporates was noted by Goh and Hooy (2008) in the years following the Asian financial crisis as the Malaysian capital market expanded.

After running budget surpluses from 1993 to 1997, Malaysia switched to an expansionary fiscal policy stance beginning 1998. As a result, there were fiscal deficits amounting to an average of RM24 billion or 4.6% of GDP a year between 1998 and 2011 (Ministry of Finance, various issues). Notwithstanding concerns about possible crowding-out effects on private investments, fiscal stimulus measures by the Malaysian government helped the economy to rebound quickly from the 1997-98 Asian financial crisis. This policy switch helped to revive the economy, which expanded a robust 6.1% in 1999 after a sharp contraction of -7.4% in 1998 (Bank Negara Malaysia, Annual Report, various issues).

Findings here show that Malaysia was able to avoid any crowding-out on its corporate bond market. This may be due to a confluence of factors. Firstly, even though its fiscal deficits reduced national savings (as public savings fell), private savings in Malaysia rose in the years after the Asian financial crisis. Secondly, Malaysia's Savings-Investment gap was positive for the years 1998-2011, reflecting higher private savings and lower private investments (Ministry of Finance, various issues). Further working in Malaysia's favour, its banking system had sufficient liquidity beginning 1999, after a brief period of tight liquidity in 1998. Coupled with low interest rates, the private sector was ensured of adequate access to affordable credit (Bank Negara Malaysia, Annual Report, various issues).

For other emerging economies seeking to reduce any risks of crowding-out when expansionary fiscal policies are conducted, such fiscal policies should be accompanied by accommodating monetary policies to ensure sufficient liquidity and affordable credit for the private sector. Ample liquidity and low interest rates will help mitigate the effects of higher government debt and / or bond issuance on the private sector. The negative impact of higher interest rates on the domestic bond market in such a situation is underscored by findings for the sub-sample period (when there were larger fiscal deficits), which show that interest rate hikes in that period adversely affected growth of the government and corporate bond markets.

Not only was there no evidence of crowding-out in Malaysia, findings in this paper show that growth in Malaysia's government debt and, accordingly, growth in its government bond market, has a positive impact on development of the corporate bond market. Even though Malaysia conducted expansionary fiscal policies between 1998 to 2011 (within the full sample period), findings for the full and sub-sample periods show a positive relationship between the corporate bond market and government debt (but not when government debt was proxied by fiscal balances). This parallels the finding by Bae (2012) in a study on domestic bond markets in 43 economies, which included Malaysia. That is, development of

corporate bond markets benefits significantly from well-functioning government bond markets.

In line with recommendations by multi-lateral organizations (e.g. World Bank and IMF, 2001), findings in this paper strongly indicate that emerging economies seeking to promote domestic bond markets should first develop their government bond markets to catalyze the development of their corporate bond markets subsequently.

Since weakening in the local currency negatively impacted both the government and corporate bond markets in Malaysia, emerging economies need to adopt fiscal and monetary policies that will contribute to exchange rate stability to boost domestic bond market development.

Finally, given the sizeable Malaysian corporate bond market, the government can look into measures to further develop the corporate bond market to better meet the needs of various corporate bond issuers. For example, the World Bank and IMF (2001, p. 365) suggested that governments of developing countries should differentiate between large and frequent versus small and infrequent corporate bond issuers so as to cater to the different needs or requirements of such issuers.

6. Conclusion

While this paper did not establish long-term relationships within Malaysian government and corporate bond markets, the full sample period for this study represents an important epoch for the Malaysian domestic bond market and analyzing this period has provided valuable insights to domestic bond market development that can benefit other emerging economies.

The size of government debt and the break in the trend in Malaysia's government debt positively impacted both the government and corporate bond markets. While both proxies, the ratio of government debt to nominal GDP and the ratio of fiscal balance to nominal GDP, were significant in the results for government bonds, this was not so for corporate bonds. The proxy, the ratio of fiscal balance to nominal GDP, was not significant in the results for corporate bonds. This suggests that the proxy, the ratio of government debt to nominal GDP, which is highly correlated to the size of government bond market, captures the impact of the well-developed Malaysian government bond market in supporting development of the Malaysian corporate bond market, in line with the findings by Bae (2012).

Accordingly, Malaysia's persistent fiscal deficits, which resulted in the growth of its government bond market, did not result in crowding-out of the private sector, including the corporate bond market. It should be stressed that Malaysia avoided any possible negative effects to the corporate bond segment due to it pursuing an accommodating monetary policy to complement its expansionary fiscal policy, further aided by an increase in private savings and reduction in private investments (Bank Negara Malaysia, Annual Report, various issues).

The bank concentration ratio, reflecting the power that big banks derive from their large market shares, negatively affected both government and corporate bond markets in the full sample period. However, this ratio was not significant at all in the sub-sample period. Together, these findings suggest that top banks in Malaysia use their power to compete with the domestic bond market to be the preferred avenue of external financing of the Malaysian government and corporates. However, as the domestic bond market grew in size, both the government and corporate segments, the power of the big banks waned. In fact, by 2010, corporate bonds accounted for 58.5% of total corporate financing, noticeably higher than its 46.4% in 2001 (Bank Negara Malaysia, 2011, p. 56).

Size of the banking sector has a significantly positive impact on government bond market development in both sample periods. However, the size of the banking sector

negatively affected the corporate bond market in both sample periods. The contrasting findings suggest that different factors may be at work here. The positive association between the former may be an indication that the size of the dominant banking sector reflects the greater development and sophistication of the financial system (Garcia and Lin, 1999) and/or the ability of the sizeable government bond market to interact with the local banking sector on a more equal footing (Song & Thakor, 2010). The negative relationship between the size of the banking sector and corporate bond market likely stems from the competition between the two (Lee *et al.*, 2019).

Findings of this paper on Malaysia's experience in developing its government and corporate bond markets provide useful insights to other emerging economies seeking to develop their domestic bond markets as an avenue for long-term financing, contributing to faster economic growth. Malaysia has been able to navigate the challenging path of running fiscal deficits without crowding out its local bond market, especially the corporate segment. This represents crucial information to emerging economies struggling to develop their nascent bond markets while needing to finance or boost government spending especially during post-crisis periods.

References

Ariff, M., & Yap, M. M. C. (2001). Financial crisis in Malaysia. In Yu, T. S., & D.Q. Xu (Eds.), *From crisis to recovery: East Asia rising again?* (pp. 305-345). World Scientific.

Bae, K. H. (2012). *Determinants of local currency bonds and foreign holdings: Implications for bond market development in the People's Republic of China* (ADB Working Paper No. 97). https://www.adb.org/publications/determinants-local-currency-bonds-and-foreign-holdings-implications-bond-market

Bank Negara Malaysia & Securities Commission. (2009). *Malaysian debt securities and sukuk market: A guide for issuers and investors*. Bank Negara Malaysia and Securities Commission Malaysia.

Bank Negara Malaysia. (1999). *The central bank and the financial system in Malaysia: A decade of change, 1989-99*. Bank Negara Malaysia.

Bank Negara Malaysia. (2001). *Annual report 2000*. Bank Negara Malaysia. http://www.bnm.gov.my/index.php?ch=en_publication&pg=en_ar&ac=4&lang=en&uc=*2*

Bank Negara Malaysia. (2002). *Annual report 2001*. Bank Negara Malaysia. http://www.bnm.gov.my/index.php?ch=en_publication&pg=en_ar&ac=5&lang=en&uc=2

Bank Negara Malaysia. (2010). *Annual report 2009*. Bank Negara Malaysia. http://www.bnm.gov.my/index.php?ch=en_publication&pg=en_ar&ac=15&lang=en&uc=2

Bank Negara Malaysia. (2011). *Financial stability and payment systems report 2010*. Bank Negara Malaysia. https://www.bnm.gov.my/files/publication/fsps/en/2011/fs2011_book.pdf

Bank Negara Malaysia. (various issues). *Annual report*. Bank Negara Malaysia. http://www.bnm.gov.my/index.php?csrf=e3a7ed14e63641b47c0609de9edd126f2c5ac976&ch=en_publication&pg=&pub=ararc&yearfr=1998

Beck, T., Demirguc-Kunt, A., & Levine, R. (2003). *Bank concentration and crisis* (NBER Working Paper No. 9921). https://www.nber.org/papers/w9921

Begg, D., Vernasca, G., Fischer, S., & Dornbusch, R. (2014). *Economics* (11th ed.). McGraw-Hill Education.

Bentson, G. J. (1994). Universal banking. *Journal of Economic Perspectives, 8*(3), 121-143.

Bhattacharyay, B. N. (2013). Determinants of bond market development in Asia. *Journal of Asian Economics, 24*(C), 124-137.

Borio, C., Lombardi, M., & Zampolli, F. (2016). *Fiscal sustainability and the financial cycle* (BIS Working Paper No. 552). http://financial-stability.org/wp-content/uploads/2016/03/2016-3_bis_fiscal-sustainability-financial-cycle.pdf

Burger, J. D., & Warnock, F. E. (2006). Local currency bond markets. *IMF Staff Papers*, *53*(Special Issue), 133-146.

Burger, J. D., Warnock, F. E., & Warnock, V. C. (2015). *Bond market development in developing Asia* (ADB Economics Working Paper No. 448). https://www.adb.org/sites/default/files/publication/173190/ewp-448.pdf

Eichengreen, B., & Luengnaruemitchai, P. (2004). *Why doesn't Asia have bigger bond markets?* (NBER Working Paper No. 10576). https://www.nber.org/papers/w10576

Essers, D., Blommestein, H. J., Cassimon, D., & Flores, P. I. (2015). *Local currency bond market development in Sub-Saharan Africa: A stock-taking exercise and analysis of key drivers* (MPRA Paper No. 65320). https://mpra.ub.uni-muenchen.de/65320/

Garcia, V. F., & Lin, L. (1999). Macroeconomic determinants of stock market development. *Journal of Applied Economics*, *2*(1), 29-59.

Goh, K. L., & Yong, S. L. (2007). Bank lending and monetary policy: The effects of structural shift in interest rates. *Economics Bulletin*, *5*(5), 1-14.

Goh, K. L., & Hooy, C. W. (2008). Bank lending and monetary policy in Malaysia: Issues and challenges. In K.N. Betrowe (Ed.), *Bank lending, banking and financial developments* (pp.51-68). Nova Science Publishers.

Gruic, B., & Wooldridge, P. (2012, December 10). *Enhancements to the BIS debt securities statistics* (BIS Quarterly Review December). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2206351

Harwood, A. (2000). *Building local currency bond markets: An Asian perspective*. International Finance Corporation.

Hauner, D. (2009). Public debt and financial development. *Journal of Development Economics*, *88*, 171-183.

Herring, R. J., & Chatusripitak, N. (2000). *The case of the missing market: The bond market and why it matters for financial development* (ADBI Working Paper No. 11). https://www.adb.org/publications/case-missing-market-bond-market-and-why-it-matters-financial-development

International Monetary Fund. (2010). *World Economic Outlook, October 2010: Recovery, risk, and rebalancing*. International Monetary Fund. https://www.imf.org/en/Publications/WEO/Issues/2016/12/31/World-Economic-Outlook-October-2010-Recovery-Risk-and-Rebalancing-23542

International Monetary Fund. (2020). *World Economic Outlook, April 2020: The great lockdown*. International Monetary Fund. https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020

La Porta, R., Lopez-de-Silances, F., Shleifer, A., & Vishny, R. (1997). Legal determinants of external finance. *The Journal of Finance*, *52*(3), 1131-1150.

Lee, M. W., & Goh, K. L. (2019). Bond market development in Malaysia: Possible crowding-out from persistent fiscal deficits?, *Economics Bulletin*, *39*(3), 1798-1807.

Lee, M. W., Goh, K. L., & Yap, M. M. C. (2019). The Malaysian domestic bond market: Growing into its rightful role. *Capital Markets Review*, *27*(1), 34-52.

Malayan Banking Berhad. (2001). *Maybank Annual Report 2001*. Malayan Banking Berhad. https://www.maybank.com/en/investor-relations/reporting-events/reports/annual-reports.page?

Mankiw, N. G. (2018). *Principles of economics* (8th ed.). Cengage Learning Asia Pte. Ltd.

McCauley, R., & Remolona, E. (2000). *Size and liquidity of government bond markets* (BIS Quarterly Review November). https://pluto.mscc.huji.ac.il/~mswiener/teaching/FIFIBI01/treasuries1.pdf

Mihaljek, D., Scatigna, M., & Villar, A. (2002). *Recent trends in bond markets* (BIS Papers No. 11). https://www.bis.org/publ/bppdf/bispap11.htm

Ministry of Finance. (various issues). *Economic report*. Ministry of Finance.

Mohanty, M. S. (2002). *Improving liquidity in government bond markets: What can be done?* (BIS Papers No. 11). https://www.bis.org/publ/bppdf/bispap11.htm

National Economic Action Council. (1998). *National economic recovery plan: Agenda for action*. Prime Minister's Department.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289-326.

Rajan, R. G., & Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics*, *69*(1), 5-50.

Reinhart, C., & Rogoff, K. (2013). Banking crises: An equal opportunity menace. *Journal of Banking and Finance*, *37*, 4557-4573.

Sahay, R., Cihak, M., N'Diaye, P., Barajas, A., Bi, R., Ayala, D., ... Yousefi, S. R. (2015). *Rethinking financial deepening: Stability and growth in emerging markets* (IMF Staff Discussion Note SDN/15/08). https://www.imf.org/external/pubs/ft/sdn/2015/sdn1508.pdf

Schinasi, G. J., & Smith, R. T. (1998). *Fixed income markets in the United States, Europe and Japan: Some lessons for emerging markets* (IMF Working Paper No. 98/173). https://www.imf.org/external/pubs/ft/wp/wp98173.pdf

Song, F., & Thakor, A. V. (2010). Financial system architecture and the co-evolution of banks and capital markets. *The Economic Journal*, *120*(547), 1021-1055.

Turner, P. (2002), *Bond markets in emerging economies: An overview of policy issues*. (BIS Papers No. 11). https://www.bis.org/publ/bppdf/bispap11.htm

World Bank & International Monetary Fund. (2001). *Developing government bond markets: A handbook*. The International Bank for Reconstruction and Development.

Asymmetric Real Exchange Rate and Foreign Direct Investment Determinants: An Empirical Study of Malaysia

Hock Tsen Wong[1*]
[1]*Faculty of Business, Economics & Accountancy, Universiti Malaysia Sabah, Malaysia.*

Abstract: Research Question: This study examines the impact of macroeconomic variables and also the asymmetric impact of the real exchange rate on foreign direct investment (FDI) by country in Malaysia, namely Japan, the United States of America, Singapore, Germany Taiwan, Korea, Australia, the United Kingdom, Hong Kong and India. Moreover, this study investigates macroeconomic determinants of FDI of those countries as a group in Malaysia. **Motivation:** The promotion of FDI shall consider potential heterogeneous of FDI from different country as the source or type of FDI likely different from country. **Idea:** There are not many studies investigate the asymmetric impact of the real exchange rate on FDI. **Data:** The data is yearly from 1980 to 2017, except for Korea the data is from 1981 to 2017 due to the availability of the data begins from 1981. **Method/Tools:** The importance of macroeconomic variables as FDI determinants by country in Malaysia is examined by the autoregressive distributed lag model (ARDL) approach. Conversely, the importance of macroeconomic variables as FDI determinants of those countries as a group in Malaysia is estimated by the system generalized method of moments (GMM) of the Arellano-Bond estimator. **Findings:** The results of the autoregressive distributed lag model (ARDL) approach show the determinants of each country are not the exactly the same. The results of the non-linear autoregressive distributed lag model (NARDL) approach shows that there is some evidence of the asymmetric impact of the real exchange rate on FDI in the long run and short run. The results of the system generalized method of moments (GMM) of the Arellano-Bond estimator reveal that the real exchange rate, positive real exchange rate, negative real exchange rate, real national income, trade openness and real average wage are found to be the main macroeconomic determinants of FDI from Japan, the United States of America, Singapore, Germany Taiwan, Australia, the United Kingdom, Hong Kong and India. **Contributions:** The implications for policymakers are to promote a dynamic competitive

* Corresponding author: Hock Tsen Wong. Tel.: +6088-320000.
Email: htwong@ums.edu.my
Acknowledgements: The author would like to thank the reviewers of the journal for their constructive comments on an early version of the paper. The author would like to thank Universiti Malaysia Sabah for financial assistance of this study through the *SKIM GERAN PENYELIDIKAN* UMS (SPGUMS) 2017 – *Skim Penyelidikan Bidang Keutamaan* (SPBK) (SBK0328-2017). The author would like to express acknowledgement to Malaysian Investment Development Authority (MIDA) for providing some FDI information. The author would like to acknowledge MPWS Rich Proofreading and Translation Services for the services of proofreading.

Received 25 Jan 2021; Final revised 12 July 2022; Accepted 19 July 2022; Available online 15 August 2022.
To link to this article: https://www.mfa.com.my/cmr/v30_i2_a2/

advantage in the home country and therefore policymakers need to pay more attention to their macroeconomic policies to reduce production and transaction costs of FDI.
Keywords: Foreign direct investment, real exchange rate, asymmetric real exchange rate, Malaysia.
JEL Classification: F21, F31

1. Introduction

Foreign direct investment (FDI) is a significant area of research in economics not only in-depth but also in breadth (Paul and Feliciano-Cestero, 2021). The globalisation of the world economy increases FDI (Chen *et al.*, 2019; Van Cauwenberge *et al.*, 2019). FDI enhances economy activities in the host country (Li and Tanna, 2019). Malaysia is a hub of FDI in the Asian region. In the period of 1980-2017, Japan, the United States of America, Singapore, Germany, Taiwan, Korea, Australia, the United Kingdom, Hong Kong and India were the main sources of FDI in Malaysia. The inflow of FDI from those countries was among the most important source of FDI. In 2017, FDI from those countries was about Malaysian Ringgit (RM) 1,311 million, RM1,107 million, RM2,307 million, RM1,517 million, RM755 million, RM659 million, RM1,270 million, RM500 million, RM1,494 million and RM38 million, respectively (Table 1). The inflow of FDI fluctuated over time. Hence, there was no permanent trend or pattern in FDI. Also, there was no dominant inflow of FDI in Malaysia over time. The sum of the inflow of FDI from the selected countries was quite substantial and can give a pattern of the inflow of FDI in Malaysia. Moreover, those countries represent an important source of FDI from the European, Western and Asia regions. There are positive correlations between the logarithm of FDI by country and the logarithms of real national income in Malaysia, respectively. The coefficients of correlation of logarithm of FDI by country, namely Japan, the United States of America, Singapore, Germany, Taiwan, Korea, Australia, the United Kingdom, Hong Kong and India with logarithm of real national income in Malaysia were 0.54, 0.59, 0.77, 0.75, 0.30, 0.73, 0.32, 0.26, 0.24 and 0.35, respectively. This may indicate that FDI promotes real national income. Figure 1 exhibits the upward trend pattern of FDI and also the close movements of the logarithm of FDI by individual countries and the logarithm of real national income in Malaysia over time. FDI moves towards the same direction, that is, an upward trend. The literature on FDI demonstrates a positive impact of FDI on the economy. FDI is not only a way for a country to jump into new technology and to restructure its economy and also FDI can help to reduce economic inequality between and within country (Ascani *et al.*, 2020).

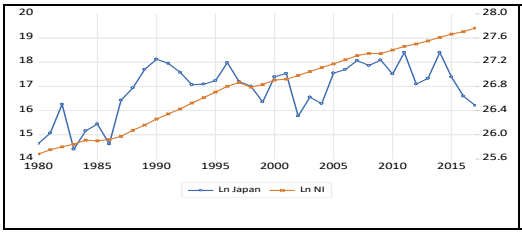
Thus, every country competes to attract FDI. Many policies have been implemented to attract FDI like attractives investment incentive, good institutional landscape, bilateral investment protection agreement and flexible ownership in the foreign company (Belloumi, 2014; Lucke and Eichler, 2016; Nielsen *et al.*, 2017; Ascani *et al.*, 2020; Hoshi and Kiyota, 2019). FDI is said driven by possibilities for global market exploitation, the pursuit of advantageous localisations and the need to rival the sourcing efficiency of its competitors (Bolivar *et al.*, 2019).

Table 1: FDI in Malaysia by Country, 1980-2017 (RM Million)

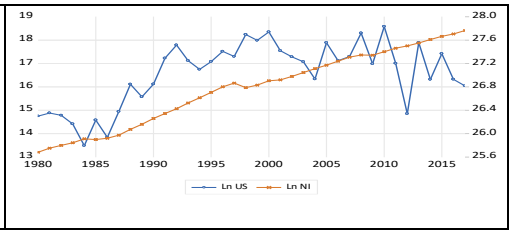
	1980	1990	2000	2010	2015	2016	2017
Japan	94	4,213	2,881	4,029	4,009	1,862	1,311
	(12.9)	(23.9)	(14.5)	(13.9)	(18.3)	(6.8)	(6.1)
The United States of America	105	567	7,492	11,739	4,150	1,413	1,107
	(14.4)	(3.2)	(37.7)	(40.4)	(18.9)	(5.2)	(5.1)
Singapore	117	895	1,778	2,157	1,395	2,114	2,307
	(16.1)	(5.1)	(9.0)	(7.4)	(6.4)	(7.7)	(10.7)
Germany	38	127	1,656	1,937	1,161	2,645	1,517
	(5.2)	(0.7)	(8.3)	(6.7)	(5.3)	(9.6)	(7.0)
Taiwan	24	6,339	916	1,256	1,275	549	755
	(3.3)	(36.0)	(4.6)	(4.3)	(5.8)	(2.0)	(3.5)
Korea	-	650	723	199	1,353	2,169	659
		(3.7)	(3.6)	(0.7)	(6.2)	(7.9)	(3.1)
Australia	9	54	130	69	255	71	1,270
	(1.3)	(0.3)	(0.7)	(0.2)	(1.2)	(0.3)	(5.9)
The United Kingdom	48	867	772	329	147	2,575	500
	(6.6)	(4.9)	(3.9)	(1.1)	(0.7)	(9.4)	(2.3)
Hong Kong	18	375	345	2,766	3,181	265	1,494
	(2.4)	(2.1)	(1.7)	(9.5)	(14.5)	(1.0)	(6.9)
India	6	219	3	50	26	1,334	38
	(0.9)	(1.2)	(0.0)	(0.2)	(0.1)	(4.9)	(0.2)

Notes: Values in the parentheses are percentages of total FDI in Malaysia.

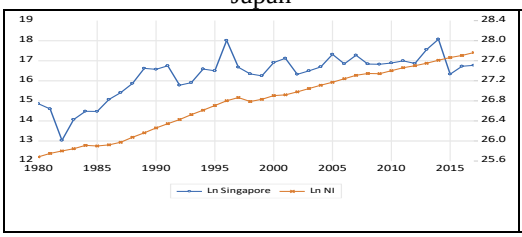
Source: Malaysian Investment Development Authority.



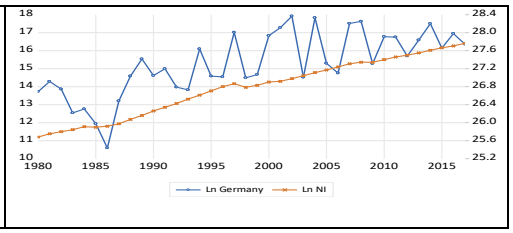
Japan



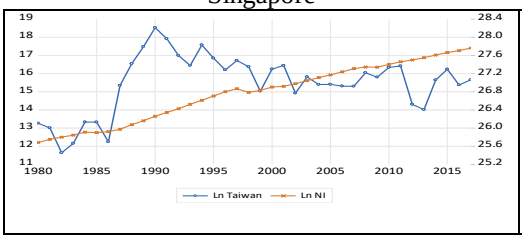
The United States of America



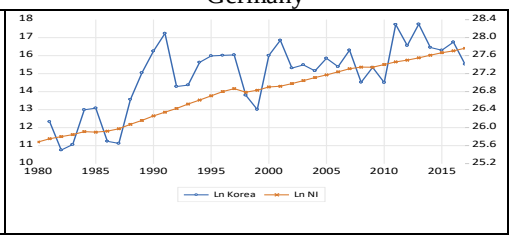
Singapore



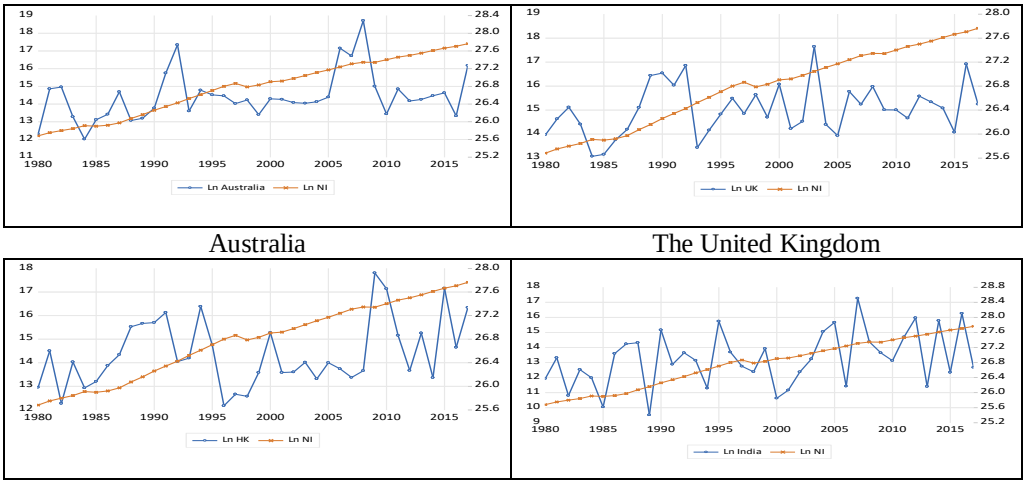
Germany



Taiwan



Korea



Australia | The United Kingdom

Hong Kong | India

Figure 1: Logarithm of FDI by Individual Country and Logarithm of Real National Income in Malaysia, 1980-2017

There is no single theory for FDI determinants (Dunning, 2009), which implies that there are many sources or determinant factors for FDI. The book written by Dunning (2009) is a comprehensive book on the determinants of FDI. Country-specific characteristics may be important FDI determinants. Additionally, FDI determinants may not be the same for every country (Kinuthia and Murshed, 2015; Ly *et al.*, 2018; Magnier-Watanabe and Lemaire, 2018; Bolivar *et al.*, 2019). Petri (2012) shows that FDI in Asia counties follows the pattern of the flying geese model of technological development, that is, transfers of technology from more advanced economies to less advanced ones. Hence, the importance of determinants of FDI are not the same for more advanced economies and the less advanced ones. Kinuthia and Murshed (2015) also report that Malaysia's success in attracting FDI compared to Kenya is due to differences in macroeconomic stabilisation, trade policies, infrastructure, and institutional factors. Exchange rate depreciation could influence FDI in either direction. When the exchange rate depreciates, export-oriented FDI profits from more export for relatively cheaper export rate. This attracts more export-oriented FDI to the host country. On the other hand, domestic- oriented FDI may experience an increase in cost of imported inputs and thus a decline in their profits. This discourages domestic oriented FDI (Boateng *et al.*, 2015; Bahmani-Oskooee and Saha, 2016). Hence, the overall impact of exchange rate depreciation on FDI could be asymmetric, that is, the impact of the real exchange rate depreciation is different from the impact of the real exchange rate appreciation. Bahmani-Oskooee and Saha (2016) exhibit the impact of exchange rate asymmetry on the stock prices of companies. However, the same principle can be applied to exchange rate asymmetry and FDI companies. The exchange rate could have a different impact on FDI.

The present study investigates the importance of macroeconomic variables as FDI determinants by country in Malaysia, namely Japan, the United States of America, Singapore, Germany, Taiwan, Korea, Australia, the United Kingdom, Hong Kong and India. FDI determinants may likely not be the same for every country as location comparative advantage for FDI from a country may not be the same for FDI from another country. The promotion of FDI shall consider potential heterogeneous on FDI from different countries as the source or type of FDI likely different from the country. FDI in the manufacturing sectors can be categorised into different categories such as science-based (such as electronics and

chemicals), supplier dominated (such as textiles and food products), scale-intensive (such as automotive and plastics) and specialised supplier (such as machinery and equipment) (Ascani *et al.*, 2020). Different FDIs seek different attractions. Therefore, strategic policy to attract FDI may to be better to be applied by the country. The knowledge of FDI determinants by country can assist to identify the global network structure of FDI. This would help the relevant authority to negotiate and to foster FDI policy in the country (Bolivar *et al.*, 2019; Nguyen *et al.*, 2020). Moreover, this study examines the importance of macroeconomic variables as FDI determinants of those countries as a group in Malaysia, namely Japan, the US, Singapore, Germany, Taiwan, Australia, the United Kingdom, Hong Kong and India. Also, there are not many studies on FDI determinants by country (Brada *et al.*, 2019). Furthermore, there are not many studies investigating the asymmetric impact of the real exchange rates on FDI. Petri (2012), and Nguyen *et al.* (2020), among others, inspect the determinants of bilateral FDI in Asia but the focus is not on the exchange rate. The impact of the real exchange rate appreciation on FDI is likely not the same as the impact of the real exchange rate depreciation on FDI. Hence, the different policies in FDI shall be implemented when the real exchange rate is strong than when the real exchange rate is weak (Bahmani-Oskooee and Saha, 2016). Bahmani-Oskooee and Saha (2016) reported that changes in exchange rate have an asymmetric impact on firms and therefore the same conclusion can be applied for FDI. Ding *et al.* (2022) report that financial constraints and information asymmetry are two underlying mechanisms for FDI. Constrained firms are unlikely to invest in areas in which they have less experience. Country-specific experience is particularly important in countries with poor information transparency. Certainly, an export-oriented FDI prefers to invest in a country with a weak currency. Contrary, a domestic-oriented FDI that wishes to have more sales in the domestic market would prefer a country with a stable or strong currency. The importance of macroeconomic variables as FDI determinants by country in Malaysia is examined by the Autoregressive Distributed Lag Model (ARDL) approach and the asymmetric impact of the real exchange rate is examined by the Non-Linear Autoregressive Distributed Lag Model (NARDL) approach. Conversely, the importance of macroeconomic variables as FDI determinants of those countries as a group in Malaysia is estimated by the system generalized method of moments (GMM) of the Arellano-Bond estimator. Therefore, this study provides some empirical evidence of the important determinants of FDI in the group, which is likely may not be the same by country.

2. Literature Review

There are a few studies on FDI determinants in Malaysia (Wong, 2005; Ang, 2008; Tang *et al.*, 2014; Kinuthia and Murshed, 2015). However, the impact of the asymmetric impact of the real exchange rate is not examined. Ang (2008) reports that real gross domestic product (GDP), the growth rate of GDP, financial development, infrastructure development, trade openness and higher macroeconomic uncertainty promote FDI in Malaysia. Macroeconomic uncertainty is expressed by inflation uncertainty. Tang *et al.* (2014) show that GDP, real effective exchange rate, financial development and macroeconomic uncertainty are found to have a positive impact whilst corporate income tax and social uncertainty are found to having detrimental impact on FDI in the electrical and electronic (E&E) industry in Malaysia in the long run. All explanatory variables are found to Granger cause FDI in the E&E industry in the long run. Macroeconomic and social uncertainties are found to Granger cause FDI in the E&E industry in the short run. Kinuthia and Murshed (2015) demonstrate that macroeconomic stabilisation, trade policies, infrastructure and institutional factors are the key determinants to attracting FDI in Malaysia. As a whole, these studies examine FDI

determinants for the whole country and not FDI determinants for the bilateral country, which is important for policy implication to promote FDI by country.

There are many essential FDI determinants reported in the literature of FDI. However, these studies focus on FDI determinants for the whole country and not FDI determinants for the bilateral country. Also, the influence of the real exchange rate is not examined. (Zhai, 2014; Nielsen *et al.*, 2017; Ly *et al.*, 2018; Raff *et al.*, 2018; Yan *et al.*, 2018). Paul and Feliciano-Cestero (2021) provide an excellent overview of FDI, that is, the most commonly used theories, variables, statistical methods and so forth. The empirical evidence of FDI from the country level or industry level is good for policy-makers to bring FDI. There had been an extensive rise in FDI research and publication in the past years. Macroeconomic variables can influence location advantage for FDI. Boateng *et al.* (2015) report that the real GDP, sector GDP, exchange rate and trade openness are found to have a significant positive impact whilst money supply, inflation, unemployment and interest rate are found to have a significant negative impact on FDI in Norway. Macroeconomic variables are argued to explain the changing pattern of FDI in Norway. Macroeconomic factors are key elements of locational specific advantage that exert a significant influence on FDI in recent years (Dunning, 2009). However, these studies do not examine the asymmetric impact of the real exchange rate on FDI.

Macroeconomic policies can reduce the production and transaction costs of FDI and therefore macroeconomic policies are important for FDI. Fan *et al.*, (2018) demonstrate that an increase in minimum wage will lead to an increase in outward FDI from China. Moreover, outward FDI is found to be stronger for more productive firms, foreign ownership firms, labour-intensive firms, coastal FDI firms and production-oriented FDI firms. Nguyen *et al.* (2020) report that unskilled labour-cost advantages are an important channel that drives FDI within Asia. This is supported by facts on the movements of FDI from China to other low-wage Asian countries as rising wages in China. Hence, policies lowing trading costs such as China's belt and road initiative significantly attract FDI. Uddin *et al.* (2019) reveal that good institutional environment attracts FDI such as government size, legal environment, trade openness and form of government. Villaverde and Maza (2015) reveal that the important FDI determinants are economic potential, labour market characteristics, technological progress and competitiveness. Nonetheless, market size and labour regulation are found to be insignificant FDI determinants. Desbordes and Wei (2017) show that country's financial development (SFD) and destination country's financial development (DFD) affect positively FDI. The economic impacts of SFD and DFD are about the same, but their effects vary across margins and types of FDI. The impact of the real exchange rate on FDI is not investigated. Vo (2018) uses the panel data and exposes that FDI in Vietnam depends on the market size, inflationary risk and the stock market volatility of the source country and the bilateral trade link and distance between the source and the host country. Nonetheless, the influence of the real exchange rate and also of the asymmetric impact of the real exchange rate on FDI are not examined.

Bolivar *et al.* (2019) report that country features such as size, openness, skill levels and institutional stability influence FDI and the network structure and the power positions of each country. Ascani *et al.* (2020) show that inter-sectoral linkages of FDI alter local innovative activity. The link between FDI and local innovation is positive but does not surpass local administrative boundaries on aggregate. Brada *et al.* (2019) report that an increase in the level of corruption in the host country or the level of the difference between corruption in the host country and the home country will lead to a decrease in FDI, is affected. Therefore, a clean institution is good for promoting FDI. FDI from a country with, better institutional quality shows greater investment efficiency than FDI from a country with, weaker institutions (Chen *et al.*, 2019). Li and Tanna (2019) show that institutional

quality is relatively more important than human capital development for developing countries to absorb total factor productivity gain from FDI. Li *et al.* (2019) reveal that negative sentiment influences is strong on FDI than positive sentiment and the accumulated sentiment is strong than transient sentiment. National sentiment affects FDI. FDI can be sensitive to macroeconomic issues. Therefore, macroeconomic variables could strongly affect FDI.

Overall, there is a huge literature on FDI determinants but there is no consensus on a set of determinants. Regularly, the key macroeconomic FDI determinants are real income, real wage, the real exchange rate, trade openness, financial development, and macroeconomic and social stability. FDI determinants may not be the same for all countries. Petri (2012), Nguyen *et al.* (2020), among others, investigates the macroeconomic determinants of FDI by country but do not examine the impact of the real exchange rate and also the asymmetric impact of the real exchange rate on FDI. The impact of the real exchange rate on FDI can be asymmetric and therefore a different policy for FDI shall be implemented to promote FDI (Bahmani-Oskooee and Saha, 2016). FDI can promote the economy and economy expansion might stimulate FDI (Wong, 2003). The ARDL approach is widely used to estimate FDI determinants in the literature. There are not many studies examining the impact of the real exchange rate asymmetric effects on FDI. It is important as the effect of the real exchange rate depreciation and the effect of the real exchange rate appreciation may not be the same. Therefore, its impact on the economy is not the same.

3. Methodology

Real FDI (FDI_t) is expressed as $FDI_t = \frac{NFDI_t}{CPI_t}$, where $NFDI_t$ is FDI in approved projects in the manufacturing sector (RM million) and $CPI_{,t}$ is consumer price index (CPI) in Malaysia (2010 = 100). The real exchange rate (RER_t) is expressed as real effective exchange rate (REER, 2010 = 100, based on CPI). REER is a measure of the value of a currency against a weighted average of several foreign currencies divided by a price deflator or index of costs. An increase in REER implies that exports become more expensive and imports become cheaper. Consequently, an increase indicates a loss in trade competitiveness (International Monetary Fund, 2022). Real national income (NI_t) is expressed as$RNI_t = \frac{NI_t}{GDPD_t}$, where NI_t is gross national income in Malaysia (RM million) and $GDPD_t$ is GDP deflator in Malaysia (2010 = 100). Real average wage (RAW_t) is expressed as, $RAW_t = \frac{\frac{SW_t}{TN_t}}{CPI_t}$, where SW_t is salary and wage paid in the manufacturing sector in Malaysia (RM million) and TN_t is the total number of persons engaged in the manufacturing sector. Trade openness (TO_t) is expressed as $TO_t = \frac{XM_t}{GDP_t}$, where XM_t is total exports and imports in Malaysia (RM million) and $GDP_t$is GDP in Malaysia. Inflation (INF_t) is inflation in Malaysia ($INF_t = \frac{CPI_t - CPI_{t-1}}{CPI_t} \times 100$). A dummy variable ($D_t$) is used to capture the Asian financial crisis, 1997-1998, that is, 1 for the years 1997-1998 and 0 for the rest of the years. During the Asian financial crisis, the Malaysian economy was strongly affected (Ariff and Abu Bakar, (1999). Financial development (FD_t) is expressed as $FD_t = \frac{BM_t}{GDP_t}$, where BM_t is broad money in Malaysia (RM million). Real infrastructure ($INFRA_t$) is expressed as $INFRA_t = \frac{NINFRA_t}{CPI_t}$, where $NINFRA_t$ is development expenditure of the Malaysian federal government in transport, communication, electricity and water and trade and industry (RM million). Autocracy (AC_t) is institutionalised autocracy in Malaysia, which is the institution freedom index for a measure of governance or how the government is run. Polity (PO_t) is a polity revised combined polity score in Malaysia, which is a measure of how a government is

formed and elected. FDI data were obtained from the Malaysian Investment Development Authority. Infrastructure data were obtained from *Economic Report*, Ministry of Finance Malaysia. Trade openness, financial development and inflation data were obtained from World Development Indicators Data Bank, The World Bank. Exchange rate, gross national income, GDP deflator and CPI data were obtained from *International Financial Statistics*, International Monetary Fund. Institutionalised autocracy and polity data were obtained from PolityTM IV Project, Center for Systemic Peace, 2017. All data were transformed into the natural logarithms before estimation, except inflation, institutionalised autocracy and polity. The data is yearly from 1980 to 2017, except for Korea the data is from 1981 to 2017 due to the availability of the data begins from 1981. The data is subject to the available during the time of collecting the data for estimation.

This study begins with the unit root tests. The Dickey and Fuller generalization least square (DF-GLS) and Ng and Perron (NP) unit root test statistics are used to examine the stationary of the data. The NP unit root test statistics are demonstrated to have more power in small samples than the Dickey and Fuller and Phillips and Perron unit root tests. The ARDL approach is used to examine the long-run relationship of the variables in the FDI models. This study estimates the following long-run FDI models:

$$ln\, FDI_t = \beta_{10} + \beta_{11}\, ln\, RER_t + \beta_{12}\, ln\, NI_t + \beta_{13}\, ln\, RAW_t + \beta_{14}\, ln\, TO_t + \beta_{15}\, INF_t + u_{1,t} \quad (1)$$

$$\ln FDI_t = \beta_{20} + \beta_{21}\, RER_t^+ + \beta_{22}\, RER_t^- + \beta_{23} \ln NI_t + \beta_{24}\, \ln RAW_t + \beta_{25}\, ln\, TO_t + \beta_{26}\, INF_t + u_{2,t} \quad (2)$$

where ln is logarithm, RER_t is the real exchange rate at time *t*, NI_t is real national income at time *t*, RAW_t is real average wage at time *t*, TO_t is trade openness at time *t*, INF_t is inflation at time *t*, $RER_t^+ = \sum_{j=1}^{t} \Delta\, ln\, RER_j^+ = \sum_{j=1}^{t} max\, (\Delta\, ln\, RER_j\, , 0)$, $RER_t^- = \sum_{j=1}^{t} \Delta\, ln\, RER_j^- = \sum_{j=1}^{t} min\, (\Delta\, ln\, RER_j\, , 0)$ and $u_{i,t}$ (i = 1, 2) *is* a disturbance term, respectively (Shin *et al.*, 2014; Bahmani-Oskooee and Saha, 2015; 2016). RER_t^+ and RER_t^- are the partial sum process of positive and negative variation, respectively in *ln* RER_t. The coefficient of real national income is expected to be positive whilst the coefficient of the real exchange rate, real average wage and inflation is expected to be negative. The coefficient of trade openness can be either positive or negative (Kinuthia and Murshed, 2015). Model (2) is used to explore the asymmetric impact of the real exchange rate on FDI as exchange rate depreciation can lead to more or less in FDI in the host country (Boateng *et al.*, 2015; Bahmani-Oskooee and Saha, 2016). The asymmetric effect of a series is available in Eviews software. The test of asymmetric effect can be carried out using the Wald statistic. The coefficients estimated are said to be the long-run coefficients.

The error correction models of the FDI models (1) and (2), respectively are as follows:

$$\Delta\, ln\, F\, DI_t = \beta_{30} + \beta_{31} D_t + \sum_{i=0}^{p} \beta_{32i}\, \Delta\, ln\, R\, ER_{t-i} + \sum_{i=0}^{q} \beta_{33i}\, \Delta\, ln\, N\, I_{t-i} + \sum_{i=0}^{r} \beta_{34i}\, ln\, R\, AW_{t-i} + \sum_{i=0}^{s} \beta_{35i}\, \Delta\, ln\, T\, O_{t-i} + \sum_{i=1}^{v} \beta_{36i}\, \Delta INF_{t-i} + \beta_{37} ec_{t-1} + u_{3,t} \quad (3)$$

$$\Delta \ln FDI_t = \beta_{40} + \beta_{41} D_t + \sum_{i=0}^{p} \beta_{42i} \Delta RER^{+}_{t-i} + \sum_{i=0}^{q} \beta_{43i} \Delta RER^{-}_{t-i} + \sum_{i=0}^{r} \beta_{44i} \Delta \ln NI_{t-i} + \sum_{i=1}^{s} \beta_{45i} \Delta \ln RAW_{t-i} + \sum_{i=0}^{v} \beta_{46i} \Delta \ln TO_{t-i} + \sum_{i=1}^{w} \beta_{47i} \Delta INF_{t-i} + \beta_{48} ec_{t-1} + u_{4,t} \quad (4)$$

where Δ is the first difference operator, D_t is the dummy variable to capture the influence of the Asian financial crisis, 1997-1998 and ec_{t-1} is an error correction term and $u_{i,t}$ (i = 3, 4) is a disturbance term. The sum of the coefficients of $\sum_{i=0}^{p} \beta_{42i} \Delta RER^{+}_{t-i}$ and sum of the coefficients of $\sum_{i=0}^{q} \beta_{43i} \Delta RER^{-}_{t-i}$ are not the same implies the asymmetric impact of the real exchange rate in the short run. This can be tested using the Waldstatistic (Bahmani-Oskooee and Saha, 2016). The ordinary least squares (OLS) estimator with Newey-West standard error (Huber-White standard error) is used when there is autocorrelation (heteroscedasticity) in the disturbance term. The coefficients estimated are called be the short-run coefficients. The advantages of the ARDL approach are that the approach does not need all the explanatory variables in the same order, that is, variables can be an $I(1)$ variable, $I(0)$ variable or fractionally integrated variable but not $I(2)$ variable. Moreover, the ARDL approach is relatively more efficient in the case of small and finite sample data sizes. Furthermore, the ARDL approach can obtain unbiased estimates of the long-run model (Belloumi, 2014). Shin *et al.* (2014) demonstrate that Pesaran *et al.* (2001) bounds testing approach could be applied to judge short-run symmetry or asymmetry. The introduction of the asymmetry effect in the estimation and thus it is called the non-linear ARDL model.

The autoregressive distributed lag model (ARDL) approach is used to estimate the importance of macroeconomic variables as FDI determinants by country in Malaysia. The non-linear autoregressive distributed lag model (NARDL) approach is used to estimate the asymmetric effect of the real exchange rate. Contrary, the system GMM of the Arellano-Bond estimator is also used to examine bilateral FDI of Malaysia with Japan, the US, Singapore, Germany, Taiwan, Australia, the United Kingdom, Hong Kong and India as a group in the study. The system GMM of the Arellano-Bond estimator gives more robust inferences as compared to the single estimated GMM estimator and is comparable a better instrument then the conventional one and remove simultaneity from the set of regressors by appropriate instrumental list. The system GMM of the Arellano-Bond estimator enables to exploit the time series dynamics and the pooled country characteristics of the data and to control of endogeneity, namely unobserved heterogeneity, simultaneity and dynamic heterogeneity (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998; Doytch and Uctum, 2011; Khan *et al.*, 2019). The main aim is to identify the main FDI determinants of Malaysia with those countries. In the estimation of the system GMM of the Arellano-Bond estimator, Korea is excluded to allow all the data are strictly balanced, that is from 1980 to 2017. The instruments used for the estimation of the system GMM of the Arellano-Bond estimator are financial development, lag one period of real infrastructure, the Asian financial dummy variable, autocracy and polity (Griebeler and Wagner, 2017; Mourao, 2018; Chen *et al.*, 2019; Uddin *et al.*, 2019).

4. Findings and Discussion

Table 2 displays the results of the DF-GLS and NP unit root test statistics. The lag length used to estimate the DF-GLS and NP unit root test statistics is mainly based on the Schwarz information criterion (SIC). Overall, the DF-GLS and NP unit root test statistics show the same conclusion, that is, all variables are non-stationary in levels and become stationary after taking the first differences, except inflation.

Table 2: The Results of the DF-GLS and NP Unit Root Test Statistics

	DF-GLS	MZa	MZt	MSB	MPT
$ln\ FDI_{j,t}$	-1.4890(1)	-4.2177(5)	-1.4508	0.3440***	5.8108***
$ln\ FDI_{us,t}$	-1.3617(2)	-3.1129(1)	-1.2463	0.4004***	7.8683***
$ln\ FDI_{s,t}$	-1.4497(1)	-5.1699(0)	-1.5577	0.3013***	4.8664***
$ln\ FDI_{g,t}$	-1.0706(2)	-2.5467(2)	-1.0518	0.4130***	9.2522***
$ln\ FDI_{t,t}$	-1.5407(5)	-5.2074(0)	-1.5914	0.3056***	4.7625***
$ln\ FDI_{k,t}$	-1.0329(3)	-2.0877(3)	-0.9640	0.4617***	11.1947***
$ln\ FDI_{a,t}$	-1.3592(4)	-4.2973(5)	-1.2803	0.2979***	5.9656***
$ln\ FDI_{uk,t}$	-1.0949(7)	-1.8838(7)	-0.9369	0.4973***	12.5833***
$ln\ FDI_{hk,t}$	-1.3384(0)	-3.9972(5)	-1.2189	0.3049***	6.3055***
$ln\ FDI_{in,t}$	-1.4319(3)	-2.9293(3)	-1.2101	0.4131***	8.3635***
$ln\ RER_t$	-0.3112(0)	-0.0355(0)	-0.0216	0.6080***	24.7479***
$ln\ NI_t$	0.0531(3)	-3.2032(3)	-1.0098	0.3152***	7.3460***
$ln\ TO_t$	-1.2028(1)	-2.3692(1)	-1.0883	0.4594***	10.3409***
$ln\ RAW_t$	0.3512(1)	1.2924(1)	0.8067	0.6242***	32.7687***
INF_t	-1.7404*(2)	-8.8466***(3)	-2.1001**	0.2374***	2.7811***
$\Delta\ ln\ FDI_{j,t}$	-7.8473***(0)	-16.5410***(0)	-2.8582***	0.1728***	1.5463
$\Delta\ ln\ FDI_{us,t}$	-10.223***(0)	-13.5054***(0)	-2.5940***	0.1921***	1.8320***
$\Delta\ ln\ FDI_{s,t}$	-7.4109***(0)	-17.0808***(0)	-2.9213***	0.1710***	1.4383
$\Delta\ ln\ FDI_{g,t}$	-7.4648***(1)	-38.2272***(1)	-4.3648***	0.1142	0.6610
$\Delta\ ln\ FDI_{t,t}$	-5.7117***(1)	-31.8362***(1)	-3.9868***	0.1252	0.7786
$\Delta\ ln\ FDI_{k,t}$	-5.4185***(0)	-17.1957***(0)	-2.9250***	0.1701***	1.4514
$\Delta\ ln\ FDI_{a,t}$	-4.6550***(0)	-16.7386***(0)	-2.8562***	0.1706***	1.5986
$\Delta\ ln\ FDI_{uk,t}$	-6.5751***(1)	-31.1518***(1)	-3.8884***	0.1248	0.9630
$\Delta\ ln\ FDI_{hk,t}$	-7.1249***(0)	-17.2672***(0)	-2.9248***	0.1694**	1.4682
$\Delta\ ln\ FDI_{in,t}$	-12.6405**(0)	-9.9447***(0)	-2.1264**	0.2138***	2.8579***
$\Delta\ ln\ RER_t$	-4.5652***(0)	-16.8135***(0)	-2.8986***	0.1724***	1.4603
$\Delta\ ln\ NI_t$	-4.4000***(0)	-16.4711***(0)	-2.8695***	0.1742***	1.4885
$\Delta\ ln\ TO_t$	-3.6233***(0)	-14.4135***(0)	-2.6455***	0.1835***	1.8473***
$\Delta\ ln\ RAW_t$	-4.0926***(0)	-15.4452***(0)	-2.7772***	0.1798***	1.5930
$\Delta\ INF_t$	-1.7698*(3)	-8.0812*(1)	-2.0050**	0.2481***	3.0510***

Notes: $FDI_{z,t}$ is FDI in approved projects of country *z* in Malaysia at time *t* (*z* = Japan (j), the United States of America (*us*), Singapore (*s*), Germany (*g*), Taiwan (*t*), Korea (*k*), Australia (*a*), the United Kingdom (*uk*), Hong Kong (*hk*), India (*in*)). The DF-GLS and NP unit root statistics are estimated based on the model including an intercept. Values in the parentheses are the lags used in the estimations. The critical values of the NP unit root test statistics, namely MZa, MZt, MSB and MPT at the 1% (5%, 10%) are -13.80 (-8.10, -5.70), -2.58 (-1.98, -1.62), 0.17 (0.23, 0.28) and 1.78 (3.17, 4.45), respectively. *** (**, *) denotes significance at the 1% (5%, 10%) level.

The ARDL bounds testing approach and the long-run coefficients of the ARDL approach are given in Table 3 whereas the ARDL bounds testing approach and the long-run coefficients of the ARDL approach with the asymmetric impact of the real exchange rate are given in Table 4. The Wald statistics are found to be statistically significant. Therefore, there are long-run relationships between FDI and their determinants. The coefficients of the real exchange rate are found to be negative and statistically significant for FDI from the

United States of America, Taiwan, the United Kingdom and Hong Kong. The coefficients of real national income are found to be positive and statistically significant for FDI from Japan, Singapore, Korea, Hong Kong, and India. The coefficients of trade openness are found to be positive and statistically significant for FDI from the United States of America whilst negative for FDI from Taiwan, the United Kingdom, Hong Kong and India. The coefficients of real average wage are found to be negative and statistically significant for FDI from Japan, Singapore, Taiwan, the United Kingdom, Hong Kong and India. The coefficients of inflation are found to be negative and statistically significant for FDI from Singapore, Korea, and Australia. The results of the ARDL approach with the asymmetric impact of the real exchange rate exhibit about the same conclusion as the results of the ARDL approach without the asymmetric impact of the real exchange rate. Moreover, the coefficients of positive real exchange rate are found to be negative and statistically significant for FDI from Singapore, the United Kingdom, Hong Kong, and India. The coefficients of negative real exchange rate are found to be negative and statistically significant for FDI from Japan, the United States of America, Taiwan, the United Kingdom, Hong Kong, and India. Nonetheless, the asymmetric impact of the real exchange rate is found to be significant for FDI from Singapore, Korea, and India. This implies that the fall in the real exchange rate promotes FDI from Singapore, Korea, and India.

Table 3: The Results of Bounds Testing Approach for Cointegration and the Long Run Coefficients of the ARDL Approach

	$ln\ FDI_{j,t}$	$ln\ FDI_{us,t}$	$ln\ FDI_{s,t}$	$ln\ FDI_{g,t}$	$ln\ FDI_{t,t}$
ln RER$_t$	6.9273	-3.4316**	-0.4777	-4.4248	-10.4770***
	(1.0107)	(-1.8559)	(-0.2360)	(-1.2998)	(-3.4205)
ln NI$_t$	7.5494***	1.0140	4.4067***	1.2920	1.5222
	(3.7557)	(0.9677)	(4.1149)	(0.7243)	(0.7293)
ln TO$_t$	1.8851	2.2022**	-0.4804	-0.4541	-3.9138*
	(0.7481)	(2.2468)	(-0.5041)	(-0.2521)	(-1.9615)
ln RAW$_t$	-12.2480***	-2.6845	-7.0681***	-1.3626	-8.2623*
	(-5.2282)	(-1.3033)	(-2.9888)	(-0.4000)	(-1.9057)
INF_t	-0.4748	0.0468	-0.4154***	-0.0986	0.0790
	(-1.7362)	(0.6067)	(-3.5249)	(-0.5651)	(0.3859)
constant	-333.0639**	-28.6599	-156.8084***	-7.4289	-27.7582
	(-3.0611)	(-0.6522)	(-3.4825)	(-0.0955)	(-0.3136)
W1	8.7055***	5.5731***	5.6841***	6.0317***	3.4373***

	$ln\ FDI_{k,t}$	$ln\ FDI_{a,t}$	$ln\ FDI_{uk,t}$	$ln\ FDI_{hk,t}$	$ln\ FDI_{in,t}$
ln RER$_t$	-2.9712	-4.8236	-8.4531***	-6.6772***	-3.8047
	(-0.7706)	(-1.3498)	(-3.9139)	(-2.8011)	(-1.4553)
ln NI$_t$	4.6166*	0.7766	0.5561	3.8145**	3.8271**
	(1.9840)	(0.3673)	(0.5478)	(2.3305)	(2.3516)
ln TO$_t$	-0.3276	-0.5176	-2.4306**	-5.6691***	-3.2377**
	(-0.1572)	(-0.2672)	(-2.4886)	(-3.7054)	(-2.0528)
ln RAW$_t$	-7.9510	-3.0067	-4.6227**	-8.9642**	-7.1635**
	(-1.5756)	(-0.7092)	(-2.1049)	(-2.6017)	(-2.1493)
INF_t	-0.5032*	0.3673*	0.0611	-0.1946	-0.0151
	(-1.9814)	(1.9479)	(0.7853)	(-1.6517)	(-0.1191)
constant	-161.4986	-7.7014	12.2092	-103.9513	-116.3580*
	(-1.6160)	(-0.0864)	(0.2835)	(-1.527533)	(-1.7058)
W	4.0950***	5.1248***	7.137233***	6.9270***	11.1441***

Notes: See also Table 2 for explanations. W1 is the Wald statistic for the ARDL bounds testing approach of cointegration. *** (**, *) denotes significance of the t-statistic at the 1% (5%, 10%) level.

Table 4: The Results of Bounds Testing Approach for Cointegration and the Long Run Coefficients of the ARDL Approach – The Asymmetric Impact of the Real Exchange Rate

	$ln\ FDI_{j,t}$	$ln\ FDI_{us,t}$	$ln\ FDI_{s,t}$	$ln\ FDI_{g,t}$	$ln\ FDI_{t,t}$
RER_t^+	-2.4607	0.8549	-14.1559***	-8.0115	-17.4195
	(-0.4043)	(0.1333)	(-2.8092)	(-0.9284)	(-1.1496)
RER_t^-	-6.9770***	-3.6690*	0.0063	-4.3094	-9.7667***
	(-3.3855)	(-1.9585)	(0.0038)	(-1.3681)	(-2.8454)
$ln\ NI_t$	2.0873	0.1220	6.7604***	1.5032	3.4465
	(1.2356)	(0.0728)	(4.5515)	(0.4849)	(0.7490)
$ln\ TO_t$	-3.5048***	2.3280**	-0.3035	-0.6147	-4.2193*
	(-3.7647)	(2.3512)	(-0.3904)	(-0.3713)	(-1.9537)
$ln\ RAW_t$	-7.8734***	-2.8170	-6.8964***	-0.5242	-8.7659*
	(-4.5272)	(-1.3739)	(-3.6119)	(-0.1724)	(-1.9296)
INF_t	-0.0683	0.0855	-0.5257***	-0.1486	0.0564
	(-0.8070)	(0.8966)	(-4.6900)	(-0.6464)	(0.2654)
constant	-92.1328*	-25.4437	-217.2375***	-26.0470	-132.5827
	(-1.7546)	(-0.4929)	(-4.5812)	(-0.2725)	(-0.9463)
W1	5.1849***	4.8433***	5.2032***	6.0365***	2.9385
W2	0.5240	0.4714	7.7442**	0.1085	0.2245

	$ln\ FDI_{k,t}$	$ln\ FDI_{a,t}$	$ln\ FDI_{uk,t}$	$ln\ FDI_{hk,t}$	$ln\ FDI_{in,t}$
RER_t^+	-28.9366	-0.7000	-15.5107**	-19.7575*	-28.6492**
	(-1.6318)	(-0.0549)	(-2.7009)	(-1.8281)	(-2.4608)
RER_t^-	1.4118	-5.0801	-8.7682***	-8.2222***	11.6078**
	(0.4165)	(-1.3695)	(-3.7197)	(-2.8900)	(2.6433)
$ln\ NI_t$	12.7959***	-0.1056	1.7757	5.5941*	14.9667***
	(3.6121)	(-0.0308)	(1.1058)	(2.0054)	(4.9577)
$ln\ TO_t$	-0.9676	-0.3963	-2.9997**	-6.5284***	0.6956
	(-0.4799)	(-0.1979)	(-2.5707)	(-3.9538)	(0.4007)
$ln\ RAW_t$	-10.5632**	-3.1182	-4.2144*	-9.0718**	-9.1257***
	(-2.2606)	(-0.7243)	(-2.0094)	(-2.7169)	(-3.0552)
INF_t	-0.7941**	0.4047*	-0.0290	-0.3056*	-0.2826
	(-2.5469)	(1.7948)	(-0.2541)	(-1.8933)	(-1.5342)
constant	-402.787***	-11.57945	-55.1504	-179.1303**	-454.145***
	(-3.9085)	(-0.1081)	(-1.1026)	(-2.119871)	(-4.8258)
W1	4.2933***	4.3564***	6.8525***	5.8069***	12.0137***
W2	3.9181*	0.1136	0.6618	1.2918	10.1875***

Notes: See also Table 3 for explanations. W2 is the Wald statistic to test the asymmetric impact of the real exchange rate.

The results of the error correction models are reported in Table 5 whilst the results of the error correction models with the asymmetric impact of the real exchange rate is disclosed in Table 6. The coefficients of the one lag of error correction terms are that many cases found to be less than one and to have the expected negative signs and are statistically significant for the error correction models and the error correction models with the asymmetric impact of the real exchange rate. Nonetheless, there are several cases where the coefficients of the one lag of error correction terms are found to be more than one with the expected negative signs and statistically significant for the error correction models and the error correction models with the asymmetric impact of the real exchange rate. This implies the validity of an equilibrium relationship among the variables in the estimated model. The estimated models mostly fulfil the diagnostic tests of no autocorrelation, no heterogeneous disturbance term and stability of the estimated models in terms of passing the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) tests. Generally, the coefficients of the real exchange rate or positive real exchange rate and

negative real exchange rate, real national income, trade openness, real average wage, inflation, and the Asian financial crisis are found to be statistically significant for FDI. The asymmetric impact of the real exchange rate is found to be significant for FDI from Japan, the United States of America, Singapore, Germany, Taiwan, the United Kingdom, and India.

Table 5: The Results of the Error-Correction Models

	$\Delta\ ln\ FDI_{j,t}$	$\Delta\ ln\ FDI_{us,t}$	$\Delta\ ln\ FDI_{s,t}$	$\Delta\ ln\ FDI_{g,t}$	$\Delta\ ln\ FDI_{t,t}$
$\Delta\ ln\ RER$	Yes	Yes	Yes	Yes	Yes
$\Delta\ ln\ NI$	Yes	No	No	Yes	Yes
$\Delta\ ln\ TO$	Yes	No	Yes	Yes	No
$\Delta\ ln\ RAW$	Yes	Yes	Yes	No	Yes
ΔINF	Yes	Yes	Yes	No	No
D_t	Yes	No	Yes	Yes	Yes
constant	No	Yes	No	Yes	No
$\Delta\ ln\ FDI_{t-i}$	Yes	Yes	-	Yes	-
ec_{t-1}	-0.8469***	-1.1786***	-0.9213***	-0.9343***	-0.4603***
	(-11.2061)	(-7.0873)	(-7.0992)	(-6.0898)	(-4.1991)
Adj. R^2	0.9184	0.6425	0.7238	0.6998	0.6602
LM	0.6514	0.3990	0.1996	0.5238	0.3137
HETERO	0.6878	1.0803	1.1432	1.6138	0.2193
RESET	0.0033	0.1744	0.1002	0.0649	0.1756
CUSUM	S	S	S	S	S
CUSUMSQ	S	U	S	S	S

	$\Delta\ ln\ FDI_{k,t}$	$\Delta\ ln\ FDI_{a,t}$	$\Delta\ ln\ FDI_{uk,t}$	$\Delta\ ln\ FDI_{hk,t}$	$\Delta\ ln\ FDI_{in,t}$
$\Delta\ ln\ RER$	Yes	Yes	Yes	Yes	Yes
$\Delta\ ln\ NI$	Yes	Yes	No	Yes	No
$\Delta\ ln\ TO$	No	Yes	Yes	No	Yes
$\Delta\ ln\ RAW$	Yes	Yes	Yes	-	Yes
$\Delta\ INF$	Yes	Yes	No	Yes	No
D_t	Yes	Yes	No	Yes	No
constant	No	Yes	No	No	No
$\Delta\ ln\ FDI_{t-i}$	-	-	Yes	-	-
ec_{t-1}	-0.8643***	-0.9202***	-1.6843***	-1.0538***	-1.4701***
	(-8.2583)	(-5.5067)	(-6.8228)	(-6.2527)	(-9.8139)
Adj. R^2	0.7570	0.5744	0.6478	0.6438	0.7591
LM	2.0321	0.5908	1.2386	1.2625	0.7135
HETERO	1.2166	0.5512	0.1427	1.3344	0.3869
RESET	0.2933	0.6728	0.0528	5.0934**	0.0303
CUSUM	S	S	S	S	S
CUSUMSQ	S	S	U	U	S

Notes: See also Table 2 for explanations. Yes (No) indicates at least one coefficient (none of coefficient) is statistically significant. Adj. R^2 is the adjusted R^2. LM is the Lagrange multiplier test of disturbance serial correlation. HETERO is the test of heteroscedasticity. RESET is the test of functional form. CUSUM denotes the cumulative sum test of stability. CUSUMSQ denotes the cumulative sum of squares test of stability. S denotes stable. U denotes unstable. The OLS estimator with Newey-West standard error is used when the Lagrange Multiplier test of disturbance serial correlation is found to be statistically significant. The OLS estimator with Huber-White standard error is used when the test of heteroscedasticity is found to be statistically significant. *** (**, *) denotes significance of the t-statistic at the 1% (5%, 10%) level.

Table 6: The Results of the Error-Correction Models – The Asymmetric Impact of the Real Exchange Rate

	$\Delta \ln FDI_{j,t}$	$\Delta \ln FDI_{us,t}$	$\Delta \ln FDI_{s,t}$	$\Delta \ln FDI_{g,t}$	$\Delta \ln FDI_{t,t}$
ΔRER^{+}	Yes	Yes	Yes	No	Yes
ΔRER^{-}	No	Yes	No	Yes	No
$\Delta \ln NI$	Yes	Yes	No	Yes	Yes
$\Delta \ln TO$	Yes	Yes	Yes	Yes	No
$\Delta \ln RAW$	Yes	Yes	Yes	No	Yes
ΔINF	No	Yes	Yes	Yes	No
D_t	Yes	No	Yes	Yes	No
constant	No	Yes	Yes	Yes	Yes
$\Delta \ln FDI_{t-i}$	-	Yes	-	-	-
ec_{t-1}	-0.5573***	-0.8761***	-0.8970***	-0.9620***	-0.5440***
	(-3.6074)	(-4.8712)	(-7.6737)	(-6.9296)	(-5.1816)
Adj. R^2	0.7129	0.7372	0.7087	0.7751	0.6841
LM	1.8944	0.3354	0.3874	0.3228	0.3551
HETERO	0.2676	0.9115	1.1301	1.2730	0.7592
RESET	0.7158	5.8456**	1.4086	0.4694	0.1107
CUSUM	S	S	S	S	S
CUSUMSQ	U	S	S	S	S
W3	5.6453**	4.3205*	15.7405***	18.3743***	6.1759**

	$\Delta \ln FDI_{k,t}$	$\Delta \ln FDI_{a,t}$	$\Delta \ln FDI_{uk,t}$	$\Delta \ln FDI_{hk,t}$	$\Delta \ln FDI_{in,t}$
ΔRER^{+}	Yes	Yes	Yes	Yes	Yes
ΔRER^{-}	No	No	Yes	Yes	Yes
$\Delta \ln NI$	Yes	No	Yes	Yes	Yes
$\Delta \ln TO$	Yes	Yes	Yes	Yes	Yes
$\Delta \ln RAW$	Yes	No	Yes	Yes	No
ΔINF	Yes	Yes	Yes	No	Yes
D_t	Yes	No	Yes	No	Yes
constant	No	No	No	No	No
ec_{t-1}	-0.8010***	-0.8961***	-1.0948***	-0.7200***	-1.3092***
	(-5.3750)	(-4.4373)	(-8.1151)	(-4.0474)	(-8.2446)
Adj. R^2	0.6424	0.4567	0.7913	0.8073	0.6534
LM	2.0860	0.3975	1.0743	1.9489	0.8659
HETERO	0.4111	1.2027	0.3592	0.8551	0.5360
RESET	0.0064	0.7872	0.0091	2.6368	0.0022
CUSUM	S	S	S	S	S
CUSUMSQ	S	S	S	S	S
W3	0.0076	2.7594	21.4702***	0.3061	8.4295***

Notes: See also Table 4 for explanations. W3 is the Wald statistic to test the asymmetric impact of the real exchange rate in the short run.

The results of the system GMM of the Arellano-Bond estimator are given in Table 7. The Arellano-Bond tests for AR(1) in the first differences are all rejected. Moreover, the Arellano-Bond tests for AR(2) in the first differences are all not rejected. This supports the model specification is appropriate. Sargan's test over-identifying restrictions in testing instrumental variables are valid, but are not rejected. This indicates that the model has valid instrumentation. The Wald statistic (W3) is to test the asymmetric impact of the real exchange rate in the short run in many cases is significant. The null hypothesis is the coefficient of the positive real exchange rate is equal to the coefficient of the negative real exchange rate. Therefore, the asymmetric impact of the teal exchange rate is not in the long run. Generally, real national income is found to have a positive impact on FDI whereas the

real exchange rate, positive real exchange rate or negative real exchange rate, trade openness and real average wage are found to have negative impact on FDI.

Table 7: The Results of the System GMM of the Arellano-Bond Estimator

	$ln\ FDI_{i,t}$	$ln\ FDI_{i,t}$
$ln\ RER_t$	-4.4598***	-
	(-5.39)	
RER_t^+	-	-6.5001**
		(-2.07)
RER_t^-	-	-4.2614***
		(-4.84)
$ln\ NI_t$	2.7513***	3.2285***
	(5.40)	(3.70)
$ln\ TO_t$	-1.4551***	-1.5135***
	(-3.05)	(-3.11)
$ln\ RAW_t$	-6.1281***	-6.0742***
	(-5.90)	(-5.82)
INF_t	-0.0355	-0.0555
	(-0.91)	(-1.13)
constant	-82.4626***	-116.397***
	(-3.84)	(-4.35)
AR1	-7.25***	-7.25***
AR2	0.05	0.03
Sargan	35.80	35.32
W4	-	0.45

Notes: See also Table 2 for explanations. AR1 is the Arellano-Bond test for AR(1) in first differences. AR2 is the Arellano-Bond test for AR(2) in first differences. Sargan is the Sargan's test of over identification of restrictions. W4 is the Wald statistic for testing the symmetric of the coefficient of positive real exchange rate and the coefficient of negative real exchange rate in the short run. *** (**, *) denotes significance of the t-statistic at the 1% (5%, 10%) level.

There are some remarks from this study. Depreciation of the real exchange rate attracts FDI. Contrarily, appreciation of the real exchange rate hinders FDI as the cost of investment increases for foreign investors (Ang, 2008; Tang *et al.*, 2014). Real national income attracts FDI seeking the domestic market. Bekhet and Al-Smadi (2015), among others, present that GDP promote FDI in Jordan. On the other hand, Villaverde and Maza (2015), Bolivar *et al.* (2019) among others, reveal insignificance of GDP on FDI. Trade openness can encourage or discourage FDI. Trade openness comforts FDI oriented export whilst deters FDI seeking domestic market as trade openness leads to more competition. This study found that trade openness decreases FDI. Contrarily, Boateng *et al.* (2015) discovered that trade openness increases FDI in Norway. Inflation discouraged businesses including FDI (Ang, 2008; Tang *et al.*, 2014). A relatively low labour cost produces a conducive environment to attract FDI in the long run and short run. Kinuthia and Murshed (2015), among others, indicate real average wage is a significant FDI determinant in Malaysia. High labour cost deters FDI, especially labour-intensive FDI. High labour cost increases overall production cost and reduces the profit of the firm. This would lead the firm to search for an alternative location advantage in terms of production cost (Fan *et al.*, 2018). Inflation is an indication of economic stability. High inflation reduces real income in domestic currency for FDI whereas low inflation is a result of economic stability and stimulates FDI. Overall, inflation is not a significant FDI determinant may be due to inflation that is low in Malaysia for an average of about 3 per cent over the period from 1979 to 2015 (International Financial Statistics, International Monetary Fund). The Asian financial crisis, 1997-1998 is found to have an influential impact on FDI for a certain country in the short run only.

Boateng *et al.* (2015) address macroeconomic variables are key elements of location-specific advantage that exert a significant influence on FDI. The dynamic of macroeconomic policy is notably to foster FDI. The macroeconomic policies shall be directed to stabilise the exchange rate as an appreciation of the exchange rate hinders FDI. In the short run, fluctuation of exchange rate could have a asymmetric impact on FDI, that is, depreciation of the exchange rate may discourage FDI from some countries. Price stability is an indication of macroeconomic stability. High inflation results in high labour costs, which discourages FDI. FDI may seek an alternative location advantages in terms of lower production costs. Trade openness discourages FDI, especially domestic-oriented FDI. Conversely, trade openness encourages FDI oriented export. A right level of trade liberalisation would sustain a maximum level of FDI. FDI determinants are not the same for all countries. Therefore, additional incentives shall be given to attract FDI from some countries. Good quality of government institutions and political stability are also crucial to promoting FDI (Brada *et al.*, 2019; Chen *et al.*, 2019; Li and Tanna, 2019). The authority shall assist foreign companies to reduce their production costs. FDI may promote economic development, but FDI is no beneficial per se. Therefore, a policy to attract FDI shall be given to attract FDI that is beneficial to the host country. Identifying the heterogeneous composition of FDI is an important step to design can effective FDI policy (Ascani *et al.*, 2020).

Bolivar *et al.* (2019) report that country features such as size, openness, skill levels and institutional stability influence FDI and the network structure and the power positions of each country. Ascani *et al.* (2020) show that inter-sectoral linkages of FDI alter local innovative activity. The link between FDI and local innovation is positive but does not surpass local administrative boundaries on aggregate. Brada *et al.* (2019) report that an increase in the level of corruption in the host country or the level of the difference between corruption in the host country and the home country will lead to a decrease in FDI is affected. Therefore, a clean institution is good for promoting FDI. FDI from a country with better institutional quality shows greater investment efficiency than FDI from a country with weaker institution (Chen *et al.*, 2019). Li and Tanna (2019) show that institutional quality is relatively more important than human capital development for developing countries to absorb total factor productivity gain from FDI. Li *et al.* (2019) reveal that negative sentiment influences more strongly on FDI than positive sentiment and the accumulated sentiment is stronger than transient sentiment. National sentiment affects FDI. Hence, the asymmetric impact of real exchange is rate more influential in the long run.

5. Conclusion

This study explores the importance of macroeconomic variables as FDI determinants by country in Malaysia, namely Japan, the USA, Singapore, Germany Taiwan, Korea, Australia, the United Kingdom, Hong Kong and India and the importance of macroeconomic variables as FDI determinants of those countries as a group in Malaysia, except Korea. Macroeconomic variables can be an important role as location decision variables for FDI. FDI determinants are not the same by country as different investments from different countries Macroeconomic variables are important for FDI. FDI determinants are not the same in the long run and short run. The asymmetric impact of the real exchange rate on FDI is found more in the short run than in the long run. Macroeconomic policies can influence location comparative advantage as many macroeconomic determinants are found to be statistically significant. Thus, different FDI policy is better being implemented for a different country. The evidence of FDI determinants by country benefits the policymaker to identify good and appropriate policies in supporting FDI and to cope with the increasingly difficult monitoring of FDI, which is less home-country centric but global. The real

exchange rate, positive real exchange rate, negative real exchange rate, real national income, trade openness and real average wage are found to be the main FDI determinants of those countries as a group in Malaysia. There is no evidence of the asymmetric impact of the real exchange rate in those countries as a group in Malaysia in the long run. A successful FDI policy may not be successful for all countries. Hence, it shall be creative in promoting FDI. Attractive Macroeconomic factors are one of the key elements of location-specific advantage that strive a significant influence on FDI decisions in recent years. The importance of FDI determinants is not the same across the country and the implications for policymakers are to promote a dynamic competitive advantage in the home country, therefore policymakers need to pay more attention to their macroeconomic policies to reduce production and transaction costs of FDI. The dynamic of macroeconomic policy is notably to nurture FDI.

References

Alvarado, R., Iniguez, M., & Ponce, P. (2017). Foreign direct investment and economic growth in Latin America. *Economic Analysis and Policy*, *56*, 176-187.

Ang, J. B. (2008). Determinants of foreign direct investment in Malaysia. *Journal of Policy Modeling*, *30*, 185-189.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, *58*, 277-297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*, 29-51.

Ariff, M., & Abu Bakar, S. Y. (1999). The Malaysian financial crisis: Economic impact and recovery prospects. *Developing Economies*, *37*(4), 417-438.

Ascani, A., Balland, P. A., & Morrison, A. (2020). Heterogeneous foreign direct investment and local innovation in Italian Provinces. *Structural Change and Economic Dynamics*, *53*, 388-401.

Bahmani-Oskooee, M., & Saha, S. (2015). On the relation between stock prices and exchange rates: A review article. *Journal of Economic Studies*, *42(4)*, 707-732.

Bahmani-Oskooee, M., & Saha, S. (2016). Do exchange rate changes have symmetric or asymmetric effects on stock prices? *Global Finance Journal*, *31*, 57-72.

Bekhet, H. A., & Al-Smadi, R. W. (2015). Determinants of Jordanian foreign direct investment inflows: Bounds testing approach. *Economic Modelling*, *46*, 27-35.

Belloumi, M. (2014). The relationship between trade, FDI and economic growth in Tunisia: An application of the autoregressive distributed lag model. *Economic Systems*, *38*, 269-287.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of* Econometrics, *87*, 115-143.

Boateng, A., Hua, X., Nisar, S., & Wu, J. (2015). Examining the determinants of inward FDI: Evidence from Norway. *Economic Modelling*, *47*, 118-127.

Bolivar, L. M., Casanueva, C., & Castro, I. (2019). Global Foreign Direct Investment: A network perspective. *International Business Review*, *28*, 696-712.

Brada, J. C., Drabek, Z. Mendez, J. A., & Perez, M. F. (2019). National levels of corruption and foreign direct investment. *Journal of Comparative Economics*, *47*, 31-49.

Chan, M. W. L., Hou, K., Li, X., & Mountain, D. C. (2014). Foreign direct investment and its determinants: A regional panel causality analysis. *The Quarterly Review of Economics and Finance*, *54*, 579-589.

Chen, D. Yu, X., & Zhang, Z. (2019). Foreign direct investment comovement and home country institutions. *Journal of Business Research*, *95*, 220-231.

Chen, G. S., Yao, Y., & Malizard, J. (2017). Does foreign direct investment crowd in or crowd out private domestic investment in China? The effect of entry mode. *Economic Modelling*, *61*, 409-419.

Desbordes, R., & Wei, S. J. (2017). The effects of financial development on foreign direct investment. *Journal of Development Economics*, *127*, 153-168.

Ding, H., Fan, H., Jin, Y., & Qi, T. (2022). Talented overseas returnees and outward foreign direct investment. *European Economic Review*, 104210.

Doytch, N., & Uctum, M. (2011). Does the worldwide shift of FDI from manufacturing to services accelerate economic growth? A GMM estimation study. *Journal of International Money and Finance*, *30*, 410-427.

Dunning, J. H. (2009). Location and the multinational enterprise: A neglected factor?. *Journal of International Business Studies*, *40*, 5-19.

Fan, H., Lin, F., & Tang, L. (2018). Minimum wage and outward FDI from China. *Journal of Development Economics*, *135*, 1-19.

Griebeler, M. D. C., & Wagner, E. M. (2017). A signaling model of foreign direct investment attraction. *EconomiA*, *18*, 344-358.

Hoshi, T., & Kiyota, K. (2019). Potential for inward foreign direct investment in Japan. *Journal of The Japanese and International Economies*, *52*, 32-52.

Iamsiraroj, S. (2016). The foreign direct investment–economic growth nexus. *International Review of Economics and Finance*, *42*, 116-133.

International Monetary Fund. (2022). *What is real effective exchange rate (REER)?*. International Monetary Fund. http://datahelp.imf.org/knowledgebase/articles/537472-what-is-real-effective-exchange-rate-reer)

Khan, H. U. R., Islam, T., Yousaf, S. U., Zaman, K., Shoukry, A. M., Sharkawy, M. A., Gani, S., Aamir, A., & Hishan, S. S. (2019). The impact of financial development indicators on natural resource markets: Evidence from two-step GMM estimator. *Resources Policy*, *62*, 240-255.

Kinuthia, B. K., & Murshed, S. M. (2015). FDI determinants: Kenya and Malaysia compared. *Journal of Policy Modeling*, *37*, 388-400.

Li, C., & Tanna, S. (2019). The impact of foreign direct investment on productivity: New evidence for developing countries. *Economic Modelling*, *80*, 453-466.

Li, M. Y., Makino, S., & Jiang, C. (2019). Does national sentiment affect foreign direct investment, and if so, how? Additional evidence. *International Business Review*, *28*(5), 101586.

Lucke, N., & Eichler, S. (2016). Foreign direct investment: The role of institutional and cultural determinants. *Applied Economics*, *48*(11), 935-56.

Ly, A., Esperança, J., & Davcik, N. S. (2018). What drives foreign direct investment: The role of language, geographical distance, information flows and technological similarity. *Journal of Business Research*, *88*, 111-122.

Magnier-Watanabe, R., & Lemaire, J. P. (2018). Inbound foreign direct investment in Japan: A typology. *International Business Review*, *27*, 431-442.

Mourao, P. R. (2018). What is China seeking from Africa? An analysis of the economic and political determinants of Chinese outward foreign direct investment based on stochastic frontier models. *China Economic Review*, *48*, 258-268.

Nguyen, A. T. N., Haug, A. A., Owen, P. D., & Genç, M. (2020). What drives bilateral foreign direct investment among Asian economies?. *Economic Modelling*, *93*,125-141.

Nielsen, B. B., Asmussen, C. G., & Weatherall, C. D. (2017). The location choice of foreign direct investments: Empirical evidence and methodological challenges. *Journal of World Business*, *52*, 62-82.

Paul, J., & Feliciano-Cestero, M. M. (2021). Five decades of research on foreign direct investment by MNEs: An overview and research agenda. *Journal of Business Research*, *124*, 800-812.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*, 289-326.

Petri, P. A. (2012). The determinants of bilateral FDI: Is Asia different?. *Journal of Asian Economics*, *23*, 201-209.

Raff, H., Ryan, M., & Stahler, F. (2018). Financial frictions and foreign direct investment: Evidence from Japanese microdata. *Journal of International Economics*, *112*, 109-122.

Shin, Y., Yu, B. C., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In Sickles, R. C. and Horrace, W. C. (Eds.), *Festschrift in honor of Peter Schmidt: Econometric methods and applications*, Springer New York, 281-314.

Tang, C. F., Yip, C. Y., & Ozturk, I. (2014). The determinants of foreign direct investment in Malaysia: A case for electrical and electronic industry. *Economic Modelling*, *43*, 287-292.

Uddin, M., Chowdhury, A., Zafar, S., Shafique, S., & Liu, J. (2019). Institutional determinants of inward FDI: Evidence from Pakistan. *International Business Review*, *28*(2), 344-358.

Van Cauwenberge, A., Vancauteren, M., Braekers, R., & Vandemaele, S. (2019). International trade, foreign direct investments, and firms' systemic risk: Evidence from the Netherlands. *Economic Modelling*, *81*, 361-386.

Villaverde, J., & Maza, A. (2015). The determinants of inward foreign direct investment: Evidence from the European regions. *International Business Review*, *24*, 209-223.

Vo, X. V. (2018). Determinants of capital flows to emerging economies – Evidence from Vietnam. *Finance Research Letters*, *27*, 23-27.

Wong, H. T. (2003). Foreign direct investment and economic growth: An empirical study on ASEAN-4 and China. *Labuan Bulletin of International Business and Finance*, *1*(1), 65-78.

Wong, H. T. (2005). The determinants of foreign direct investment in manufacturing industry of Malaysia. *Journal of Economic Cooperation*, *26*(2), 91-110.

Yan, B., Zhang, Y., Shen, Y., & Han, J. (2018). Productivity, financial constraints and outward foreign direct investment: Firm-level evidence. *China Economic Review*, *47*, 47-64.

Zhai, W. (2014). Competing back for foreign direct investment. *Economic Modelling*, *39*, 146-150.

Capital Markets Review Vol. 30, No. 2, pp. 39-61 (2022)

Actively Managed ETFs: A Performance Evaluation

Gerasimos Georgiou Rompotis[1*]
[1]*Department of Economics, National and Kapodistrian University of Athens, Greece.*

Abstract: Research Question: The current study examines whether actively managed Exchange Traded Funds (ETFs) in the United States can beat the market. The market timing skills of ETF managers are evaluated too. **Motivation:** This study has been motivated by the recent increased interest of investors in actively managed ETFs. This interest has been answered by the creators of active ETFs via the launch of several of such products over the last couple of years. As a result, significant money has flown into active ETFs during the last two years, and especially in 2021. **Idea:** In other words, by examining the latest return data of active ETFs, we try to confirm whether the recent growth in the active ETF market has been driven by material performance records of these funds. **Data:** The performance of 50 U.S. equity actively managed ETFs is examined over the period 1/1/2018 - 31/12/2021. **Method/Tools:** Standard methodology including single-factor market model and the Fama-French-Carhart four- and six-factor models is used. **Findings:** The findings are in line with previous evidence in the literature. Active ETFs fail to achieve any material above market return. In addition, it is shown that the Fama-French-Carhart factors are material in explaining the performance of the examined ETFs. Finally, the managers of active ETFs do not seem to possess any superior market timing skills. **Contributions:** When it comes to the contribution of this study, we note that we use the most recent data than any other known study in the literature. Moreover, based on methodology found in the literature on traditional mutual funds, we consider several factors in assessing the performance of active ETFs than just the market index, which is frequently the case in similar studies. Finally, market timing skills are assessed via an enhanced set of regression models. All the above enhance our knowledge about the failure of active ETFs to beat the market and to compete their passive peers.

Keywords: ETFs, active management, performance, market timing.
JEL Classification: G11

1. Introduction

This study re-examines the long-lasting question about whether the active fund managers can create value for their investors by gaining above-market returns and beating their passively managed rivals. To do so, the study employs a sample of 50 actively managed equity Exchange Traded Funds (ETFs) listed in the United States.

Active ETFs were launched in the U.S. in February of 2008, even though the first appearance of such ETFs was made in Germany at the beginning of the new century. The first

* Corresponding author: Gerasimos Georgiou Rompotis. Tel.: +302107277000.
Email: geras3238@yahoo.gr

Received 10 Feb 2022; Final revised 21 Aug 2022; Accepted 12 Sept 2022; Available online 30 Sept 2022.
To link to this article: https://www.mfa.com.my/cmr/v30_i2_a3/

years of the active sector of the ETF market were not easy, as investors were reluctant to massively invest in such products. However, the long-awaited boom in the market of active ETFs seems to be closer than ever. After more than a decade of weak growth and frequent failures, active management is becoming a trend in the ETF market. Investors are flooding in at a record pace. Inflows into actively managed ETFs in the US during the first six months of 2021 amounted to $55 billion, when the inflows during the entire 2020 were $59 billion.[1] Nevertheless, the ETF market is still dominated by passive products. At the end of 2021, from the 2,793 ETFs listed in the U.S., 803 ETFs were active. At the same time, the total assets managed by these funds amounted to $287 billion, when the entire ETF market in the U.S. managed about $7 trillion.[2] These numbers indicate that the market share of active ETFs (4.1%) is still very low and, thus, there must be room for further growth.

Actively managed ETFs can be found in the following asset classes: i) equity, ii) asset allocation, iii) fixed income, iv) alternatives, v) currency, and vi) commodities. With respect to classes, fixed income is by far the largest segment of the active ETF marketplace, even though thematic and defensive strategies are gaining ground. The popularity of fixed income active ETFs is justified by their decent records of beating their passively managed rivals.

The performance of active equity ETFs in the U.S. is examined in this study over the period 1/1/2018 - 31/12/2021 with standard methodology found in the literature. In the first step, raw daily returns are computed. Then, the single-factor market model is used to assess whether active ETFs produce any significant alpha. Multifactor regression analysis of ETFs' performance is conducted too. Finally, the ability of active ETF managers to time the market is evaluated.

First, the empirical findings reveal that the ETFs in the sample achieved positive average raw returns during the period under study. However, these returns did not exceed the corresponding return of the S&P 500 Index, which is used as the market proxy. This inability of active ETFs to beat the market index is also verified by the insignificant alpha estimates obtained from the single- and multi-factor regression analysis of performance. Furthermore, the results indicate that the Fama and French (1992 and 2015) stock market factors and the momentum factor of Carhart (1997) are quite significant in explaining the performance of active ETFs in the U.S. Finally, the results accentuate that, overall, the managers of active ETFs do not possess any efficient market timing abilities, while some evidence is obtained on the opposite.

This study has been motivated by the recent increased interest of investors in actively managed ETFs, the significant growth in the number of such products and the significant money inflows into them during the last two years, and especially in 2021. In other words, by examining the latest return data of active ETFs, we try to confirm whether the recent growth in the active ETF market has been driven by material performance records of these funds. To the best of our knowledge, the most recent study on the subject is that of Rompotis (2020), which examines the performance of 37 pairs of equity active and passive ETF with data up to December 31, 2016. Obviously, the current study cannot capture the recent growth in the active ETF market as the current study does and that is why an expansion to our previous work is justified.

When it comes to the contribution of this study, we note that we use the most recent data than any other known study in the literature. Moreover, based on methodology found in the literature on traditional mutual funds, we consider several factors in assessing the performance of active ETFs than just the market index, which is frequently the case in similar

[1] The information reported in this paragraph has been found in: "Active ETFs: The Next Act", www.bnymellon.com/content/dam/bnymellon/documents/pdf/aerial-view/active-etfs-the-next-act.pdf.
[2] Refer to: "Active Management ETF Overview", www.etf.com/channels/active-management-etfs, and "NYSE Arca Q4 2021 Quarterly ETF Report", www.nyse.com/etf/exchange-traded-funds-quarterly-report.

studies. Finally, market timing skills are assessed via an enhanced set of regression models. All the above enhance our knowledge about the failure of active ETFs to beat the market and to compete their passive peers.

In addition, we deem that our empirical results can explain why, at least until recently, investors have been reluctant to embrace the actively managed ETFs. They can also contribute to the fierce debate about the merits and pitfalls of active management by demonstrating, once again, that the increased costs incurred by active managers cannot be compensated for by spectacular returns records. Finally, given that in our study we use equity active ETFs, their poor performance records relative to market returns could explain why fixed-income dominates the active ETF marketplace.

The remainder of this paper is structured as follows: Section 2 provides the literature review. Section 3 develops the research methodology applied in our study and describes the sample used. Empirical findings are discussed in Section 4 and conclusions are offered in Section 5.

2. Literature Review

In this section, we discuss the findings of the literature on the performance of actively managed ETFs. To the best of or knowledge, the studies discussed below concern the most significant studies on the matter.

First, on active vs passive ETFs, Rompotis (2011a) examines the performance of three pairs of comparable active and passive ETFs traded on the U.S. stock market. The results reveal that the active ETFs underperform both the corresponding passive ETFs and the market indexes. The study also found that both active and passive ETFs provide investors with no positive excess returns. Further regression analysis indicates that the managers of active ETFs do not possess the selectivity and market timing skills. Rompotis (2013) studies nine pairs of active and passive ETFs following common market benchmarks and found similar results. In addition, active ETFs were also found to be more expensive than the passive ETFs. However, this increased cost of active ETFs relative to the passive peers is not justified by their performance records. The paper also verifies the inability of active ETF managers to implement efficient market timing strategies.

More recently, Rompotis (2020) studies the performance and risk of a sample of 37 equity active and passive ETF pairs up to December 31, 2016. Several return metrics are computed, such as absolute, buy-and-hold and risk-adjusted returns. Moreover, cross-sectional regression analysis of the factors that may affect the performance of ETFs is applied. Finally, the ability of managers to time the market is examined. The findings are similar to those in most of the previous studies. Active ETFs underperform their passive peers being, at the same time, more volatile than them. In addition, they cannot achieve any material excess return, while their managers are found unable to time the market.

How active ETFs performs relative to other assets? Rompotis (2011b) has compared the performance of 14 U.S. equity active ETFs against the performance of the S&P 500 Index over a period spanning from the inception of each ETF up to June 30, 2010. The empirical findings indicate that active ETFs cannot beat the market. Furthermore, the managers of these ETFs are found to be lacking any material skills to time the market. Rompotis (2015) examines the performance of a sample of 22 active ETFs listed in the Canadian stock market. The ability of active ETFs to produce excess returns relative to the market is evaluated. The ability of the managers to time the market is assessed too. The empirical findings indicate that, similarly to their U.S. cousins, the Canadian active ETFs fail to beat the market. On the contrary, the majority of them deliver significantly negative alphas. In addition, the managers of these funds seem to be unable to time the market efficiently. More recently, Kumar (2021) examine the performance of active and smart beta equity ETFs listed in the U.S. since 2000.

Using a sample of 95 active ETFs and 376 smart beta ETFs, the author shows that, during a five-year period ending at October 30, 2020, only 20% of active ETFs and 15% of smart beta ETFs outperformed the S&P500 Index. Moreover, using the Fama-French-Carhart six-factor model, Kumar (2021) finds that more than 20% of smart beta equity ETFs and 10% of active equity ETFs have significant alphas.

Do active ETFs underperform? In this respect, Schizas (2014) presents empirical results on the first active ETFs based on risk and return. Using models for the returns and volatility of the underlying assets, the author compares the performance of these models with alternative investment solutions, such as passive ETFs, mutual funds and hedge funds. The results indicate that active ETFs are more volatile than the passive ones but the performance of the two groups is comparable to each other. The results is consistent with Dolvin (2014) who also finds that active funds are more volatile than their passive peers without, however, providing any return advantages. Therefore, active ETFs cannot be considered as good substitutes for the existing passively managed funds. However, contrary to previous studies, the author reveals that, in terms of relative risk, i.e. Information and Treynor ratios, active ETFs with highest average daily trading volumes seem to perform better than their passive peers.

Garyn-Tal (2013) examines whether the performance of ETFs is affected by active management in a positive way. Performance is assessed via the Fama-French-Carhart four-factor model. The author uses weekly return data on 10 active ETFs for the period 2008-2012 and finds an investment strategy in active ETFs that earns a positive risk-adjusted excess return, based on R2, as extracted from the regression of the ETFs' excess return on the four-factors' excess return. On the other hand, Meziani (2015) identifies the transparency issue and the relevant contention between the Securities and Exchange Commission (SEC) and fund sponsors seeking for approval of new active ETFs, as the main obstacle to the growth of active ETFs. He also reveals that only fixed-income active ETFs can contribute to enhancing the performance of an investment portfolio and reducing its overall risk. Therefore, it is not a surprise that fixed-income active ETFs possess by far the largest share of the U.S. active ETF market.

3. Methodology

In this section, we develop the methodology to be used in our analysis of active ETFs' performance. First, we compute the raw returns of ETFs. A single-factor regression analysis of ETFs' performance follows. The regression analysis of performance is expanded by using a four-factor and a six-factor model. Finally, the market timing skills of ETF managers are assessed. Overall, the methodology that we will use is common in the relevant literature on ETFs and traditional actively managed mutual funds.

3.1 Raw Returns

We compute the raw return of active ETFs in percentage terms over the period 2018-2021 with daily trade data found on www.nasdaq.com. Percentage return is calculated with formula (1):

$$Ri,t = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad (1)$$

where $R_{i,t}$ refers to the percentage daily return of the *ith* ETF on the trade day *t* and $P_{i,t}$ refers to the close trade price of the ETF on day *t*.[3] Formula (1) is also used for the calculation of

[3] We have also calculated the absolute returns with dividend-adjusted trade price data without returns differing significantly from the dividend-free returns. For simplicity purposes, we only report the returns which are not adjusted for dividends.

market performance. We use the S&P 500 Index as a proxy for the market. In addition, formula (1) is used for the calculation of total (or cumulative) return of ETFs and market over the entire period under study. Finally, the risk of ETFs and the market index is calculated as the standard deviation in daily returns.

3.2 Single-factor Performance Analysis

The first model used to examine the performance of ETFs is the following:

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \varepsilon_i \quad (2)$$

where R_i denotes the daily return of ETFs, R_m represents the return of the S&P 500 Index and R_f is the risk-free rate expressed by the one-month U.S. Treasury bill rate. The model is applied with the regression method of the Least Squares and, when it is necessary, adjustments are made, for dealing with autocorrelation and heteroskedasticity issues.

Alpha represents the above-market return that can be achieved by an ETF. It is used to assess the selection skills of ETF managers. If ETFs can achieve above-market returns, alpha estimates will be positive and statistically significant. Beta measures the part of risk that cannot be mitigated by diversification techniques and indicates the systematic risk of active ETFs.

3.3 Four-Factor Performance Analysis

We evaluate the exposure of ETFs to certain market factors with the Fama and French (1992) three-factor model, to which we add the momentum factor of Carhart (1997). The model is shown in Equation (3):

$$R_i - R_f = \alpha_i + \beta_{1,i}(R_m - R_f) + \beta_{2,i}SMB + \beta_{3,i}HML + \beta_{4,i}MOM + \varepsilon_i \quad (3)$$

where R_i, R_m and R_f are defined as in Section 3.2. The model is applied with the regression method of the Least Squares and, when it is necessary, adjustments are made, for dealing with autocorrelation and heteroskedasticity issues.

SMB (Small Minus Big) is the average return on nine small-cap portfolios minus the average return on nine large-cap portfolios. HML (High Minus Low) is the average return on two value portfolios (in book-to-market equity terms) minus the average return on two growth portfolios.

In the Fama and French model, the size effect implies that small cap companies outperform large firms. The book-to-market equity ratio effect captured by the HML factor implies that the average returns on stocks with a high book-value to market-value equity ratio must be greater than the returns on stocks with a low book-value to market-value equity ratio.

Finally, the existence of a momentum in asset prices is considered to be an anomaly which is difficult to explain, because the efficient capital markets theory suggests that an increase in the price of an asset cannot indicate a further increase in future prices. An explanation to this anomaly offered by behavioralists is that investors are not rational and that they underreact to the release of new information. In doing so, they fail to reflect new information into stock prices.

3.4 Six-Factor Performance Analysis

We evaluate the exposure of ETFs to certain market factors with the Fama and French (2015) five-factor model, in which we add the momentum factor of Carhart (1997). The model is shown in Equation (4):

$$R_i-R_f=\alpha_i+\beta_{1,i}(R_m-R_f)+\beta_{2,i}SMB+\beta_{3,i}HML+\beta_{4,i}RMW+\beta_{5,i}CMA+\beta_{6,i}MOM+\varepsilon_i \quad (4)$$

where R_i, R_m and R_f, SMB, HML and MOM are defined as above. The model is applied with the regression method of the Least Squares and, when necessary, adjustments are made, for dealing with autocorrelation and heteroskedasticity issues.

Finally, the Robust Minus Weak and the Conservative Minus Aggressive factors correspond to the Fama and French (2015) operating profitability and investment factors. Based on the findings of Fama and French (2015), a negative loading is expected for the RMW factor, that is, the excess return of active ETFs must be affected by the profitability factor in a negative fashion. Furthermore, past investment is viewed as a proxy for the expected future investment. Fama and French (2015) suggest that CMA implies a negative relationship between the expected investment and the expected internal rate of return.[4]

3.5 Market Timing Analysis

The ability of active ETF managers to time the market is evaluated in this section. Market timing implies the efficient increase or decrease in a portfolio's exposure to equities prior to market accessions or decreases, respectively. In our analysis, we use two alternative models to assess the market timing skills of active ETF managers.

The first method is the Treynor and Mazuy (1966) model shown in Equation (5):

$$R_i-R_f=\alpha_i+\beta_i(R_m-R_f)+\gamma_i(R_m-R_f)^2+\varepsilon_i \quad (5)$$

where R_i, R_m, R_f, α_i and β_i are defined as above. γ_i measures the market timing skills. The model is applied with the method of the Least Squares and, when necessary, adjustments are made, for dealing with autocorrelation and heteroskedasticity issues.

If the manager increases (decreases) efficiently the portfolio's exposure to the market index prior to market accessions (recessions), γ_i will be positive and statistically significant, indicating that the manager can capture the bull and bear moments of the market.

The second model used is the higher moment model suggested by Jagannathan and Korajczyk (1986). This model is based on the Treynor and Mazuy (1966) model but additionally includes a cubic term of the market excess performance. The cubic term is used to evaluate the ability of managers to time the market volatility. The model is shown in Equation (6):

$$R_i-R_f=\alpha_i+\beta_i(R_m-R_f)+\gamma_i(R_m-R_f)^2+\delta_i(R_m-R_f)^3+\varepsilon_i \quad (6)$$

where R_i, R_m, R_f, α_i, β_i and γ_i are defined as above and δ_i measures the response of each ETF to market volatility. The model is applied with the regression method of the Least Squares and, when necessary, adjustments are made, for dealing with autocorrelation and heteroskedasticity issues.

3.5 The Sample

The sample includes 50 equity active ETFs traded on the U.S. market. If we consider the total number of active ETFs available in the U.S. today, this relatively small sample is due to the fact that the population of active ETFs surged over the last two years (2020 and 2021). However, we needed sufficient return data to apply substantive testing on performance. Thus, we decided that a period spanning from 1/1/2018 to 31/12/2021 serves the purposes of our

[4] The historical daily data of risk-free rate, the Fama and French three "traditional" factors, as well as the robust minus weak factor and the conservative minus aggressive factor, and the momentum factor are available on http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

analysis. No other selection criterion has been applied. As a result, our sample is limited to these 50 active ETFs.

Table 1 presents the profiles of active ETFs, which include their ticker, name, inception date, age as of 31/12/2021(in years), expense ratio, average daily volume over the period 1/1/2018-31/12/2021, average trading frequency, as the fraction of the days with no zero volume to the entire to total trade days over the period 1/1/2018-31/12/2021, average intraday volatility, computed as (Daily Highest Price-Daily Lowest Price)/Daily Close Price, and assets under management as of 31/12/2021.[5]

Table 1: Profiles of ETFs
This table presents the profiles of active ETFs, which include their ticker, name, inception date, age in years as of 31/12/2021, expense ratio, average daily volume over the period 1/1/2018-31/12/2021, average trading frequency, as the fraction of the days with no zero volume to the entire to total trade days over the period 1/1/2018-31/12/2021, average intraday volatility, computed as (Daily Highest Price-Daily Lowest Price)/Daily Close Price, and assets under management (AUM) as of 31/12/2021.

Ticker[1]	Name[1]	Inception[1]	Age	Exp. Ratio[1]	Volume[2]	Trade Freq.	Intr. Vol.	AUM ($ M)[1]
ARKK	ARK Innovation ETF	Oct 31, 2014	7.17	0.75%	2,952,830	100.00%	2.76	12,366.60
ARKG	ARK Genomic Revolution ETF	Oct 31, 2014	7.17	0.75%	1,210,900	100.00%	3.06	4,041.90
ARKW	ARK Next Generation Internet ETF	Sep 29, 2014	7.26	0.83%	530,375	100.00%	2.43	2,431.80
EMLP	First Trust North American Energy Infrastructure Fund	Jun 21, 2012	9.53	0.96%	559,641	100.00%	1.28	2,229.70
ARKQ	ARK Autonomous Technology & Robotics ETF	Sep 30, 2014	7.26	0.75%	248,857	100.00%	2.02	1,558.00
SECT	Northern Lights Fund Trust IV Main Sector Rotation ETF	Sep 05, 2017	4.32	0.78%	68,831	100.00%	1.13	1,025.30
SYLD	Cambria Shareholder Yield ETF	May 14, 2013	8.64	0.59%	23,823	100.00%	1.54	425.90
DUSA	Davis Select U.S. Equity ETF	Jan 11, 2017	4.97	0.62%	19,244	100.00%	1.09	377.10
PHDG	Invesco S&P 500® Downside Hedged ETF	Dec 06, 2012	9.07	0.40%	37,404	99.40%	0.92	362.10
DWLD	Davis Select Worldwide ETF	Jan 11, 2017	4.97	0.63%	38,845	100.00%	1.21	336.70
AMZA	InfraCap MLP ETF	Oct 01, 2014	7.25	2.01%	104,528	100.00%	3.12	312.60
CCOR	Core Alternative ETF	May 24, 2017	4.61	1.09%	23,557	99.80%	0.94	277.70
LRGE	ClearBridge Large Cap Growth ESG ETF	May 22, 2017	4.61	0.59%	18,960	88.59%	0.90	228.40
QVAL	Alpha Architect U.S. Quantitative Value ETF	Oct 22, 2014	7.20	0.49%	21,922	100.00%	1.33	214.00

[5] Tickers, names, inception dates, expense ratios and assets under management have been found on www.etfdb.com. Volumes have been found on www.nasdaq.com.

Ticker[1]	Name[1]	Inception[1]	Age	Exp. Ratio[1]	Volume[2]	Trade Freq.	Intr. Vol.	AUM ($ M)[1]
DFNL	Davis Select Financial ETF	Jan 11, 2017	4.97	0.64%	19,367	100.00%	1.24	205.80
CACG	ClearBridge All Cap Growth ESG ETF	May 03, 2017	4.67	0.53%	16,959	100.00%	1.14	189.40
RFDI	First Trust RiverFront Dynamic Developed International ETF	Apr 13, 2016	5.72	0.83%	31,510	100.00%	0.72	166.40
AIEQ	AI Powered Equity ETF	Oct 17, 2017	7.21	0.80%	44,579	100.00%	1.47	144.80
IVAL	Alpha Architect International Quantitative Value ETF	Dec 17, 2014	7.04	0.60%	18,004	100.00%	0.74	143.10
FLLV	Franklin Liberty U.S. Low Volatility ETF	Sep 20, 2016	5.28	0.29%	12,168	88.39%	0.73	139.50
HUSV	First Trust Horizon Managed Volatility Domestic ETF	Aug 24, 2016	5.36	0.70%	40,785	100.00%	0.86	127.90
GVAL	Cambria Global Value ETF	Mar 12, 2014	7.64	0.71%	26,812	100.00%	0.93	125.10
RFDA	RiverFront Dynamic US Dividend Advantage ETF	Jun 07, 2016	5.57	0.52%	14,326	100.00%	0.84	113.00
EYLD	Cambria Emerging Shareholder Yield ETF	Jul 14, 2016	5.47	0.65%	6,928	100.00%	1.18	95.30
DGRE	WisdomTree Emerging Markets Quality Dividend Growth Fund	Aug 01, 2013	8.42	0.32%	18,844	100.00%	0.95	90.30
QMOM	Alpha Architect U.S. Quantitative Momentum ETF	Dec 02, 2015	6.08	0.49%	12,646	99.90%	1.46	85.50
HDGE	AdvisorShares Ranger Equity Bear ETF	Jan 26, 2011	10.94	5.20%	61,121	100.00%	1.67	79.50
TTAI	FCF International Quality ETF	Jun 28, 2017	4.51	0.61%	3,174	91.57%	0.38	79.20
RESP	WisdomTree US ESG Fund	Feb 23, 2007	14.86	0.28%	10,791	99.90%	0.89	77.00
HDMV	First Trust Horizon Managed Volatility Developed Intl ETF	Aug 24, 2016	5.36	0.80%	21,180	100.00%	0.69	75.10
IMOM	Alpha Architect International Quantitative Momentum ETF	Dec 23, 2015	6.03	0.60%	12,991	99.70%	0.69	68.20
AADR	AdvisorShares Dorsey Wright ADR ETF	Jul 20, 2010	11.46	1.10%	16,322	99.21%	1.20	66.70

Ticker[1]	Name[1]	Inception[1]	Age	Exp. Ratio[1]	Volume[2]	Trade Freq.	Intr. Vol.	AUM ($ M)[1]
FYLD	Cambria Foreign Shareholder Yield ETF	Dec 03, 2013	8.08	0.59%	7,759	100.00%	0.85	52.90
DBLV	AdvisorShares DoubleLine Value Equity ETF	Oct 04, 2011	10.25	0.91%	2,351	99.80%	0.73	48.20
FTHI	First Trust BuyWrite Income ETF	Jan 06, 2014	7.99	0.85%	15,024	99.80%	1.03	47.90
WBIF	WBI BullBear Value 3000 ETF	Aug 27, 2014	7.35	1.25%	9,210	100.00%	0.59	47.50
RFEM	First Trust RiverFront Dynamic Emerging Markets ETF	Jun 14, 2016	5.55	0.95%	10,187	99.31%	0.75	46.80
WBIG	WBI BullBear Yield 3000 ETF	Aug 27, 2014	7.35	1.14%	14,903	100.00%	0.63	44.40
VMOT	Alpha Architect Value Momentum Trend ETF	May 03, 2017	4.67	1.75%	14,117	100.00%	0.65	43.60
WBIL	WBI BullBear Quality 3000 ETF	Aug 25, 2014	7.36	1.25%	11,187	100.00%	0.59	42.60
UTES	Virtus Reaves Utilities ETF	Sep 23, 2015	6.28	0.49%	3,748	90.18%	0.85	40.60
RFFC	RiverFront Dynamic US Flex-Cap ETF	Jun 07, 2016	5.57	0.52%	14,916	100.00%	0.91	33.30
CWS	AdvisorShares Focused Equity ETF	Sep 20, 2016	5.28	0.66%	2,302	97.72%	0.95	31.90
RESE	WisdomTree Emerging Markets ESG Fund	Apr 07, 2016	5.74	0.32%	7,027	100.00%	0.73	27.60
SMCP	AlphaMark Actively Managed Small Cap ETF	Apr 21, 2015	6.70	1.18%	1,318	67.66%	0.38	23.70
RFEU	First Trust RiverFront Dynamic Europe ETF	Apr 14, 2016	5.72	0.83%	8,385	90.28%	0.51	21.90
YLDE	ClearBridge Dividend Strategy ESG ETF	May 22, 2017	4.61	0.60%	1,813	64.09%	0.30	19.00
FTLB	First Trust Hedged BuyWrite Income ETF	Jan 06, 2014	7.99	0.85%	3,739	90.58%	0.45	10.90
RESD	WisdomTree International ESG Fund	Nov 03, 2016	5.16	0.30%	5,827	95.34%	0.33	8.90
VWID	Virtus WMC International Dividend ETF	Oct 10, 2017	4.23	0.49%	210	44.25%	0.07	7.10
Average			**6.73**	**0.84%**	**127,645**	**96.11%**	**1.06**	**577.17**
Median			**6.18**	**0.68%**	**15,673**	**100.00%**	**0.91**	**87.90**
Min			**4.23**	**0.28%**	**210**	**44.25%**	**0.07**	**7.10**
Max			**14.86**	**5.20%**	**2,952,830**	**100.00%**	**3.12**	**12,366.60**

Notes: [1] Source: www.etfdb.com. [2] Source: www.nasdaq.com.

The average age of active ETFs approximates seven years while the oldest ETF in the sample is about 15 years old. Overall, age indicates that this section of the ETF market is relatively young. This fact might have implications for the management and performance of these funds.

The average expense ratio of active ETFs is equal to 84 basis points (bps). The minimum expense ratio is 28 bps, which is comparable to the expense ratios of several passively managed ETFs. However, the maximum expense record in the sample is 520 bps. This percentage stands as an outlier in the sample.

When it comes to trading activity, the average daily volume in Table 1 amounts to 128th. shares. It is notable that the range between the minimum and maximum volume in the sample is huge. Overall, if we focus on the median term of volumes, we can see that the daily trading activity for most of active ETFs in the sample does not exceed 16th. shares per day. This is a rather weak trading activity relative to the popular passive ETF products.

The average trading frequency is quite high at 96%. This indicates that, on average, active ETFs present only a few days of zero trading activity. However, we should note that the minimum trading frequency in the sample just exceeds 44%. Therefore, there are active ETFs whose trading activity is quite poor. This element might imply liquidity issues for the corresponding active ETFs.

With respect to intraday volatility, the respective average term in Table 1 is 1.06. The median term is even lower at 0.91. These low measures indicate that the period under study has been a rather smooth era for the active ETF market.

Finally, in regard to assets, Table 1 shows that the average active ETF in the sample managed about $577 million at the end of 2021. The largest actively managed equity ETF is the ARK Innovation ETF (ARKK), with assets exceeding $12 billion. On the other hand, the bottom record of assets in the sample is just $7 million. Overall, the rather small figure of assets, compared to the hundreds of billions managed by several successful passive ETFs, verify the long-lasting reluctance of investors to embrace actively managed ETFs.

4. Empirical Results

4.1. Raw Returns

The descriptive statistics of returns are provided in Table 2. The table presents the average and median daily returns, the standard deviation of returns, and the minimum and maximum returns. The cumulative return of each ETF over the entire study period is also presented along with the average daily and the cumulative excess return of each ETF against the S&P 500 Index, as well as the excess risk relative to the market index.

Table 2: Descriptive Statistics of Returns

This table presents the descriptive statistics of each ETF's return, namely the average daily return, the median daily return, the standard deviation of returns, and the minimum and maximum returns. In addition, the cumulative return of each ETF is presented along with the average daily and the cumulative excess return of each ETF against the S&P 500 Index, as well as the excess risk relative to the market index. The study period spans from 1/1/2018 to 31/12/2021.

Ticker	Average	Median	StDev	Min	Max	Cumulative	Daily Exc. Ret.	Cum. Exc. Ret	Excess Risk
ARKK	0.12	0.26	2.35	-15.57	10.42	145.18	0.05	68.38	1.02
ARKG	0.12	0.25	2.49	-13.76	11.16	141.39	0.05	64.59	1.15
ARKW	0.12	0.28	2.20	-15.11	9.73	149.59	0.05	72.79	0.86
EMLP	0.01	0.08	1.40	-14.05	9.28	0.85	-0.05	-75.95	0.06
ARKQ	0.10	0.22	1.89	-10.44	9.20	128.25	0.03	51.45	0.55
SECT	0.06	0.10	1.42	-13.36	16.03	62.28	-0.01	-14.52	0.08
SYLD	0.07	0.11	1.78	-10.96	12.16	67.48	0.00	-9.32	0.45

Ticker	Average	Median	StDev	Min	Max	Cumulative	Daily Exc. Ret.	Cum. Exc. Ret	Excess Risk
DUSA	0.05	0.12	1.41	-9.69	10.02	45.55	-0.02	-31.25	0.07
PHDG	0.04	0.04	0.88	-7.37	11.50	38.13	-0.03	-38.66	-0.46
DWLD	0.02	0.09	1.46	-11.23	9.36	9.14	-0.05	-67.66	0.12
AMZA	-0.07	0.00	3.22	-42.38	24.10	-70.84	-0.13	-147.64	1.88
CCOR	0.02	0.00	0.67	-5.33	5.17	21.08	-0.04	-55.72	-0.66
LRGE	0.08	0.02	1.33	-9.13	8.24	106.14	0.02	29.34	-0.01
QVAL	0.03	0.03	1.67	-11.92	10.58	19.26	-0.03	-57.54	0.33
DFNL	0.04	0.09	1.74	-13.57	12.19	28.35	-0.03	-48.45	0.40
CACG	0.07	0.13	1.38	-12.08	9.01	80.23	0.00	3.43	0.04
RFDI	0.02	0.09	1.19	-10.98	7.44	13.15	-0.05	-63.65	-0.15
AIEQ	0.06	0.17	1.46	-12.00	8.09	60.73	-0.01	-16.07	0.12
IVAL	-0.01	0.06	1.36	-11.27	10.03	-21.04	-0.08	-97.84	0.02
FLLV	0.06	0.02	1.23	-11.45	9.42	69.86	-0.01	-6.94	-0.11
HUSV	0.05	0.11	1.14	-11.08	9.56	56.72	-0.01	-20.08	-0.20
GVAL	0.00	0.09	1.31	-11.67	6.41	-11.92	-0.07	-88.72	-0.03
RFDA	0.05	0.09	1.24	-9.15	8.26	48.99	-0.02	-27.81	-0.10
EYLD	0.01	0.06	1.27	-9.43	6.60	2.31	-0.06	-74.49	-0.06
DGRE	0.01	0.11	1.39	-12.12	6.76	2.60	-0.05	-74.20	0.05
QMOM	0.08	0.22	2.02	-14.81	11.16	75.60	0.01	-1.20	0.68
HDGE	-0.10	-0.15	1.57	-11.96	11.77	-68.18	-0.17	-144.98	0.23
TTAI	0.04	0.00	1.35	-11.60	14.55	33.95	-0.03	-42.85	0.01
RESP	0.06	0.12	1.32	-9.54	8.81	59.54	-0.01	-17.26	-0.02
HDMV	0.00	0.07	0.97	-10.15	6.35	-7.97	-0.07	-84.77	-0.37
IMOM	0.02	0.04	1.41	-10.48	9.48	10.78	-0.05	-66.02	0.07
AADR	0.02	0.11	1.53	-15.35	8.96	6.55	-0.05	-70.25	0.19
FYLD	0.01	0.06	1.33	-11.18	8.91	3.07	-0.05	-73.72	-0.01
DBLV	0.04	0.07	1.24	-8.34	7.17	37.02	-0.03	-39.78	-0.10
FTHI	0.00	0.07	1.02	-7.31	7.52	-6.07	-0.07	-82.87	-0.31
WBIF	0.01	0.04	0.82	-6.12	3.59	6.45	-0.06	-70.35	-0.52
RFEM	0.00	0.06	1.44	-11.67	7.41	-6.24	-0.06	-83.04	0.10
WBIG	0.01	0.05	0.78	-6.08	2.91	2.20	-0.06	-74.60	-0.56
VMOT	0.00	0.05	0.93	-4.31	3.72	-8.19	-0.07	-84.98	-0.41
WBIL	0.02	0.05	0.81	-5.71	3.15	12.99	-0.05	-63.81	-0.53
UTES	0.05	0.03	1.34	-10.36	9.88	47.50	-0.02	-29.30	0.00
RFFC	0.05	0.11	1.35	-11.68	8.02	44.65	-0.02	-32.15	0.01
CWS	0.06	0.08	1.23	-6.98	7.71	70.20	-0.01	-6.60	-0.11
RESE	0.01	0.08	1.41	-16.49	7.74	4.23	-0.05	-72.57	0.08
SMCP	0.03	0.00	1.36	-10.04	7.65	17.95	-0.04	-58.85	0.02
RFEU	0.03	0.01	1.25	-10.98	7.35	19.02	-0.04	-57.77	-0.09
YLDE	0.05	0.00	1.16	-13.05	7.92	56.70	-0.01	-20.10	-0.17
FTLB	0.00	0.00	0.69	-4.01	5.11	-6.35	-0.07	-83.15	-0.65
RESD	0.03	0.03	1.14	-9.05	6.02	25.59	-0.04	-51.21	-0.20
VWID	0.01	0.00	1.18	-9.72	16.29	4.32	-0.05	-72.48	-0.16
Average	**0.03**	**0.08**	**1.39**	**-11.24**	**9.00**	**32.58**	**-0.03**	**-44.22**	**0.05**
Median	**0.03**	**0.07**	**1.34**	**-11.03**	**8.86**	**20.17**	**-0.04**	**-56.63**	**0.00**
Min	**-0.10**	**-0.15**	**0.67**	**-42.38**	**2.91**	**-70.84**	**-0.17**	**-147.64**	**-0.66**
Max	**0.12**	**0.28**	**3.22**	**-4.01**	**24.10**	**149.59**	**0.05**	**72.79**	**1.88**

The average daily return of active ETFs is 3 (basic points) bps, with the majority of them presenting slightly positive average daily returns. Moreover, the average cumulative return in the sample is 33%, with 80% of the funds presenting positive cumulative returns. These returns seem to be quite satisfactory. However, the majority of active ETFs fall short in the comparison with the passive market index. The average cumulative excess raw return of active ETFs relative to the S&P 500 Index is negative at -44%, whereas only six out of 50 funds present positive above-market raw returns.

The average risk estimate of active ETFs is 1.39, which is rather low. Moreover, Table 2 reports an average excess risk relative to the risk of the market of 5 bps. In addition, 25 ETFs

present risk that is higher than that of the market and 25 ETFs present the opposite. Overall, the measures of excess risk indicate that, actually, the risk of active ETFs is quite aligned to market risk.

The main conclusion that can be reached by analyzing raw returns and risks is that, on average, active ETFs cannot beat the market, even though there are limited cases in which active ETFs do outperform the market index. On the other hand, the total risk of these ETFs seems to be quite low and to be going hand-in-hand with market risk.

4.2 Single-factor Performance Analysis

The results of the single-factor performance regression analysis are reported in Table 3. The table includes the alpha and beta estimates along with t-tests on the statistical significance of estimates and R-squared on the explanatory power of the model.

Table 3: Single-Factor Performance Regression Results

This table presents the results of the single-factor performance regression model via which the daily excess return (return minus risk free rate) of each ETF is regressed on the excess return of the S&P 500 Index. Alpha reflects the above-market return that can be achieved by an ETF. Beta counts for the systematic risk of ETFs. The study period spans from 1/1/2018 to 31/12/2021.

Ticker	alpha	T-test	beta	T-test	R^2
ARKK	0.04	0.76	1.26[a]	32.80	0.52
ARKG	0.05	0.77	1.17[a]	25.81	0.40
ARKW	0.04	0.88	1.19[a]	33.44	0.53
EMLP	-0.04	-1.42	0.82[a]	39.56	0.61
ARKQ	0.03	0.86	1.12[a]	41.90	0.64
SECT	0.00	0.03	0.94[a]	59.84	0.78
SYLD	0.00	-0.01	1.10[a]	46.30	0.68
DUSA	-0.01	-0.60	0.96[a]	67.55	0.82
PHDG	0.03	1.00	0.14[a]	7.16	0.05
DWLD	-0.04[c]	-1.62	0.94[a]	53.44	0.74
AMZA	-0.15[c]	-1.75	1.33[a]	21.13	0.31
CCOR	0.01	0.62	0.14[a]	9.20	0.08
LRGE	0.03	1.33	0.86[a]	54.24	0.75
QVAL	-0.03	-1.15	1.05[a]	49.19	0.71
DFNL	-0.03	-0.84	1.07[a]	46.54	0.68
CACG	0.01	0.59	0.97[a]	92.24	0.89
RFDI	-0.03	-1.52	0.78[a]	56.20	0.76
AIEQ	0.00	-0.03	0.96[a]	57.67	0.77
IVAL	-0.07[b]	-2.67	0.83[a]	45.58	0.67
FLLV	0.01	0.56	0.83[a]	68.33	0.82
HUSV	0.00	0.23	0.78[a]	72.27	0.84
GVAL	-0.05[c]	-2.10	0.79[a]	42.49	0.64
RFDA	-0.01	-0.76	0.90[a]	119.11	0.93
EYLD	-0.02	-0.65	0.52[a]	20.86	0.30
DGRE	-0.04	-1.36	0.81[a]	39.42	0.61
QMOM	0.01	0.16	1.14[a]	36.40	0.57
HDGE	-0.04	-1.47	0.92[a]	40.82	0.62
TTAI	-0.01	-0.25	0.74[a]	34.40	0.54
RESP	0.00	-0.34	0.96[a]	124.75	0.94
HDMV	-0.04[b]	-2.53	0.61[a]	50.58	0.72
IMOM	-0.03	-0.96	0.79[a]	35.93	0.56
AADR	-0.04	-1.20	0.89[a]	39.14	0.60
FYLD	-0.04	-1.31	0.77[a]	38.43	0.60
DBLV	-0.01	-0.62	0.82[a]	60.25	0.78
FTHI	-0.04[b]	-2.22	0.64[a]	47.37	0.69
WBIF	-0.01	-0.53	0.34[a]	21.29	0.31
RFEM	-0.05[c]	-1.61	0.83[a]	38.25	0.59
WBIG	-0.01	-0.71	0.32[a]	21.03	0.31
VMOT	-0.03	-1.54	0.47[a]	29.36	0.46
WBIL	-0.01	-0.28	0.35[a]	22.21	0.33

Ticker	alpha	T-test	beta	T-test	R^2
UTES	0.01	0.28	0.63[a]	25.57	0.39
RFFC	-0.01	-1.33	0.98[a]	123.83	0.94
CWS	0.01	0.64	0.75[a]	44.82	0.67
RESE	-0.04	-1.43	0.85[a]	42.96	0.65
SMCP	-0.01	-0.24	0.56[a]	21.02	0.31
RFEU	-0.02	-0.83	0.74[a]	40.94	0.63
YLDE	0.01	0.49	0.64[a]	34.83	0.55
FTLB	-0.02	-1.28	0.30[a]	22.75	0.34
RESD	-0.02	-0.81	0.72[a]	51.49	0.73
VWID	-0.01	-0.34	0.37[a]	14.62	0.18
Average	**-0.01**	**-0.58**	**0.79**	**45.31**	**0.59**
Median	**-0.01**	**-0.63**	**0.82**	**40.88**	**0.62**
Min	**-0.15**	**-2.67**	**0.14**	**7.16**	**0.05**
Max	**0.05**	**1.33**	**1.33**	**124.75**	**0.94**

Notes: [a] indicates statistical significance at 1% level; [b] indicates statistical significance at 5% level; [c] indicates statistical significance at 10% level.

The average alpha estimate of active ETFs is slightly negative amounting to -1 bps. The majority of individual alphas are statistically insignificant, while there are only seven significant alphas, which are all negative. Overall, these results show that active ETFs in the U.S. cannot outperform the market, while there are some cases in which active ETFs actually underperform the market. This finding is in line with the findings of the raw return analysis in the previous section.

In regard to the systematic risk of active ETFs, Table 3 reports an average beta of 0.79. Furthermore, about 80% of beta coefficients are lower than unity. These results may indicate a conservatism of active ETFs relative to the market index, implying that, actually, active ETFs are not that active. However, these results might be viewed as if the active ETFs in the sample invest in stocks and markets which are not absolutely comparable to the S&P 500 Index.

4.3 Four-Factor Performance Analysis

The results of the four-factor performance regression Model (3) are provided in Table 4. The table includes the alpha coefficients along with the estimates of the explanatory variables of the model. T-tests on the statistical significance of estimates are offered too along with R-squared on the sufficiency of the model to explain the performance of active ETFs in the sample.

Table 4: Four-Factor Performance Regression Results

This table presents the results of a four-factor performance regression model via which the daily excess return of each ETF is regressed on the excess return of S&P 500 Index, the Fama & French (1992) SMB (small minus big) factor, HML (high minus low book-to-price ratio) factor, and the Carhart (1997) MOM (momentum) factor. The study period spans from 1/1/2018 to 31/12/2021.

Ticker	alpha	T-test	beta	T-test	SMB	T-test	HML	T-test	MOM	T-test	R^2
ARKK	0.01	0.28	1.28[a]	49.19	1.28[a]	26.29	-1.12[a]	-24.39	0.03	0.70	0.79
ARKG	0.01	0.29	1.19[a]	37.63	1.53[a]	25.81	-1.31[a]	-23.50	-0.03	-0.69	0.72
ARKW	0.02	0.46	1.22[a]	46.00	0.90[a]	18.07	-0.92[a]	-19.77	0.11[a]	3.09	0.75
EMLP	-0.03	-1.12	0.78[a]	42.00	0.14[a]	3.97	0.28[a]	8.71	-0.05[c]	-1.79	0.69
ARKQ	0.02	0.68	1.11[a]	51.73	0.88[a]	21.79	-0.53[a]	-13.89	0.03	0.92	0.77
SECT	0.00	0.22	0.93[a]	59.96	0.17[a]	5.96	0.07[b]	2.45	0.12[a]	5.38	0.79
SYLD	0.02	1.60	1.01[a]	87.61	0.66[a]	30.48	0.52[a]	25.77	0.01	0.75	0.93
DUSA	0.00	-0.16	0.93[a]	73.57	0.13[a]	5.53	0.21[a]	9.28	-0.01	-0.56	0.86
PHDG	0.02	0.93	0.15[a]	7.42	-0.07[c]	-1.95	-0.04	-1.15	-0.09[a]	-3.09	0.06
DWLD	-0.04[c]	-1.62	0.92[a]	53.91	0.27[a]	8.36	-0.03	-0.87	-0.02	-0.82	0.76
AMZA	-0.12[c]	-1.64	1.21[a]	21.85	1.01[a]	9.80	0.51[a]	5.23	-0.26[a]	-3.31	0.48
CCOR	0.02	0.89	0.13[a]	8.84	-0.10[a]	-3.71	0.16[a]	6.15	0.00	0.17	0.13

Ticker	alpha	T-test	beta	T-test	SMB	T-test	HML	T-test	MOM	T-test	R^2
LRGE	0.02	1.02	0.87[a]	57.35	0.06[b]	2.14	-0.22[a]	-8.22	-0.01	-0.68	0.77
QVAL	-0.02	-0.91	0.98[a]	65.47	0.52[a]	18.55	0.28[a]	10.52	-0.07[a]	-3.48	0.86
DFNL	0.00	0.09	1.00[a]	80.66	0.19[a]	8.04	0.71[a]	32.47	-0.01	-0.49	0.91
CACG	0.00	-0.01	0.99[a]	110.87	0.17[a]	9.98	-0.27[a]	-17.51	-0.03[b]	-2.25	0.93
RFDI	-0.03	-1.50	0.77[a]	55.91	0.16[a]	6.11	-0.01	-0.50	0.00	-0.05	0.77
AIEQ	-0.01	-0.40	0.96[a]	72.80	0.35[a]	14.10	-0.25[a]	-10.84	0.18[a]	9.89	0.86
IVAL	-0.06[c]	-2.61	0.81[a]	46.86	0.18[a]	5.66	0.11[a]	3.68	-0.07[a]	-2.97	0.72
FLLV	0.01	0.77	0.83[a]	68.28	-0.06[b]	-2.78	0.10[a]	4.83	0.00	0.11	0.83
HUSV	0.01	0.45	0.78[a]	74.39	-0.16[a]	-8.18	0.12[a]	6.43	0.05[a]	3.07	0.85
GVAL	-0.04[c]	-1.93	0.76[a]	44.06	0.17[a]	5.39	0.18[a]	6.02	-0.04[c]	-1.78	0.70
RFDA	-0.01	-0.79	0.89[a]	120.03	0.08[a]	5.85	-0.02[c]	-1.80	-0.03[a]	-3.02	0.94
EYLD	-0.02	-0.54	0.50[a]	20.18	0.19[a]	4.14	0.06	1.39	-0.01	-0.17	0.32
DGRE	-0.04	-1.36	0.80[a]	38.89	0.16[a]	4.21	-0.04	-1.00	-0.01	-0.49	0.61
QMOM	0.00	-0.01	1.13[a]	51.64	0.91[a]	22.18	-0.40[a]	-10.37	0.49[a]	15.98	0.80
HDGE	-0.04[b]	-2.27	0.89[a]	60.42	-0.67[a]	-24.37	0.18[a]	7.05	0.42[a]	20.72	0.85
TTAI	0.00	-0.12	0.73[a]	33.62	0.09[b]	2.22	0.08[b]	2.19	0.04	1.42	0.55
RESP	0.00	-0.18	0.95[a]	124.57	0.06[a]	4.34	0.03[b]	2.22	0.01	0.76	0.94
HDMV	-0.04[b]	-2.43	0.61[a]	49.76	0.07[a]	3.03	0.04[c]	1.78	0.02	0.94	0.72
IMOM	-0.03	-1.03	0.79[a]	36.58	0.22[a]	5.51	-0.08[b]	-2.01	0.14[a]	4.81	0.59
AADR	-0.03	-1.22	0.87[a]	42.52	0.38[a]	9.94	0.00	-0.01	0.33[a]	11.40	0.69
FYLD	-0.02	-1.02	0.73[a]	40.35	0.22[a]	6.55	0.24[a]	7.60	-0.02	-0.77	0.68
DBLV	0.00	-0.12	0.79[a]	69.50	0.19[a]	8.77	0.22[a]	10.90	-0.01	-0.78	0.85
FTHI	-0.03[c]	-1.87	0.61[a]	48.63	0.14[a]	5.92	0.21[a]	9.47	0.13[a]	7.15	0.74
WBIF	-0.01	-0.43	0.33[a]	20.63	0.17[a]	5.59	0.03	0.93	0.04[c]	1.82	0.34
RFEM	-0.05[c]	-1.64	0.82[a]	37.77	0.16[a]	3.86	-0.06	-1.46	0.00	-0.04	0.60
WBIG	-0.01	-0.59	0.31[a]	20.36	0.12[a]	4.35	0.04	1.51	0.06[b]	2.90	0.32
VMOT	-0.03[c]	-1.81	0.46[a]	32.40	0.36[a]	13.33	-0.12[a]	-4.63	0.16[a]	8.01	0.59
WBIL	-0.01	-0.26	0.34[a]	21.85	0.13[a]	4.38	-0.01	-0.53	0.06[b]	2.69	0.35
UTES	0.01	0.44	0.62[a]	25.24	-0.12[b]	-2.54	0.17[a]	3.89	0.00	0.12	0.41
RFFC	-0.01	-1.59	0.96[a]	142.00	0.24[a]	19.22	-0.07[a]	-5.53	-0.02[c]	-1.85	0.96
CWS	0.02	0.76	0.74[a]	43.99	0.08[b]	2.70	0.05	1.59	0.02	0.87	0.67
RESE	-0.04	-1.45	0.85[a]	42.41	0.13[a]	3.59	-0.04	-1.15	0.01	0.31	0.65
SMCP	0.00	-0.13	0.53[a]	20.80	0.42[a]	8.79	0.02	0.34	-0.09[b]	-2.42	0.38
RFEU	-0.02	-0.76	0.73[a]	40.29	0.09[b]	2.74	0.03	1.03	-0.02	-0.98	0.63
YLDE	0.02	0.80	0.62[a]	34.74	0.03	0.92	0.19[a]	5.88	-0.01	-0.49	0.58
FTLB	-0.02	-0.98	0.28[a]	22.16	0.16[a]	6.65	0.13[a]	5.86	0.12[a]	6.91	0.41
RESD	-0.01	-0.71	0.71[a]	51.26	0.13[a]	5.14	0.03	1.15	-0.02	-1.14	0.74
VWID	-0.01	-0.28	0.36[a]	14.10	0.10[b]	2.15	0.03	0.68	-0.02	-0.53	0.18
Average	**-0.01**	**-0.52**	**0.77**	**50.46**	**0.25**	**6.97**	**-0.01**	**0.76**	**0.03**	**1.52**	**0.66**
Median	**-0.01**	**-0.41**	**0.80**	**45.03**	**0.16**	**5.56**	**0.03**	**1.27**	**0.00**	**0.03**	**0.72**
Min	**-0.12**	**-2.61**	**0.13**	**7.42**	**-0.67**	**-24.37**	**-1.31**	**-24.39**	**-0.26**	**-3.48**	**0.06**
Max	**0.02**	**1.60**	**1.28**	**142.00**	**1.53**	**30.48**	**0.71**	**32.47**	**0.49**	**20.72**	**0.96**

Notes: a indicates statistical significance at 1% level; b indicates statistical significance at 5% level; c indicates statistical significance at 10% level.

The results on the above-market return of active ETFs are in line with those derived from the single-factor model. The average alpha is slightly negative at -0.01, with 41 out of 50 individual alphas being insignificant. In addition, there are nine cases in which alphas are significantly negative. These negative alphas indicate that the corresponding active ETFs underperform the market index.

The estimates of systematic risk are essentially equal to those obtained from the single-factor performance regression model. The average beta is equal to 0.77 (it was 0.79 in the single-factor market model above). In addition, the average difference in betas between the single- and the multi-factor models is 0.02 (not reported in Table 4). The estimates of systematic risk obtained via the four-factor model verify the conclusion reached through the single-factor regression analysis, that is, the examined active ETFs are either more

conservative that the S&P 500 index, or this index does not explain the performance of active ETFs in the best way.

The results on size factor reveal a positive relationship between the performance of active ETFs with this factor. There are only six SMB estimates which are significantly negative, while, with just one exception, all other estimates are positive and significant at 10% or better. The average SMB estimate of the sample is 0.25. This means that, on average terms, 25% of the performance of the average active ETF can be explained by the size factor suggested by Fama and French (1992).

This positive correlation between active ETFs' return and the size factor may be the result of active ETFs being small-cap portfolios themselves. Alternatively, it can indicate that the active ETFs choose to invest in companies with a small capitalization, which are supposed to perform better than the large-cap companies. As the size factor of Fama and French implies that small-cap entities beat the larger ones, our results seem to verify this assumption.

When it comes to the relationship between active ETFs' performance and the value factor, the average HML estimate offered by the four-factor model is not materially different from zero (being equal to -0.01). Based on this average term, we can claim that there is not a material relationship between the performance of actively managed ETFs and the Fama and French value factor.

At the fund level, there are 34 significant HML estimates, of which 22 are positive and 12 are negative. Significantly positive HML estimates mean that that the corresponding actively managed ETF portfolios have a positive relationship with the value premium suggested by Fama and French (1992). Alternatively, the positive estimates of the value factor indicate that the corresponding ETF portfolios are more exposed to value stocks. The opposite is the case for active ETFs with significantly negative HML estimates. However, the variation in significant estimates shows that there is not a consistent relationship between performance and the value factor. This relationship rather seems to be fund specific.

With respect to the impact of the market momentum factor on the performance of active ETFs, the empirical findings show that this relationship is not consistent either. At first, the average MOM estimate of the sample is equal to 0.03, that is just 3 basis points above zero. Based on this result, we can say that just 3% of the performance of the average active ETF can be explained by the momentum factor suggested by Carhart (1997).

In regard to individual momentum estimates, Table 4 includes 24 out of 50 MOM estimates which are statistically significant at 10% or better. 14 of them are positive and 10 are negative. As the MOM factor refers to winning and losing stocks based on their past performance, a positive MOM estimate indicates that the corresponding active ETF portfolios are heavier to equities with positive past returns that those ETF portfolios with negative MOM estimates. However, based on the variation in the individual MOM estimates we cannot reach a unique inference about the impact of market momentum on returns achieved by active ETFs. At best, the relationship between performance and the momentum factor is fund specific, as it was the relationship with the value factor.

4.4 Six-Factor Performance Analysis

The results of the six-factor performance regression Model (4) are provided in Table 5. The table includes the alpha coefficients along with the estimates of the explanatory variables of the model. T-tests on the statistical significance of estimates are offered too along with R-squared on the sufficiency of the model to explain the performance of active ETFs in the sample.

Table 5: Six-Factor Performance Regression Results

This table presents the results of a six-factor performance regression model via which the daily excess return of each ETF is regressed on the excess return of S&P 500 Index, the Fama & French (2015) SMB (small minus big) factor, HML (high minus low book-to-price ratio) factor, the RMW (robust minus weak) factor, the CMA (conservative minus aggressive) factor, and the Carhart (1997) MOM (momentum) factor. The study period spans from 1/1/2018 to 31/12/2021.

Ticker	alpha	T-test	beta	T-test	SMB	T-test	HML	T-test	RMW	T-test	CMA	T-test	MOM	T-test	R^2
ARKK	0.05	1.54	1.24[a]	53.69	0.96[a]	21.48	-0.71[a]	-14.95	-1.12[a]	-16.65	-0.63[a]	-7.13	-0.04	-1.28	0.84
ARKG	0.05	1.40	1.20[a]	42.34	1.14[a]	20.71	-1.02[a]	-17.36	-1.53[a]	-18.53	0.00	0.01	-0.18[a]	-4.49	0.79
ARKW	0.05	1.48	1.15[a]	46.74	0.66[a]	13.75	-0.48[a]	-9.47	-0.74[a]	-10.29	-0.99[a]	-10.60	0.11[a]	3.15	0.80
EMLP	-0.02	-0.92	0.80[a]	41.70	0.07[c]	1.96	0.28[a]	7.18	-0.30[a]	-5.36	0.19[b]	2.67	-0.09[a]	-3.29	0.70
ARKQ	0.03	1.24	1.09[a]	50.32	0.75[a]	17.87	-0.34[a]	-7.63	-0.43[a]	-6.80	-0.34[a]	-4.14	0.01	0.29	0.79
SECT	0.01	0.57	0.93[a]	58.66	0.10[a]	3.29	0.12[a]	3.61	-0.28[a]	-6.16	0.01	0.17	0.09[a]	3.98	0.80
SYLD	0.02	1.27	1.02[a]	86.26	0.70[a]	30.62	0.45[a]	18.30	0.14[a]	4.04	0.16[a]	3.66	0.01	0.88	0.93
DUSA	0.01	0.31	0.90[a]	71.34	0.08[a]	3.28	0.35[a]	13.62	-0.11[a]	-3.04	-0.42[a]	-8.70	0.01	0.39	0.87
PHDG	0.02	0.86	0.17[a]	7.95	-0.07[c]	-1.70	-0.10[b]	-2.41	-0.03	-0.48	0.23[a]	2.86	-0.11[a]	-3.57	0.07
DWLD	-0.03	-1.24	0.90[a]	51.48	0.20[a]	5.92	0.13[a]	3.68	-0.19[a]	-3.67	-0.41[a]	-6.13	-0.01	-0.45	0.77
AMZA	-0.09	-1.30	1.18[a]	20.79	0.78[a]	7.07	0.81[a]	6.87	-0.84[a]	-5.06	-0.45[b]	-2.09	-0.31[a]	-3.85	0.50
CCOR	0.01	0.60	0.17[a]	11.07	-0.07[b]	-2.51	0.01	0.47	0.02	0.47	0.47[a]	8.25	-0.03	-1.21	0.19
LRGE	0.02	1.11	0.86[a]	54.30	0.05[c]	1.74	-0.17[a]	-5.21	0.00	0.11	-0.17[b]	-2.79	0.00	-0.13	0.77
QVAL	-0.03	-1.38	0.99[a]	64.69	0.60[a]	20.45	0.19[a]	6.05	0.31[a]	6.93	0.10[c]	1.64	-0.05[b]	-2.32	0.86
DFNL	0.01	0.85	0.97[a]	81.07	0.10[a]	4.24	0.88[a]	35.91	-0.26[a]	-7.43	-0.42[a]	-9.32	-0.01	-0.33	0.92
CACG	0.00	0.36	0.97[a]	107.09	0.13[a]	7.69	-0.20[a]	-10.72	-0.08[a]	-3.10	-0.19[a]	-5.54	-0.02[c]	-1.83	0.93
RFDI	-0.02	-1.35	0.76[a]	53.43	0.13[a]	4.82	0.02	0.64	-0.08[c]	-1.96	-0.05	-0.93	-0.01	-0.28	0.77
AIEQ	0.00	0.17	0.97[a]	74.35	0.25[a]	9.74	-0.19[a]	-7.07	-0.42[a]	-10.99	0.06	1.18	0.14[a]	7.60	0.87
IVAL	-0.06[b]	-2.51	0.80[a]	44.53	0.17[a]	4.79	0.15[a]	3.99	-0.04	-0.81	-0.09	-1.38	-0.07[b]	-2.76	0.72
FLLV	0.01	0.67	0.83[a]	65.60	-0.05[b]	-2.00	0.08[a]	3.19	0.05	1.32	0.04	0.73	0.00	0.24	0.83
HUSV	0.00	0.05	0.80[a]	74.88	-0.12[a]	-5.89	0.02	1.07	0.10[a]	3.24	0.25[a]	6.20	0.04[b]	2.56	0.86
GVAL	-0.04[c]	-1.75	0.75[a]	42.20	0.13[a]	3.91	0.22[a]	6.05	-0.14[b]	-2.68	-0.05	-0.70	-0.05[b]	-2.12	0.70
RFDA	-0.01	-1.14	0.90[a]	117.35	0.11[a]	7.37	-0.07[a]	-4.26	0.09[a]	4.10	0.09[a]	2.98	-0.03[b]	-2.64	0.94
EYLD	-0.01	-0.34	0.49[a]	18.95	0.14[b]	2.75	0.15[a]	2.80	-0.18[b]	-2.38	-0.18[c]	-1.82	-0.01	-0.31	0.33
DGRE	-0.03	-1.16	0.79[a]	36.90	0.12[a]	2.80	0.04	0.96	-0.15[b]	-2.37	-0.17[b]	-2.05	-0.02	-0.58	0.62
QMOM	0.02	0.66	1.11[a]	51.24	0.74[a]	17.78	-0.18[a]	-4.16	-0.57[a]	-9.08	-0.35[a]	-4.21	0.45[a]	15.07	0.82
HDGE	-0.05[b]	-2.46	0.88[a]	57.69	-0.64[a]	-21.59	0.13[a]	4.24	0.10[b]	2.35	0.09[c]	1.64	0.43[a]	20.08	0.85
TTAI	0.00	0.09	0.72[a]	31.97	0.04	0.86	0.16[a]	3.40	-0.18[b]	-2.72	-0.13	-1.56	0.03	1.10	0.55
RESP	0.00	-0.28	0.95[a]	119.57	0.07[a]	4.58	0.02	1.00	0.03	1.21	0.03	0.87	0.01	0.81	0.94

Notes: [a] indicates statistical significance at 1% level; [b] indicates statistical significance at 5% level; [c] indicates statistical significance at 10% level.

Table 5: Six-Factor Performance Regression Results

Ticker	alpha	T-test	beta	T-test	SMB	T-test	HML	T-test	RMW	T-test	CMA	T-test	MOM	T-test	R^2
HDMV	-0.04[b]	-2.42	0.61[a]	48.34	0.06[b]	2.47	0.02	0.71	-0.05	-1.45	0.10[b]	2.04	0.00	0.25	0.72
IMOM	-0.02	-0.77	0.78[a]	35.03	0.16[a]	3.61	0.00	0.05	-0.24[a]	-3.67	-0.11	-1.28	0.13[a]	4.13	0.60
AADR	-0.02	-0.89	0.86[a]	40.98	0.29[a]	7.23	0.10[b]	2.29	-0.31[a]	-5.05	-0.13[c]	-1.69	0.30[a]	10.37	0.70
FYLD	-0.02	-0.79	0.72[a]	38.33	0.18[a]	4.88	0.31[a]	8.14	-0.14[b]	-2.63	-0.15[b]	-2.13	-0.02	-0.88	0.68
DBLV	0.00	-0.06	0.79[a]	67.16	0.17[a]	7.53	0.21[a]	8.61	-0.07[b]	-2.01	0.07	1.54	-0.02	-1.43	0.85
FTHI	-0.03[c]	-1.87	0.62[a]	47.18	0.13[a]	5.26	0.19[a]	7.02	-0.04	-1.13	0.09[c]	1.86	0.12[a]	6.29	0.74
WBIF	-0.01	-0.61	0.35[a]	20.98	0.19[a]	5.90	-0.05	-1.59	0.04	0.73	0.24[a]	3.86	0.03	1.20	0.35
RFEM	-0.04	-1.41	0.81[a]	35.79	0.10[b]	2.31	0.04	0.93	-0.18[b]	-2.70	-0.22[b]	-2.51	0.00	-0.13	0.61
WBIG	-0.02	-0.82	0.34[a]	21.44	0.15[a]	4.78	-0.07[b]	-2.01	0.01	0.22	0.34[a]	5.76	0.04[c]	1.83	0.35
VMOT	-0.03[c]	-1.65	0.47[a]	31.67	0.32[a]	11.16	-0.11[a]	-3.55	-0.16[a]	-3.66	0.07	1.30	0.14[a]	6.74	0.59
WBIL	-0.01	-0.49	0.36[a]	22.15	0.16[a]	5.13	-0.10[a]	-3.01	0.08[c]	1.66	0.23[a]	3.82	0.05[b]	2.25	0.36
UTES	0.01	0.32	0.64[a]	25.04	-0.10[c]	-1.95	0.08	1.54	0.02	0.31	0.27[a]	2.80	-0.01	-0.33	0.41
RFFC	-0.02[c]	-1.71	0.96[a]	136.05	0.26[a]	18.87	-0.06[a]	-4.41	0.06[a]	3.08	-0.05[c]	-1.72	-0.01	-0.85	0.96
CWS	0.02	0.74	0.74[a]	42.05	0.09[b]	2.64	0.05	1.27	0.02	0.41	-0.01	-0.14	0.02	0.94	0.67
RESE	-0.03	-1.23	0.84[a]	40.55	0.08[b]	2.06	0.02	0.55	-0.18[a]	-3.01	-0.10	-1.23	0.00	-0.09	0.66
SMCP	0.00	-0.01	0.54[a]	20.47	0.37[a]	7.16	0.02	0.31	-0.23[a]	-3.04	0.14	1.42	-0.12[a]	-3.19	0.39
RFEU	-0.01	-0.60	0.72[a]	38.32	0.06[c]	1.70	0.08[b]	2.10	-0.10[c]	-1.81	-0.10	-1.38	-0.03	-1.06	0.64
YLDE	0.02	0.69	0.63[a]	33.93	0.05	1.31	0.13[a]	3.46	0.03	0.60	0.15[b]	2.15	-0.02	-0.74	0.59
FTLB	-0.02	-0.96	0.29[a]	21.75	0.15[a]	5.79	0.12[a]	4.26	-0.05	-1.41	0.08[c]	1.65	0.11[a]	6.04	0.41
RESD	-0.01	-0.67	0.71[a]	48.85	0.13[a]	4.60	0.04	1.43	-0.01	-0.17	-0.04	-0.79	-0.02	-0.98	0.74
VWID	-0.01	-0.25	0.37[a]	13.85	0.08[c]	1.65	0.01	0.26	-0.09	-1.21	0.11	1.12	-0.04	-0.95	0.19
Average	**-0.01**	**-0.36**	**0.77**	**49.36**	**0.21**	**5.80**	**0.04**	**1.36**	**-0.17**	**-2.44**	**-0.05**	**-0.40**	**0.02**	**1.08**	**0.67**
Median	**-0.01**	**-0.41**	**0.80**	**43.43**	**0.13**	**4.69**	**0.04**	**1.04**	**-0.09**	**-1.99**	**0.00**	**-0.07**	**0.00**	**-0.20**	**0.72**
Min	**-0.09**	**-2.51**	**0.17**	**7.95**	**-0.64**	**-21.59**	**-1.02**	**-17.36**	**-1.53**	**-18.53**	**-0.99**	**-10.60**	**-0.31**	**-4.49**	**0.07**
Max	**0.05**	**1.54**	**1.24**	**136.05**	**1.14**	**30.62**	**0.88**	**35.91**	**0.31**	**6.93**	**0.47**	**8.25**	**0.45**	**20.08**	**0.96**

Notes: [a] indicates statistical significance at 1% level; [b] indicates statistical significance at 5% level; [c] indicates statistical significance at 10% level.

The results on the above-market return of active ETFs are not different from those derived from the single-factor model and the four-factor model. The average alpha is slightly negative, with the majority of individual alpha estimates being insignificant. In addition, there are seven cases in which alphas are significantly negative showing that these funds underperform the market index.

The estimates of systematic risk are essentially equal to those obtained from the single-factor and the four-factor performance regression models. The average beta is equal to 0.77 (it was 0.79 in the single-factor model and 0.77 in the four-factor model in the previous two sections, respectively). In addition, the average difference in betas between the single- and the multi-factor models is 0.02 (not reported in Table 4). Based on these results, we re-confirm the conservatism of the examined active ETFs relative to the S&P 500 Index found via the single-factor and the four-factor regression analysis of performance.

The results on size factor reveal a positive relationship between the performance of active ETFs with this factor. There are only six SMB estimates which are significantly negative, while, with just one exception, all other estimates are positive and significant at 10% or better. The average SMB estimate is equal to 0.21 being slightly different from that obtained via the four-factor model which was equal to 0.25. Once again, this average estimates verifies that a significant portion of active ETFs' performance can be explained by the size factor of Fama and French (1992). The explanations offered to the corresponding positive relationship between performance and the size factor revealed by the four-factor model apply to the six-factor model too.

In regard to the relationship between active ETFs' performance and the value factor, 21 and 13 significantly positive and negative HML estimates, respectively are found in Table 5. We remind that similar results were obtained when we examined the four-factor model in the previous section. Therefore, the conclusion about a rather fund specific relationship between the performance of active ETFs and the value factor is verified by the results of the six-factor model.

On the impact on ETF performance by the Robust Minus Weak factor, the results reveal a negative such effect for 27 ETFs in the sample and a positive relationship in 7 cases. The rest RMW estimates are insignificant. The negative sign for the majority of the significant estimates in the sample is in line with our expectations about a negative relationship between the performance of ETFs and the RMW factor.

It should be noted that a positive value in RMW factor means that firms with higher profitability earn better results. Therefore, a negative sign for the RMW factor means that companies of lower profitability achieve lower returns too. In our case, the results indicate that more than half of the examined active ETFs are exposed to companies with poor profitability records.

When it comes to the Conservative Minus Aggressive (CMA) factor, the results indicate that there is not a monotonic relationship between the return of active ETFs and this factor. 16 significantly negative estimates of the CAM factor are obtained and 15 significantly positive. Based on these results, our assumption about a negative impact on the performance of active ETFs by the CMA factor is only partially verified.

Given that the CMA factor stands for the difference in returns between firms with low and high investment policies, the positive CMA estimates indicate that the corresponding ETFs are exposed to companies with significant investment plans. The opposite is the case for those active ETFs with significantly negative CMA coefficients.

With respect to the impact of the market momentum factor on the performance of active ETFs, the empirical findings show that this relationship is not consistent either. Specifically, 10 MOM estimates are negative and significant and 13 are significantly positive. Therefore, more than half of estimates are not statistically significant at any acceptable level. Similar

results offered the four-factor model in the previous section. Therefore, once again, we cannot make a solid inference about the relationship between the performance of actively managed ETFs and the momentum factor. As we have already pointed out, this relationship is rather fund specific.

4.5 Market Timing Analysis

This section discusses the regression results on the timing skills of active ETF managers. The results of the Treynor and Mazuy (1966) model are reported in Table 6. The alphas, betas and gammas of the model are presented along with t-tests on the significance of estimates and R-squared used to assess the ability of the model to explain the market timing ability of managers.

Table 6: Market Timing Regression Results - Treynor and Mazuy Model
This table presents the results of the Treynor and Mazuy (1966) Model on the timing ability of ETF managers. The daily excess return of each ETF is regressed on the excess return of the S&P 500 Index and the squared excess return of the index. The study period spans from 1/1/2018 to 31/12/2021.

Panel A: Active ETFs

Ticker	alpha	T-test	beta	T-test	gamma	T-test	R^2
ARKK	0.07	1.41	1.25[a]	32.21	-0.02[a]	-2.84	0.52
ARKG	0.08	1.28	1.16[a]	25.31	-0.02[b]	-2.28	0.40
ARKW	0.07	1.48	1.18[a]	32.86	-0.02[b]	-2.63	0.53
EMLP	0.00	0.07	0.80[a]	39.07	-0.02[a]	-6.29	0.62
ARKQ	0.04	1.17	1.12[a]	41.33	-0.01	-1.43	0.64
SECT	-0.01	-0.31	0.94[a]	59.50	0.00	1.43	0.78
SYLD	0.00	0.11	1.10[a]	45.78	0.00	-0.51	0.68
DUSA	0.00	-0.23	0.95[a]	66.75	0.00	-1.49	0.82
PHDG	-0.04	-1.41	0.17[a]	8.88	0.03[a]	10.38	0.14
DWLD	-0.02	-0.76	0.93[a]	52.76	-0.01[a]	-3.53	0.74
AMZA	0.00	0.06	1.27[a]	20.48	-0.08[a]	-7.72	0.35
CCOR	-0.04[c]	-1.84	0.16[a]	11.05	0.03[a]	10.56	0.17
LRGE	0.03	1.53	0.86[a]	53.59	0.00	-1.04	0.75
QVAL	-0.02	-0.71	1.04[a]	48.54	-0.01[c]	-1.72	0.71
DFNL	-0.02	-0.53	1.07[a]	45.95	0.00	-1.21	0.68
CACG	0.01	0.83	0.97[a]	91.23	0.00	-1.07	0.89
RFDI	0.00	-0.21	0.76[a]	55.72	-0.01[a]	-5.48	0.77
AIEQ	0.02	0.69	0.95[a]	56.94	-0.01[a]	-3.07	0.77
IVAL	-0.04[c]	-1.75	0.82[a]	44.93	-0.01[a]	-3.66	0.68
FLLV	0.01	0.67	0.83[a]	67.59	0.00	-0.51	0.82
HUSV	0.01	0.72	0.78[a]	71.42	0.00[b]	-2.11	0.84
GVAL	-0.01	-0.22	0.77[a]	42.30	-0.03[a]	-8.03	0.66
RFDA	-0.01	-0.90	0.90[a]	118.06	0.00	0.72	0.93
EYLD	0.02	0.59	0.51[a]	20.22	-0.02[a]	-5.21	0.32
DGRE	-0.01	-0.18	0.80[a]	38.83	-0.02[a]	-4.91	0.62
QMOM	0.02	0.52	1.13[a]	35.86	-0.01	-1.58	0.57
HDGE	-0.07[b]	-2.23	0.91[a]	40.18	0.01[a]	3.37	0.63
TTAI	0.02	0.60	0.73[a]	33.79	-0.01[a]	-3.63	0.55
RESP	0.00	-0.09	0.95[a]	123.44	0.00	-1.01	0.94
HDMV	-0.01	-0.86	0.60[a]	50.35	-0.01[a]	-7.09	0.73
IMOM	-0.01	-0.23	0.78[a]	35.33	-0.01[a]	-3.02	0.57
AADR	-0.02	-0.58	0.88[a]	38.54	-0.01[b]	-2.51	0.61
FYLD	0.00	0.16	0.75[a]	37.92	-0.02[a]	-6.22	0.61
DBLV	0.00	0.06	0.81[a]	59.50	-0.01[a]	-2.82	0.78
FTHI	-0.04[b]	-2.10	0.64[a]	46.87	0.00	-0.25	0.69
WBIF	-0.01	-0.28	0.34[a]	20.95	0.00	-1.01	0.31
RFEM	-0.02	-0.60	0.82[a]	37.62	-0.02[a]	-4.20	0.60
WBIG	-0.01	-0.37	0.32[a]	20.65	0.00	-1.36	0.31
VMOT	-0.02	-0.98	0.47[a]	28.84	-0.01[b]	-2.19	0.46
WBIL	0.00	-0.12	0.35[a]	21.90	0.00	-0.67	0.33
UTES	0.02	0.64	0.62[a]	25.13	-0.01	-1.59	0.40

Panel A: Active ETFs							
Ticker	**alpha**	**T-test**	**beta**	**T-test**	**gamma**	**T-test**	**R^2**
RFFC	0.00	-0.03	0.97[a]	123.67	-0.01[a]	-5.48	0.94
CWS	0.02	0.68	0.75[a]	44.34	0.00	-0.22	0.67
RESE	0.00	-0.02	0.83[a]	42.46	-0.02[a]	-5.94	0.66
SMCP	0.05	1.29	0.54[a]	20.36	-0.03[a]	-6.52	0.33
RFEU	0.01	0.40	0.73[a]	40.37	-0.02[a]	-5.19	0.63
YLDE	0.03	1.05	0.64[a]	34.25	-0.01[b]	-2.48	0.55
FTLB	-0.02	-0.84	0.30[a]	22.32	0.00[c]	-1.70	0.34
RESD	0.00	0.21	0.72[a]	50.86	-0.01[a]	-4.30	0.73
VWID	0.05[a]	1.61	0.34[a]	13.82	-0.04[a]	-8.34	0.23
Average	**0.00**	**-0.01**	**0.78**	**44.81**	**-0.01**	**-2.39**	**0.60**
Median	**0.00**	**-0.02**	**0.81**	**40.27**	**-0.01**	**-2.38**	**0.63**
Min	**-0.07**	**-2.23**	**0.16**	**8.88**	**-0.08**	**-8.34**	**0.14**
Max	**0.08**	**1.61**	**1.27**	**123.67**	**0.03**	**10.56**	**0.94**

Notes: [a] indicates statistical significance at 1% level; [b] indicates statistical significance at 5% level; [c] indicates statistical significance at 10% level.

In the case of active ETFs, the majority of alphas are not statistically significant. Only 5 alphas are significant, with just one of them being positive. Beta estimates are all significant and quite close to those obtained from the single-factor and the six-factor regression models of performance in the previous sections. When it comes to the ability of active ETF managers to time the market, 60% (30 out 50) of the gamma estimates in Table 5 are negative and significant. The average gamma in the sample is also negative. On the other hand, there are just 3 gammas that are positive and significant. Based on these findings, we may infer that the active ETF managers do not display any spectacular market timing skill.

The results of the Jagannathan and Korajczyk (1986) model on the market timing skills of active ETF managers are exhibited in Table 7. We remind that the main difference of this model from the previous one is that this model also includes a cubic excess-market return component, seeking to capture the response of ETF managers to market volatility.

Table 7: Market Timing Regression Results – Jagannathan and Korajczyk Model
This table presents the results of the Jagannathan and Korajczyk (1986) Model on the timing ability of ETF managers. The daily excess return of each ETF is regressed on the excess return of the S&P 500 Index and the squared and cubic excess returns of the index. The study period spans from 1/1/2018 to 31/12/2021.

Ticker	**alpha**	**T-test**	**beta**	**T-test**	**gamma**	**T-test**	**delta**	**T-test**	**R^2**
ARKK	0.08	1.48	1.36[a]	27.76	-0.03[a]	-3.87	0.00[a]	-3.73	0.53
ARKG	0.08	1.32	1.25[a]	21.54	-0.02[a]	-2.97	0.00[b]	-2.60	0.41
ARKW	0.07	1.54	1.27[a]	28.02	-0.02[a]	-3.56	0.00[a]	-3.38	0.54
EMLP	0.00	-0.04	0.69[a]	27.18	-0.01[a]	-4.04	0.00[a]	6.69	0.64
ARKQ	0.05	1.32	1.27[a]	37.83	-0.02[a]	-3.66	0.00[a]	-7.34	0.66
SECT	-0.01	-0.30	0.95[a]	47.02	0.00	1.19	0.00	-0.55	0.78
SYLD	0.00	0.14	1.13[a]	37.06	0.00	-1.03	0.00[c]	-1.78	0.68
DUSA	0.00	-0.17	1.00[a]	55.08	-0.01[b]	-2.60	0.00[a]	-3.78	0.82
PHDG	-0.03	-1.36	0.45[a]	22.04	0.02[a]	5.23	-0.01[a]	-21.90	0.42
DWLD	-0.02	-0.70	0.99[a]	44.32	-0.01[a]	-4.67	0.00[a]	-4.16	0.75
AMZA	0.01	0.09	1.37[a]	17.35	-0.09[a]	-7.98	0.00[b]	-2.03	0.35
CCOR	-0.03[c]	-1.78	0.23[a]	12.82	0.02[a]	8.26	0.00[a]	-6.41	0.20
LRGE	0.03	1.58	0.89[a]	43.69	-0.01	-1.75	0.00[b]	-2.46	0.75
QVAL	-0.02	-0.69	1.07[a]	39.05	-0.01[b]	-2.10	0.00	-1.50	0.71
DFNL	-0.02	-0.57	1.02[a]	34.57	0.00	-0.36	0.00[b]	2.56	0.69
CACG	0.01	0.85	0.98[a]	72.33	0.00	-1.38	0.00	-1.16	0.89
RFDI	0.00	-0.18	0.79[a]	45.01	-0.01[a]	-5.83	0.00[c]	-1.96	0.77
AIEQ	0.02	0.72	0.98[a]	46.12	-0.01[a]	-3.60	0.00[b]	-2.18	0.77
IVAL	-0.04[c]	-1.78	0.80[a]	34.14	-0.01[a]	-2.90	0.00[c]	1.88	0.68
FLLV	0.01	0.57	0.76[a]	49.97	0.00	1.66	0.00[a]	6.99	0.83
HUSV	0.01	0.61	0.71[a]	52.86	0.00	0.36	0.00[a]	7.83	0.85

Ticker	alpha	T-test	beta	T-test	gamma	T-test	delta	T-test	R^2
GVAL	-0.01	-0.26	0.73[a]	31.90	-0.02[a]	-6.97	0.00[b]	2.20	0.67
RFDA	-0.01	-0.78	0.96[a]	104.78	0.00[b]	-2.66	0.00[a]	-10.95	0.94
EYLD	0.02	0.61	0.53[a]	16.77	-0.02[a]	-5.41	0.00	-1.44	0.32
DGRE	-0.01	-0.20	0.79[a]	30.01	-0.02[a]	-4.44	0.00	0.74	0.62
QMOM	0.02	0.56	1.18[a]	29.50	-0.01[b]	-2.15	0.00[b]	-2.10	0.57
HDGE	-0.07[b]	-2.29	0.97[a]	33.64	0.02[a]	4.19	0.00[a]	3.17	0.63
TTAI	0.02	0.55	0.67[a]	24.41	-0.01[b]	-2.35	0.00[a]	3.66	0.55
RESP	0.00	0.01	0.99[a]	102.73	0.00[a]	-2.95	0.00[a]	-6.39	0.94
HDMV	-0.01	-0.90	0.58[a]	38.14	-0.01[a]	-6.03	0.00[b]	2.37	0.73
IMOM	-0.01	-0.25	0.76[a]	26.94	-0.01[b]	-2.47	0.00	1.28	0.57
AADR	-0.02	-0.55	0.91[a]	31.32	-0.01[a]	-2.91	0.00[c]	-1.69	0.61
FYLD	0.00	0.12	0.71[a]	28.24	-0.02[a]	-5.13	0.00[b]	2.59	0.61
DBLV	0.00	0.18	0.89[a]	52.62	-0.01[a]	-5.08	0.00[a]	-7.51	0.80
FTHI	-0.04[b]	-2.06	0.67[a]	38.93	0.00	-1.22	0.00[a]	-3.19	0.69
WBIF	0.00	-0.03	0.54[a]	30.21	-0.02[a]	-6.72	-0.01[a]	-18.17	0.48
RFEM	-0.02	-0.61	0.80[a]	29.02	-0.01[a]	-3.74	0.00	0.81	0.60
WBIG	0.00	-0.14	0.51[a]	29.39	-0.02[a]	-6.90	-0.01[a]	-17.54	0.47
VMOT	-0.02	-0.85	0.63[a]	33.11	-0.02[a]	-6.50	0.00[a]	-13.67	0.55
WBIL	0.00	0.16	0.55[a]	31.32	-0.02[a]	-6.44	-0.01[a]	-18.45	0.50
UTES	0.02	0.57	0.53[a]	16.98	0.00	-0.06	0.00[a]	4.77	0.41
RFFC	0.00	0.08	1.01[a]	103.12	-0.01[a]	-7.34	0.00[a]	-6.55	0.94
CWS	0.02	0.73	0.79[a]	37.01	0.00	-1.23	0.00[a]	-3.29	0.67
RESE	0.00	-0.10	0.76[a]	30.68	-0.01[a]	-4.21	0.00[a]	4.86	0.67
SMCP	0.05	1.37	0.63[a]	18.95	-0.04[a]	-7.67	0.00[a]	-4.54	0.35
RFEU	0.01	0.36	0.69[a]	30.25	-0.01[a]	-4.19	0.00[b]	2.44	0.64
YLDE	0.02	0.97	0.53[a]	23.07	0.00	-0.17	0.00[a]	7.26	0.57
FTLB	-0.01	-0.75	0.37[a]	22.15	-0.01[a]	-3.77	0.00[a]	-6.83	0.37
RESD	0.00	0.22	0.72[a]	40.05	-0.01[a]	-4.16	0.00	-0.24	0.73
VWID	0.06[a]	1.65	0.38[a]	12.12	-0.04[a]	-8.57	0.00[b]	-2.03	0.23
Average	**0.00**	**0.02**	**0.81**	**37.46**	**-0.01**	**-3.06**	**0.00**	**-2.59**	**0.62**
Median	**0.00**	**0.04**	**0.79**	**31.61**	**-0.01**	**-3.58**	**0.00**	**-1.99**	**0.64**
Min	**-0.07**	**-2.29**	**0.23**	**12.12**	**-0.09**	**-8.57**	**-0.01**	**-21.90**	**0.20**
Max	**0.08**	**1.65**	**1.37**	**104.78**	**0.02**	**8.26**	**0.00**	**7.83**	**0.94**

Notes: [a] indicates statistical significance at 1% level; [b] indicates statistical significance at 5% level; [c] indicates statistical significance at 10% level.

Alphas, betas and gammas of active ETFs are similar to those derived from the Treynor and Mazuy (1966) model. The majority of alphas are insignificant, betas are lower than unity, and gammas, with just three exceptions, are either significantly negative or insignificant. When it comes to market volatility, the majority of deltas (28 out of 50 estimates) are negative and significant indicating that the managers of the corresponding ETFs fail to time the volatility of the market. However, there are 17 cases in which deltas are positive and significant, even though their magnitude is small. In these cases, we may conclude the managers can, in some degree, time the volatility of the market.

5. Conclusion

This study is an expansion to our previous work on actively managed ETFs. It offers new empirical insights on the question about whether active management can add value for investors. Standard research issues are examined for a sample of 50 active equity ETFs traded in the U.S. The issues investigated concern the performance of these funds and their ability to beat the market. The capability of fund managers to apply efficient market timing techniques is evaluated too.

The results obtained are in line with those in the previous studies on actively managed ETFs. In particular, in most of the cases, active ETFs cannot beat the S&P 500 Index. This inference is supported both a raw analysis of returns and a single-factor regression analysis of performance. However, their total risk, calculated as the standard deviation of returns, is

comparable to that of the market index. On the other hand, the market regression model showed that the systematic risk of active ETFs is considerably lower than that of the market index. The latter evidence shows that the active ETFs are more conservative that the market index. However, it might indicate that the S&P 500 Index cannot explain the performance of the examined actively managed ETFs in the most efficient way.

In a multifactor performance regression analysis (a four-factor and a six-factor model are applied in this respect), we re-confirm that the active ETFs cannot achieve any material above-market return and that they are less aggressive than the passive market index in terms of systematic risk. Furthermore, we find that the relationship of ETFs' performance with the size factor is positive. However, there is not a monotonic impact on performance by the value, robust minus weak, conservative minus aggressive and momentum factors, as a wide variation between negative and positive estimates for these variables is observed. Therefore, we the exception of the size factor, we concluded that the relationship of active ETFs' performance with the rest of the explanatory variables is rather fund specific.

Finally, as far as the market timing is concerned, the results verify the existing findings in the literature which show that the ETF managers fail to time the market. The ETF managers cannot time market volatility either. These findings do not surprise us because they resemble those in earlier studies on the topic. However, we expected that, after more than ten years in the business, the managers of active ETFs would be more able to respond to the ascending and descending trends in equity markets.

Overall, our results are in line with the results of the previous literature on the performance of actively managed ETFs. For instance, it is not new that the active ETFs cannot beat market proxies such as the S&P 500 Index. This pattern has already been accentuated by the studies of Rompotis (2011a, 2011b, 2015 and 2020). It is not new either that the managers of active ETFs do not possess any substantial market timing skills. This inability has been demonstrated by studies such as those of Rompotis (2013 and 2020).

Based on the results of the current study, we cannot confirm that the recent growth in the active ETF market has been driven by the performance records of the market relative to the S&P 500 Index or by the improved market timing skills of the managers of active ETFs. To our view, the need of ETF investors for diversifying their choices with ETFs and the prospect of enhanced future returns are the main driving forces for the rise in the assets managed by active ETFs and in the population of such products during 2020 and 2021.

References

Beck, K. L., Chong, J., & Phillips, G. M. (2017). Risk-adjusted performance of the largest active ETFs. *The Journal of Wealth Management*, *20*(3), 52-63.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance*, *52*(1), 57-82.

Dolvin, S. D. (2014). An update on the performance of actively managed ETFs. *The Journal of Beta Investment Strategies*, *4*(4), 10-18.

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *the Journal of Finance*, *47*(2), 427-465.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, *116*(1), 1-22.

Garyn-Tal, S. (2013). An investment strategy in active ETFs. *The Journal of Index Investing*, *4*(1), 12-22.

Jagannathan, R., & Korajczyk, R. A. (1986). Assessing the market timing performance of managed portfolios. *Journal of Business*, 217-235.

Kumar, R. (2021). Active vs. Smart Beta ETFs: Two Sides of Active Management. *The Journal of Index Investing*, *11*(4-1), 25-40.

Meziani, A. S. (2015). Active exchange-traded funds: are we there yet?. *The Journal of Index Investing*, *6*(2), 86-98.

Rompotis, G. G. (2011b). The performance of actively managed exchange-traded funds. *The Journal of Index Investing*, *1*(4), 53-65.

Rompotis, G. G. (2013). Actively vs. passively managed exchange traded funds. *Aestimatio: The IEB International Journal of Finance*, (6), 116-135.

Rompotis, G. G. (2015). A Performance Evaluation of the Canadian Actively Managed ETFs. *The Journal of Index Investing*, *6*(2), 57-75.

Rompotis, G. G. (2020). Actively versus passively managed equity ETFs: new empirical insights. *International Journal of Banking, Accounting and Finance*, *11*(1), 95-135.

Rompotis, G.G. (2011a). Active vs. Passive Management: New Evidence from Exchange Traded Funds". *International Review of Applied Financial Issues and Economics*, *3*(1), 169-186.

Schizas, P. (2014). Active ETFs and their performance vis-à-vis passive ETFs, mutual funds, and hedge funds. *The Journal of Wealth Management*, *17*(3), 84-98.

Treynor, J. (1966). i K. Mazuy 1966. Can Mutual Funds Outguess the Market. *Harvard Business Review*, *44*(4), 131-136.

Capital Markets Review Vol. 30, No. 2, pp. 63-89 (2022)

Digital Cashless Payments and Economic Growth: Evidence from CPMI Countries

Yi-Xun Pang[1], Sin-Huei Ng[1*] & Wei-Theng Lau[2]
[1]*School of Economics and Management, Xiamen University Malaysia, Malaysia.*
[2]*School of Business and Economics, Universiti Putra Malaysia, Malaysia.*

Abstract: Research Question: This paper aims to investigate the relationships between digital payments and economic growth in 27 CPMI countries. Besides, it also studies the comparison of the impacts of digital payments between developed and developing countries. **Motivation:** Digital cashless payments have been widely discussed in recent years and the penetration of cashless payments around the globe is rising exponentially throughout the decade. Several studies have found that cashless payments have a positive impact on economic growth. However, the existing studies are mainly focusing on the European countries. Committee on Payments and Market Infrastructures (CPMI) is a new area to be explored because it consists of some countries that are seldom being investigated in the related fields previously. **Idea:** Analysis consists of GDP growth as the variable of interest and transaction volumes of debit cards, credit cards and e-money payments as the explanatory variables. Several control variables are used to capture other effects in the model. **Data:** Data are collected from various sources of database for the period of 2013-2019 covering a total of 27 countries/regions which consist of 18 developed countries and 9 developing countries in the CPMI membership. **Method/Tools:** This paper employs a fixed effect panel data model to analyse the relationship between digital payments and economic growth in (1) all CPMI countries, (2) developed CPMI countries, (3) developing CPMI countries. A comparative analysis is also performed between the developed and developing CPMI countries. **Findings:** Our findings are in line with the expectation, where all three digital payments are positively correlated to economic growth. However, only the e-money payment is statistically significant to the economic growth. Besides, the findings also indicate that the effects of digital payments on the developed economies are greater than the developing economies. **Contributions:** CPMI members have put in considerable efforts in facilitating cashless payments. The analysis of the relationship between digital cashless payments and economic growth in CPMI countries provides a review on the effectiveness of the initiatives taken by the member countries. Our findings are expected to offer some new insights related to digital cashless payments and contribute to the modern financial sector.

[*] Corresponding author: Sin-Huei Ng. Tel.: +603-87055037.
Email: shng@xmu.edu.my
Acknowledgements: This work is supported by Xiamen University Malaysia Research Fund [Grant No. XMUMRF/2018-C2/ISEM/0008].

Received 12 Oct 2021; Final revised 4 Aug 2022; Accepted 11 Aug 2022; Available online 30 Sept 2022.
To link to this article: https://www.mfa.com.my/cmr/v30_i2_a4/

Keywords: Digital payments, CPMI, GDP, developed economies, developing economies.
JEL Classification: G50, O39

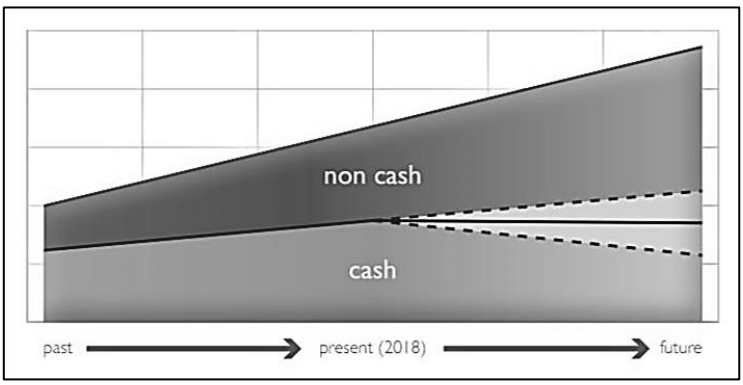
1. Introduction

1.1 Reseach Background

1.1.1 Cashless Payment

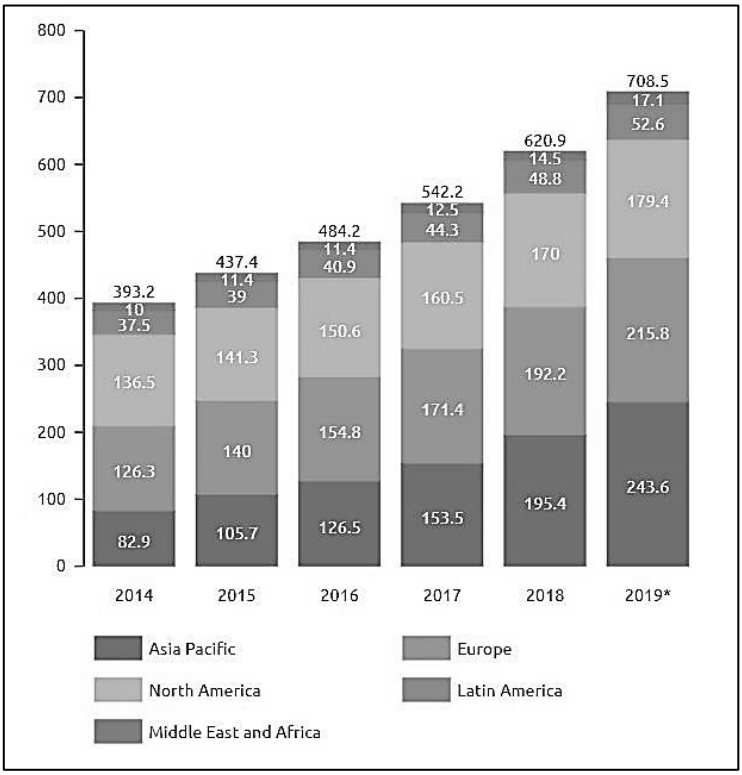
When payment is made without physical notes or coins but through the transfer between financial technologies, it is considered a cashless payment. When all the transactions within a country are made by cashless payments, the nation is considered a cashless society. A cashless transaction can be done via digital transfer payments and non-digital payments (Tee and Ong, 2016). There are several modes of digital transfer payments, which include the use of bank cards, e-wallets, internet banking, and other electronic payment applications, while non-digital payment refers to the use of cheques (Frankenfield, 2021). The history of cashless payment can be traced back to the 17th century when the first specimen of the handwritten cheque dated 1659 is found (Cheque & Creit Clearing Company, 2013). Then, in the 20th century, card payments rose as the charge cards, ATM cards, and Electronic Fund Transfer Point of Sale (EFTPOS) terminals were introduced accordingly (Moss, 2019). People start to engage in online payments and other contactless payments in the 21st century, especially when the various types of digital payment platforms were introduced.

Based on the World Cash Report 2018 by G4S Global (2018), the rates of cashless payment have grown impressively worldwide, and the increase in the cashless transaction volumes also shows that non-cash payment is overtaking cash as the most commonly used payment instruments (Figure 1). The World Payment Report by Capgemini (World Payment Report, 2020) finds that there is an upward trend in the non-cash transactions around the globe (Figure 2). Besides, the Worldpay (2021) also states that the cash usage worldwide reduced by 32% in 2020, which only accounts for just 1/5 of all face-to-face payments due to the electronic payments surge (Figure 3). Furthermore, along with the increase in e-commerce during the Covid-19 pandemic, digital and card payments accounted for around 80% of all e-commerce payment methods (Figure 4) (Worldpay, 2021).



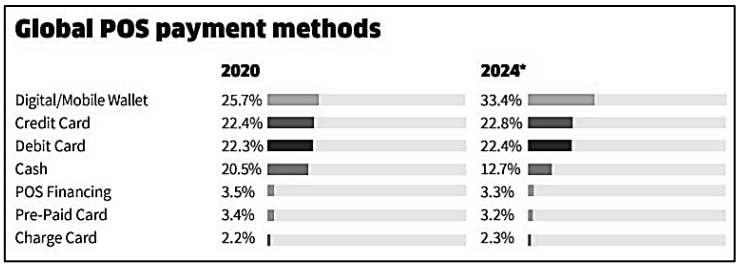
Source: World Cash Report 2018, G4S Global

Figure 1: Development of payment volumes, cash, and non-cash



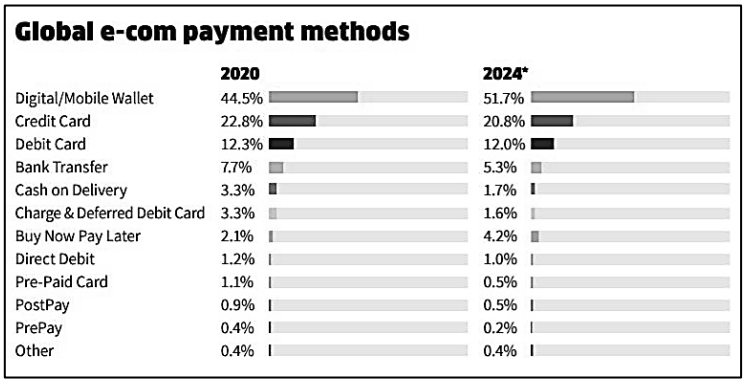
Source: World Payment Report 2020, Capgemini

Figure 2: Worldwide non-cash transactions (billions), by region, 2014-2019



Source: Worldpay (2021)

Figure 3: Global POS payment methods 2020 (current) and 2024 (forecast)



Source: Worldpay (2021)

Figure 4: Global e-commerce payment methods 2020 (current) and 2024 (forecast)

1.1.2 Cashless Payment and Economic Growth

As the globe is moving towards a cashless society, it is confidently believed that transformation from cash to cashless is beneficial to the nation's economy. The best indicator to measure an economy is the country's GDP. Based on the expenditure approach formula (equation 1.1), four key determinants will affect the country's GDP (Y), which are household consumption (C), private investment (I), government expenditure (G), and net import (NX). This equation states that there is a positive relationship between the GDP and each of the determinants.

$$Y = C + I + G + NX \quad (1)$$

The study by Lau et al. (2020) proposes that cashless payments can positively affect the country's GDP through the three channels – C, I, and G.

There are many other pieces of research studies on the economic benefits of cashless payments that support the statement mentioned above. According to Parmar (2018), one of the benefits of building a cashless society is the reduction of the risk of carrying cash. Without the physical cash, crimes such as robbery, burglary, and extortion can be effectively reduced. Besides, Bezhovski (2016), who studies the future of electronic payment systems, finds that electronic payments provide convenience and speed for the users when making transactions. In short, cashless payments increase the security and convenience for the users, thereby facilitating household consumption. Additionally, this also helps the businesses to reduce the costs such as the expenses on the security system and spending on storing cash (Hasan *et al*., 2012). Hence, this allows the merchants to increase profitability and consequently contribute to economic growth.

On the other hand, cashless payments also ensure a "black money-free nation" where the criminals are unable to bypass the financial institutions to make transactions (Parmar, 2018). Moreover, a cashless society can effectively combat corruption. It is because all the large transactions will be done digitally, and it provides an audit trail (Alaeddin *et al*., 2019). Furthermore, by building a cashless society, the collection of taxations is more effective as all the transactions are recorded, so it is easier for the government to monitor and track unscrupulous events (Parmar, 2018). Ultimately, this affects the nation's economy since the government expenditure can be increased when the tax revenue is increased and the cost of managing crimes is reduced (Shapiro and Hassett, 2012). In sum, it is strongly believed that there will be a positive relationship between cashless payments and GDP growth.

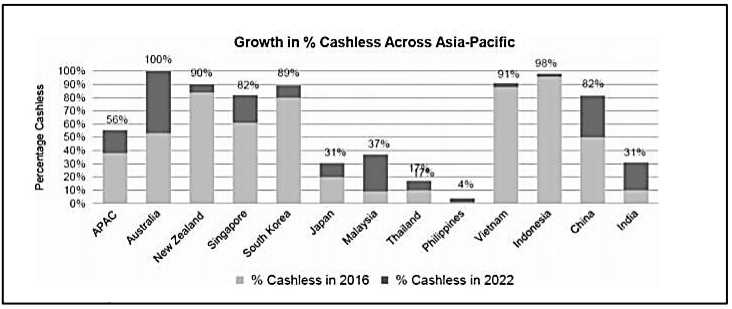
1.1.3 The CPMI Membership

The Committee on Payments and Market Infrastructures (CPMI) was previously named Committee on Payment and Settlement Systems (CPSS). It was first established in 1990 by the Group of Ten (G10) Countries Governors (Bank for International Settlements, n.d.) It consists of a group of experts on payment systems from different central banks who monitors the developments in the payment and settlement systems of the nation within the membership (Kenton, 2021). Hitherto, there are 28 central banks in the CPMI membership:

- Central Bank of Argentina
- Reserve Bank of Australia
- National Bank of Belgium
- Central Bank of Brazil
- Bank of Canada
- The People's Bank of China
- European Central Bank
- Bank of France
- Deutsche Bundesbank (Germany)
- Hong Kong Monetary Authority
- Reserve Bank of India
- Bank Indonesia
- Bank of Italy
- Bank of Japan
- Bank of Korea
- Bank of Mexico
- Netherlands Bank
- Central Bank of the Russian Federation
- Saudi Central Bank
- Monetary Authority of Singapore
- South African Reserve Bank
- Bank of Spain
- Sveriges Riksbank (Sweden)
- Swiss National Bank
- Central Bank of the Republic of Turkey
- Bank of England
- Federal Reserve Board of Governors
- Federal Reserve Bank of New York

Overall, the CPMI is an international standard-setter that aims to support financial stability by monitoring, giving advice and recommendations, as well as promoting the efficiency and safety of payment, settlement, clearing, and other arrangements (CPMI - overview, n.d.).

As the members of the CPMI that promote the development of payment systems, it is highly believed that these countries have implemented solid and secure cashless payment systems. According to the study by Frost and Sullivan (2017), Australia, Singapore, South Korea, China, and Indonesia are expected to lead the cashless payment market in APAC with a high percentage in the growth rate of cashless payment (Figure 5). Besides, Countries include Netherlands, Spain, Italy, Belgium, United Kingdom, Germany, and France are listed in the top 10 cashless countries in Europe (Rolfe, 2020).



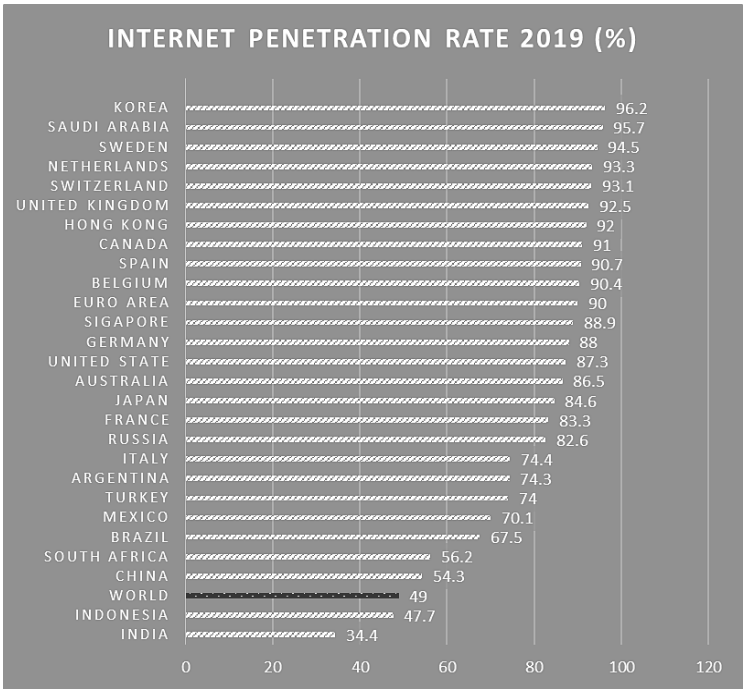
Source: Frost & Sullivan

Figure 5: Growth in % cashless across APAC 2016 (current) and 2022 (forecast)

1.2 Problem Statement

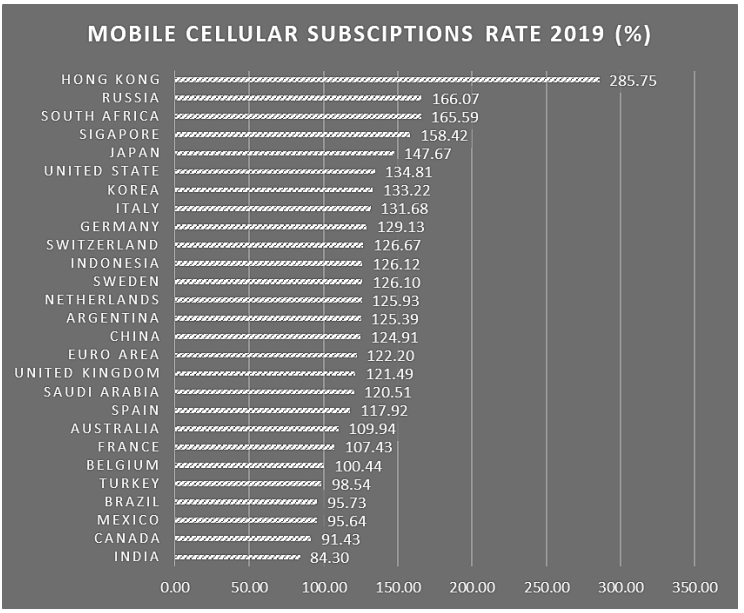
Researchers have studied the financial sector development and its impacts on the economy (Park and Shin, 2015; Cojocaru *et al*., 2016; Durusu-Ciftci *et al*., 2016). However, part of the financial sector development discussed widely in recent years is the innovation of the digital payment system (Lau *et al*., 2020). Thus, it is interesting to measure and examine the importance of digital cashless payments to the nation's economic growth by carrying out empirical research. To date, there are several empirical studies on the significance of cashless payment on economic growth. Most of the studies focus on European countries (Bolt *et al*., 2008; Hasan *et al*., 2012; Tee and Ong, 2016; Grzelczak and Pastusiak, 2020), India (Ravikumar *et al*., 2019; Sreenu, 2020), and Nigeria (Oyewole *et al*., 2013; Muyiwa *et al*., 2013).

The relationship between cashless payment and economic growth in CPMI countries is worth to be examined because there are some other countries that have not to be explored in the relevant area, such as Argentina, Brazil, Russia, China, and Singapore. On top of that, two reasons show that CPMI countries are worth to be studied as a whole. Firstly, CPMI countries have a high adoption of the internet. From Figure 6, the internet penetration rate in CPMI countries is mostly higher than the average world rate at 49% in 2019 (The World Bank, 2019). Besides, according to the statistics by The World Bank (2019), the mobile cellular subscriptions of CPMI countries are mostly higher than their population, which indicates that some citizens in the countries may hold more than one cellular device that allows them to access the internet (Figure 7). Therefore, it is strongly expected that cashless payments in CPMI countries are elevated due to the high level of internet adoption.



Source: The World Bank

Figure 6: Internet penetration rate in CPMI countries 2019



Source: The World Bank

Figure 7: Mobile cellular subscriptions rate in CPMI countries 2019

The second reason is that the members of CPMI have committed many efforts to monitor, promote, and enhance the countries' payment systems. As the trend of transiting into cashless payment, one of the priority concerns of CPMI members is the safety and integrity of cybersecurity and open digital payments (BIS Annual Economic Report, 2020). In 2016, CPMI and the International Organization of Securities Commissions (IOSCO) released specific policy guidance about cyber resilience for the financial market infrastructures (FMIs). The policy guidance aims to limit the cyber risk that may threaten the financial systems, especially the digital payment system (Guidance on cyber resilience for financial market infrastructures, 2016). In order words, the guidance has strengthened the protection and security of cashless payment. Furthermore, CPMI is also facilitating cashless payments in the nations as they find that the informal economy reduced when the usage of digital payments increased. Over the previous years, the central banks in CPMI have become more favourably towards the issuance of the Central Bank Digital Currency (CBDCs) to promote cashless payments further since it helps to eliminate the shadow economy (BIS Annual Economic Report, 2020).

In summary, the high usage of the internet and the improvement of cybersecurity is expected to increase the penetration of cashless payments in CPMI countries, resulting in a smaller informal economy as well as higher private consumption, thereby leading to economic growth in the countries. All in all, in light of the reasons above, it is necessary to analyze the nexus between cashless payments and economic growth in CPMI countries in order to validate the argument as stated above.

1.3 Research Questions

1. What are the impacts (positive/negative/unrelated) of digital cashless payments (debit cards, credit cards and e-money) on economic growth in CPMI countries?
2. What are the differences in the effects of digital cashless payments on economic growth in the developed countries and developing countries in CPMI, respectively?

1.4 Scope of Study

This paper mainly studies the digital cashless transactions volume and the GDP growth rate of 27 countries/regions in CPMI (there are two CPMI members from the United States). The digital cashless transactions mentioned above are done via credit cards, debit cards, and e-money. E-money refers to the transactions made through various e-wallets. The taken sampling period starts from 2013 until 2019 as these are the only available official data released by BIS.

1.5 Significance of Study

As mentioned above, cashless payments can be considered as "theoretically important" to economic growth as several studies find that cashless transactions enhance economic growth through the three main determinants of GDP. Nevertheless, in practice, there are other factors that affect economic growth directly or indirectly. Therefore, quantitative findings in this paper are crucial to proving the validity of the statement. By knowing the actual relationship between cashless payments and economic growth, the central banks in CPMI can check the effectiveness of the initiatives enforced by them and also take relevant actions to enhance their economic growth. For instance, if the result of this study shows that cashless payments are positively related to economic growth, the central banks can further promote the transformation from cash to cashless.

Additionally, in the context of microeconomics, this paper also aims to suggest the businesses on the transformation from traditional payment system to the digital payment system. From the aspect of users, cashless payments are convenient, efficient, and easy to use. This can be seen from the exponential increase in the usage of cashless payments every year. The result of this paper can help businesses to decide whether to install the digital payment system. Again, if the result proves that the theory mentioned above is valid, then the businesses can start to apply the cashless payment system since cashless payment increases household consumption.

1.6 Organization of Study

This paper consists of five sections: (1) Introduction, (2) Literature Review, (3) Method, (4) Findings and Discussion, and (5) Conclusion.

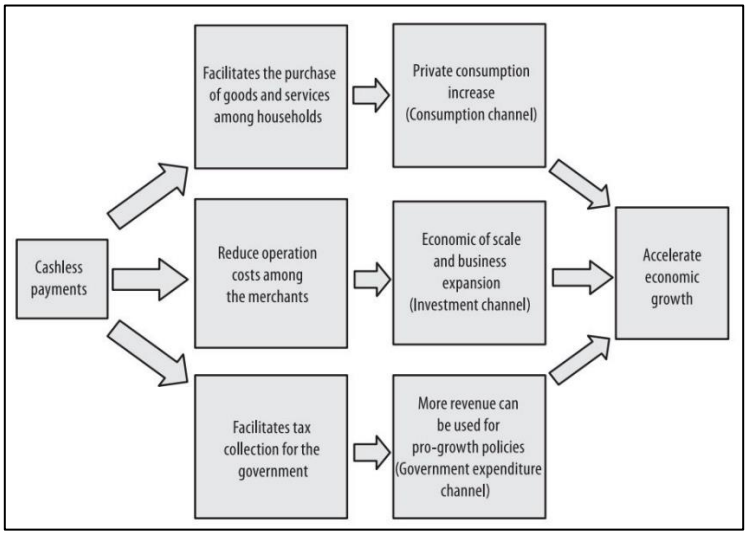
2. Literature Review

2.1 Transmission Channels of Digital Cashless Payments

Grzelczak and Pastusiak (2020) propose that the diffusion of innovation (DOI) theory which was developed by Rogers in 1995, can be used to analyze the impact of cashless payments on economic growth. This theory stated that the adoption of an innovation is mainly determined by its value, communication channels, social system, and time (LaMorte, 2019). On this basis, the diffusion of digital cashless payments should happen when the users find the improvement in the speed and convenience of making transactions and the businesses seek new profitable opportunities (Grzelczak and Pastusiak, 2020). In simpler words, people will only adopt digital payments when they find it is beneficial to them. Since the cashless payments adoption rates in CPMI countries are high, it is strongly believed that digital payments bring advantages to the users. As a result, those positive effects from the increase of cashless payments' usage can positively influence the nation's economy.

Lau *et al*. (2020) develop a transmission model in their study that explains how the positive effects of using cashless payment can lead to economic growth. As mentioned in Section 1, the model summarizes three channels of cashless payments on economic growth, which are

the household consumption channel, private investment channel, and government expenditure channel (Figure 8).



Source: Cashless Payments and Economic Growth: Evidence from Selected OECD Countries

Figure 8: Transmission channels of cashless payment on economic growth

The first channel is the consumption channel. This channel states that cashless payments increase household consumption, thereby accelerate economic growth. As people can make the payment as simple as one click on their mobile, it significantly increases the convenience of the transactions, thereby smoothing their consumption. As a result, Zandi *et al*. (2013) found that cashless payment boosted private consumption by around 0.7% in high-income countries and increased economic growth by 0.17% annually. On top of that, Adriana and Linnea (2020), who study the impact of cashless payments on Sweden's consumption, find that cashless payments can effectively reduce the pain of paying when spending. The "pain of paying" theory states that the process of handing over the money to others is like losing money; it can simultaneously cause a negative feeling and eventually lead to the avoidance or reduction of spending (Zellermayer, 1996). In the same study, they also find that there is a highly statistically significant nexus between the cashless payment percentage and the frequency of on-the-go (OTG) consumption (Adriana and Linnea, 2020). This means that higher cashless payments can lead to a higher frequency of OTG consumption. Besides, the report by Global Insight (2003) has studied the direct relationship between the share of electronic payments and real spending in many countries. The result shows that there is an average of 0.5% increase in the real consumer spending caused by a 10% increase in the share of electronic payments (The Virtuous Circle: Electronic Payment and Economic Growth, 2003). Obviously, when household consumption is increased by the use of cashless payments, it can enhance the nation's GDP growth.

Secondly, the model indicates that cashless payments can increase private investment and eventually improve economic growth. Multiple pieces of research have proven that the use of cashless payment can effectively reduce the cost of doing business and increase the profit for them. As previously described in Section 1, cashless payments can combat crimes since people and businesses are no longer carrying cash. This helps the merchants to prevent loss from robbery and theft. Furthermore, Global Insight (2003) reports that most of the merchants

who install digital payments are free from the costly materials, accounting services, and labour that need in paper-based processing. For example, all the cashier services are no longer require an employee to take charge. On the other hand, there are also the costs for digital payments, such as the expenses on the POS terminals, cybersecurity protection fees, card acceptance fees, and chargebacks. However, the costs are much lower compared to the non-digital payments. According to the report by VISA Inc. (2018) that studies the cost of digital payments and non-digital payments for SMEs, the average cost of using digital payments is 57% lower than non-digital payments. Moreover, there is also an increase of 8% in the SMEs' revenues after installing digital payments system (Digital Transformation of SMBs: The Future of Commerce, 2018). Additionally, electronic payments enable e-commerce for businesses (Deloitte, 2013). By doing e-commerce, the merchants, especially the SMEs, can expand the market size and increase their product awareness, thereby leading to economies of scale and ultimately increase their revenues. In short, the merchants can efficaciously increase their revenues, expand their business and consequently contribute more to the economic growth.

For the last transmission channel, Lau *et al*. (2020) state that cashless payments can help the government to increase revenues that can be used for government expenditure. Several studies have investigated the impacts of digital payments on the shadow economy, saying that increase in cashless payments is possible to eliminate the shadow economy. According to the International Monetary Fund (IMF), the shadow economy is also known as the informal, parallel, or underground economy. It is a part of the economy that includes illegal events and unreported transactions as well as incomes (Schneider and Enste, 2002). The economic events in a shadow economy such as money laundering, smuggling, and illegal trading are untraceable by the government. Nonetheless, one of the main characteristics of cashless payment is transparency where it can effectively increase the transparency of the financial system within the nation (Kumari and Khanna, 2017). This helps the government to track the generation of illegal transactions. Schneider (2013) finds that the usage of electronic payments in a country is negatively correlated to its shadow economy. In other words, the higher the usage of electronic payments, the smaller the size of the shadow economy. Moreover, he also concludes that the shadow economies in a country can be shrunk down by 5% if the penetration rate of electronic payments increases by 10% per annum for at least four years consecutively (Schneider, 2013). As the shadow economy becomes smaller, the tax collection can be done smoother since all the incomes are traceable by the government. A study by Immordino and Russo (2016) discover that value-added tax (VAT) evasion can be reduced by facilitating electronic payments. When the tax revenues increase, the government has more liquidity to spend on the investment and development of the country, eventually improve the GDP growth. All in all, it is strongly believed that digital cashless payments are able to accelerate economic growth by increasing household consumption, private investment, and government expenditure.

2.2 Literature Review of Previous Empirical Studies

Hitherto, several empirical studies discuss the statistical effect of cashless payments on economic growth. By looking at the papers in the last decade, most of them find that cashless payments are statistically positively related to economic growth. Hasan *et al*. (2012) analyze the relationship between electronic retail payments and economic growth across 27 European states from 1995 to 2009. The authors find that the technology of digital retail payments is correlated positively with real economic aggregates. The empirical result shows that electronic retail payments can increase the economy's efficiency, consumption, and trade and consequently accelerate economic growth. Besides, the same paper concludes that card payments have the strongest positive impact on economic growth.

Zandi *et al*. (2013) mainly focus on the impact of electronic payments in 56 countries around the world. From the study, electronic payments contributed $983 billion in global economic growth throughout the sampling period (2008-2012). In detail, electronic payments caused a 0.8% & 0.3% increase in GDP in emerging markets and developed markets, respectively. Moreover, the authors find that increase in card transactions boots the economic recovery by 0.2%. While Oyewole *et al*. (2013), who employs a multiple regression model to study the impacts of electronic cashless payments on Nigeria's economy, also states that there is a significant positive nexus between the e-payment system and Nigeria's economic growth. The paper finds that a unit change in the e-payment system can lead to three times change in the real GDP per capita in Nigeria. Furthermore, another research also studies the Nigerian economy states that there is a significant positive relationship is found between cashless banking and the Nigerian economy (Siyanbola, 2013). In 2016, Zandi *et al*. (2016) continued to study the previous topic from 2011 to 2015 but in a larger sampling size – 70 countries. This paper reiterates that electronic payments are positively related to economic growth. There is an average 0.18% increase in consumption and a 1% increase in GDP annually due to the increase in electronic payments. The authors conclude that each 1% increase in the electronic payments penetration rate can lead to an increase in consumption by around $104 billion and GDP growth by 0.04%. In addition, this paper also finds that there is a positive compounding effect in the advanced countries which have higher cashless penetration rate.

However, the research by Tee and Ong (2016) states that the impact of cashless payments on the European economy can only be effective in the long run where there is no immediate effect of the digital payments will be observed. This statement coincides with the study by Narayan (2019), which analyzes the relationship between Fintech and Indonesia's economic growth from 1998 to 2018. This paper finds that Fintech has a delayed positive effect on economic growth where the result shows there is no important effect of Fintech in the first year, but it contributes significantly to the economy starting from the second year. Yet, these results are contradicting with the study by Ravikumar *et al*. (2019) which analyze the impact of digital payments on economic growth in India from 2011 to 2019. Ravikumar *et al*. (2019) find that retail electronic payment has significant impacts on the real GDP in the short run. Interestingly, the study also reveals that digital payments will not contribute to India's economic growth in the long run.

In their latest study, Grzelczak and Pastusiak (2020), who examine the cashless payment and economic growth in selected Central, Eastern, and Western European countries in the years 2005 to 2018 find that card and e-money payments have a significant positive relationship to economic growth in the Western European countries. Meanwhile, in the Central and Eastern European countries that slightly lack of cashless technology and penetration, there is only card payment has a positive impact on economic growth. This outcome meets the suggestion by Zandi *et al*. (2016) as the cashless payments in advanced countries have a larger impact on economic growth. Furthermore, Aldaas (2020) finds a contrary result in India and Saudi Arabia. The paper states that non-cash transactions have a high and positive correlation to the Saudi Arabian economy but a low and negative correlation to the Indian economy. The author concludes that the positive impact of non-cash payments grows when the economy is moving from developing to developed stage due to the technology enhancement and cashless penetration. Again, this is corresponding to the study by Zandi *et al*. (2016) as aforementioned. Besides, Aldaas's result (2020) also shows that the positive relationship in Saudi Arabia is weakened in the short term where this statement goes in line with the outcomes from Tee and Ong's study (2016). In addition, the study by Sreenu (2020) analyzes the effects of cashless payment policy on the economic growth of India by employing the panel data cointegration test. The results of the test show that the use of e-payments is positively affecting economic growth in India. However, the study also finds that

the impacts may not be obvious in the short run, it suggests that the significance of using e-payments can be observed in the longer term.

On the other hand, Lau *et al*. (2020) test the nexus between cashless payments and economic growth in 15 OECD countries from 2007 to 2016. The study employs a random effect model to calculate the relationships. Interestingly, the result of this paper does not in line with the previous studies by other scholars. The authors find that only debit card payment has a positive impact on economic growth. In contrast, credit card and e-money payments are not related to economic growth. It is inferred that the positive effects of both payments are offset by their negative effects. Although the use of credit cards can significantly facilitate private consumption, it does increase debt accumulation among the users at the same time. This can slow down economic growth due to the increase in the default rate. For the case of e-money payment, Lau *et al*. (2020) conclude that the merchants and consumers may feel reluctant to spend massively via e-money due to the worries on the cybersecurity risk.

2.3 Hypothesis Construction

In the light of the above literature reviews on the transmission channels and previous empirical studies, a hypothesis framework is created to study the direct relationship between digital cashless payments and economic growth in CPMI countries (Figure 9).

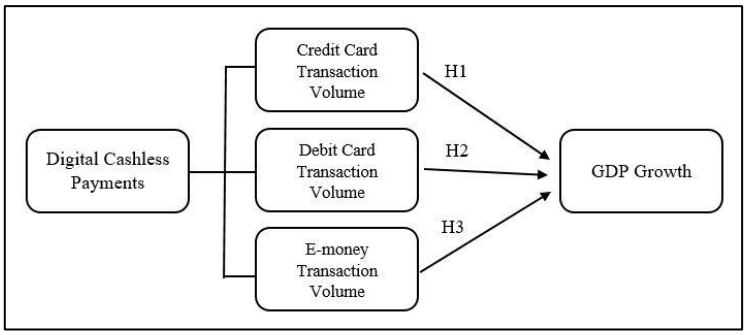


Figure 9: Hypothesis framework

The hypotheses are specified as follows:

Hypothesis 1:
H_0 = There is no significant relationship between debit card payment and GDP growth in CPMI countries.
H_1 = There is a significant relationship between debit card payment and GDP growth in CPMI countries.
Hypothesis 2:
H_0 = There is no significant relationship between credit card payment and GDP growth in CPMI countries.
H_1 = There is a significant relationship between credit card payment and GDP growth in CPMI countries.
Hypothesis 3:
H_0 = There is no significant relationship between e-money payment and GDP growth in CPMI countries.
H_1 = There is a significant relationship between e-money payment and GDP growth in CPMI countries.

Hypothesis 4:
H_0 = The impacts of digital cashless payment on economic growth in the developed countries are greater than the developing countries in CPMI.
H_1 = The impacts of digital cashless payment on economic growth in the developed countries are smaller than the developing countries in CPMI.

The first three hypotheses above are carried out to test the positive nexus between digital payments and economic growth in CPMI countries. Although there are contrary results in the previous empirical studies, it is still believed that digital payments have a positive impact on the economy in CPMI countries as most of the CPMI countries have high technology development as well as a high cashless penetration rate. Besides, the transmission channels as outlined earlier are also the main reason for the construction of Hypothesis 1 to 3. While the fourth hypothesis is developed to see the differences in the impacts of digital payments on economic growth in developed countries and developing countries in CPMI. As some of the previous researches have found that digital payments in developed countries are more likely to have a significant effect on their economy, it is worth investigating the situation in the CPMI countries.

3. Methodology

3.1 Empirical Model

A fixed effect panel data model is formed based on the variables extracted from the literature reviews and the hypotheses to measure the nexus between digital cashless payment and economic growth in CPMI countries. The empirical model is as below:

$$\mathrm{GD}P_{it} = \beta_0 + \beta_1 Credit_{it} + \beta_2 Debit_{it} + \beta_3 Emoney_{it} + \beta_4 Inflation_{it} + \beta_5 Population_{it} + \beta_6 Internet_{it} + \varepsilon_{it} \quad (2)$$

Where:

i	=	1, 2, 3 … 27, the number of the countries;
t	=	1, 2, 3 … 7, the number of the time-series;
GDP	=	GDP growth rate in CPMI countries;
Credit	=	credit card transaction volume growth rate in CPMI countries;
Debit	=	debit card transaction volume growth rate in CPMI countries;
Emoney	=	e-money transaction volume growth rate in CPMI countries;
Inflation	=	inflation rate in CPMI countries;
Population	=	population growth rate in CPMI countries;
Internet	=	internet penetration rate in CPMI countries; and
ε	=	the common residual from the combination of cross-section and time series.

Equation 2 indicates the variables used to determine the relationship between digital payments and economic growth. It includes the dependent variable, independent variables, control variables, and residual errors. GDP growth rate is the indicator of national economic condition. As the dependent variable in the model, it is used to measure the impact of digital payments on economic growth. The independent variables consist of three variables as mentioned in the hypothesis construction, which are the credit card, debit card as well as e-money payments. These independent variables are measured by their transaction volume growth rates. On top of that, there are three control variables included in the model. The control variables are used to enhance the validity of the estimation by reducing the distractions

of extraneous and other confounding variables (Bhandari, 2021; Ng, 2014). The three control variables – inflation rate, population growth, and internet penetration help the model to grasp the impact of inflation, changes in demographics, and the influence of technology enhancement within the nation. Many pieces of research have used these control variables to measure the determinants of economic growth (Lau et al., 2020).

3.2 Data Collection

The data taken in this paper cover the period from 2013 to 2019. There are a total of 27 countries/regions in the sample which consist of 18 developed countries and 9 developing countries in CPMI membership (Table 1). The list of developed countries is set based on the "List of Advanced Economies" published by the International Monetary Fund (IMF) in 2020. Most of the data are collected from various databases and the central banks (Table 2).

Table 1: List of sampled countries/regions (Sampling period: 2013-2019)

Regions	Countries
Developed countries/regions	Australia, Belgium, Brazil, Canada, Euro Area, France, Germany, Hong Kong SAR, Italy, Japan, South Korea, Netherlands, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States
Developing countries/regions	Argentina, China, India, Indonesia, Mexico, Russia, Saudi Arabia, South Africa, Turkey,

Table 2: List of collected data and source

Variables	Descriptions	Measurements	Source
	Dependent Variable		
GDP	Gross domestic product	Annual growth %	WDI
	Independent Variables		
Credit	Credit card transaction volume	Annual growth %	BIS, RBA,
Debit	Debit card transaction volume	Annual growth %	ECB, BdeM,
E-money	E-money transaction volume	Annual growth %	BdeE, Riksbank
	Control Variables		
Inflation	Inflation rate	Annual growth %	WDI, TE
Population	Population rate	Annual growth %	WDI, TWB
Internet	Internet penetration rate	Annual growth %	

Notes: WDI: World Development Indicator, BIS: Bank of International Settlement, RBA: Reserve Bank of Australia, ECB: Europe Central Bank, BdeM: Banco de México, Bank of Mexico, BdeE: Banco de España, Bank of Spain, Riksbank: Sveriges Riksbank, Central Bank of Sweden, TE: Trading Ecomomics.com, TWB: The World Bank.

3.3 Econometric Methodology

First and foremost, stationarity test is carried out to test the stationarity of the dataset. This is followed by the diagnostic tests that are conducted before the regression analysis with the aim to ensure the validity of the dataset and enhance the robustness of the results. Regression is then used to analyze the relationship between digital cashless payments and economic growth.

3.3.1 Stationarity Test

In this paper, a set of panel unit root tests that consists of four individual unit root tests is conducted to identify the existence of unit roots. The panel unit root tests include the Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), Augmented Dickey-Fuller (ADF), and Phillips-Perron (PP) tests. The LLC unit root test assumes that the panel dataset is balanced, and it is used to identify the common unit root in the dataset (Levin *et al*., 2002). While the other three unit root tests are used to detect the individual unit root in the dataset. All the tests state a null hypothesis of a unit root and an alternative hypothesis of stationary data. First differencing or second differencing are applied if the data are found non-stationary.

3.3.2 Diagnostic Tests

Three types of diagnostic tests are conducted to ensure the validity of the regression analysis. Firstly, the Variance Inflation Factor (VIF) test is conducted to determine the existence of multicollinearity. The VIF test is used to identify and quantify the correlation among the variables. When the value is close to 1, the correlation among the variables is weak (Daoud, 2017). In contrast, the variables are highly correlated when the value is larger than 5 (Daoud, 2017). Secondly, the Likelihood Ratio (LR) test is used to check the existence of heteroscedasticity in the model. The LR test is normally used to measure the normality; it is very sensitive to the deviation from normality (Zyl, 2011). Thus, it is also suitable to be used as a diagnostic test for a constant variance in residuals over a time series (Zyl, 2011). Lastly, the Durbin-Watson (DW) test is carried out to identify the existence of autocorrelation. Basically, the dataset is considered normal when the value is between 1.7 to 2.3. Before testing the panel data regression, remedial measures are performed if the problems mentioned above are found.

3.3.3 Panel Data Regression

The static panel method is employed to quantify the nexus between digital cashless payments and economic growth in CPMI counties. Three regression analyses are conducted with the same model: Regression 1 - Overall impacts of digital payments on economic growth in all CPMI countries, Regression 2 - Impacts of digital payments on economic growth in developed CPMI countries, Regression 3 - Impacts of digital payments on economic growth in developing CPMI countries. Before running the regression analysis, the Hausman test is conducted for the model selection on the Fixed Effect (FE) or Random Effect (RE) model.

4. Findings and Discussion

4.1 Descriptive Statistics

Table 3 indicates that the descriptive statistics of the balanced panel dataset from Regression 1 that consists of 189 observations. From the table, E-MONEY has the highest average growth rate at 38.824% throughout the sampling period in CPMI countries. The mean of E-MONEY is more than the total mean of both card payments; its transaction volume increases exponentially as the maximum value of E-MONEY has up to more than 2000%. This shows that digital currency has become the main cashless payment instrument in CPMI countries. Therefore, it is expected that e-money payment has the most significant relationship with economic growth. This observation is similar to the study by Lau et al. (2020), who also find that e-money payment has the highest average growth rate in the selected OECD countries. On the contrary, CREDIT has the lowest average growth rate at 15.948%. The mean of CREDIT is slightly lower than the DEBIT (18.544%). This may be resulted by the obligation of paying debt when using credit cards to make payments. For instance, it is found that Americans prefer using debit cards instead of credit cards to avoid debt (Backman, 2017).

Table 3: Descriptive statistics (Regression 1)

	N	Mean	Median	Maximum	Minimum	Skewness	Kurtosis
GDP	189	2.311	2.139	8.486	-3.546	0.507	4.292
DEBIT	189	18.544	14.396	104.344	-10.052	2.004	9.961
CREDIT	189	15.948	11.765	94.612	-64.000	1.023	10.921
E-MONEY	189	38.824	12.398	2102.198	-97.369	9.822	109.84
INFLATION	189	3.683	1.812	53.8	-2.093	4.762	29.516
POPULATION	189	0.807	0.752	3.031	-0.328	0.557	3.865
INTERNET	189	4.731	2.702	56.591	-19.048	2.861	17.397

Notes: *N refers to the number of observations.*

Table 4 and Table 5 show the descriptive statistics for Regression 2 and Regression 3, respectively. Both the developed and developing countries in CPMI have a similar condition in the transactions growth rate of digital payments. The highest mean among the independent variables is E-MONEY, followed by DEBIT and CREDIT. Notably, the average growth rate of e-payments in developing countries is much higher than the developed countries. In contrast to the previous studies, it is expected that the impacts of digital payments on economic growth in the developing CPMI countries are greater than that of the developed CPMI countries. Besides, it can be seen that the average growth rate of GDP in developing countries is also larger than the developed countries. This may be explained by the "catch-up effect" where developing countries tend to grow faster than the developed countries due to the law of diminishing returns (Fuente, 2000). As most of the developed economies have achieved a relatively steady stage compared to the developing economies that are still at the rising stage, they tend to have slower but more stable growth in their economies.

Table 4: Descriptive statistics (Regression 2)

	N	Mean	Median	Maximum	Minimum	Skewness	Kurtosis
GDP	126	1.816	1.95	4.837	-3.546	-1.214	6.639
DEBIT	126	14.043	11.792	56.14	-10.052	1.825	7.269
CREDIT	126	12.133	10.531	83.505	-64	0.253	13.444
E-MONEY	126	35.99	6.87	2102.198	-97.368	8.466	78.863
INFLATION	126	1.443	1.276	9.03	-1.144	2.357	11.508
POPULATION	126	0.625	0.624	1.721	-0.328	0.147	2.562
INTERNET	126	2.307	1.845	17.93	-9.223	0.953	7.418

Table 5: Descriptive statistics (Regression 3)

	N	Mean	Median	Maximum	Minimum	Skewness	Kurtosis
GDP	63	3.302	2.819	8.486	-2.565	-0.08	2.173
DEBIT	63	27.545	22.334	104.344	2.061	1.88	9.15
CREDIT	63	21.779	16.35	94.619	2.061	1.928	7.645
E-MONEY	63	44.493	27.425	230.403	-16.751	1.525	4.865
INFLATION	63	8.145	4.899	538	-2.093	2.837	11.13
POPULATION	63	1.172	1.164	3.031	-0.049	0.41	3.967
INTERNET	63	9.578	6.536	56.591	-19.048	1.796	8.992

4.2 Stationarity Test

Table 6 shows the results of the panel unit root tests. Notably, all the variables have at least three out of four tests rejecting the null hypothesis in which the probability values are lower than 0.05, except for POPULATION. All the unit root tests for POPULATION fail to reject the null hypothesis. This means that population growth data is non-stationary.

Table 6: Panel Unit Root Test

Panel Unit Root Test H_0 = Unit root				
Variables	P-value			
	LLC	IPS	ADF	PP
GDP	0.0000	0.0009	0.0000	0.0000
DEBIT	0.0000	0.0067	0.0024	0.0000
CREDIT	0.0000	0.0010	0.0002	0.0000
E-MONEY	0.0206	0.3649	0.0024	0.0000
INFLATION	0.0000	0.0000	0.0000	0.5263
POPULATION	0.3781	0.9998	0.9628	0.1487
INTERNET	0.0000	0.0000	0.0000	0.0000

From Table 7, all the probability values of POPULATION drop below 0.05 after applying the second differencing. The unit root is eliminated and the dataset is now stationary.

Table 7: Panel Unit Root Test (second differencing on POPULATION)

Panel Unit Root Test H_0 = Unit root				
Variables	P-value			
	LLC	IPS	ADF	PP
GDP	0.0000	0.0009	0.0000	0.0000
DEBIT	0.0000	0.0067	0.0024	0.0000
CREDIT	0.0000	0.0010	0.0002	0.0000
E-MONEY	0.0206	0.3649	0.0024	0.0000
INFLATION	0.0000	0.0000	0.0000	0.5263
D(POPULATION,2)	0.0000	0.0000	0.0178	0.0002
INTERNET	0.0000	0.0000	0.0000	0.0000

4.3 Diagnostic Tests

As stated in Section 3, the VIF test is conducted to identify the presence of multicollinearity. From Table 8, all the values of centered VIF are below 2, suggesting that the variables are not correlated, and there is no multicollinearity in the datasets of all regressions.

Table 8: Variance Inflation Factors Test

Variance Inflation Factors Test VIF ≈ 1, no correlated; VIF > 5, highly correlated			
	Centered VIF		
	Regression 1	Regression 2	Regression 3
DEBIT	1.2172	1.0885	1.6517
CREDIT	1.6363	1.0505	1.4686
E-MONEY	1.0242	1.0870	1.2047
INFLATION	1.0044	1.1239	1.1841
D(POPULATION,2)	1.0048	1.0281	1.1979
INTERNET	1.0871	1.1234	1.1705

Next, Table 9 shows the result of the Heteroscedasticity LR test. The null hypothesis of the test states that all the residuals in the model are homoscedastic. As observed, all the probability values of the likelihood ratio are higher than 0.05, suggesting that heteroscedasticity is absent in the datasets.

Table 9: Heteroscedasticity Likelihood Ratio Test

Heteroscedasticity Likelihood Ratio Test H_0 = Residuals are homoscedastic			
	P-value		
	Regression 1	Regression 2	Regression 3
Likelihood ratio	0.9839	1.0000	0.9248

The last diagnostic test is the DW test, which is conducted to detect the existence of autocorrelation (Table 10). Unfortunately, the values of the DW statistics of all regressions are approximate 1. This indicates that there are negative autocorrelations among the variables. The presence of autocorrelations may lead to inconsistency and bias on the estimated variance of the regression coefficients, thereby causing the hypothesis test to be invalid (Asteriou and Hall, 2011). Therefore, the lagged dependent variable (LDV) is added to the model. Based on the study by Keele and Kelly (2006), it is proved that the inclusion of a LDV may eliminate the residual serial correlation when the dependent variable is stationary. Notably, the values of DW statistics are between 1.7 and 2.3 after the LDV is added. When the value of DW statistics is approximately 2, it indicates that the autocorrelation is mostly remedied.

Table 10: Durbin-Watson Test

Durbin-Watson Test DW ≈ 2, no autocorrelation; DW ≈ 0, negative autocorrelation; DW ≈ 4, positive autocorrelation			
	DW stat		
	Regression 1	Regression 2	Regression 3
Durbin-Watson	0.8218	1.2167	1.0565
LDV = GDP(-1)	1.9204	1.7191	2.0978

Notes: LDV refers to Lagged Dependent Variable.

4.4 Panel Data Regression

As aforementioned, the Hausman test is conducted to select the appropriate model for the estimation of this study. Table 11 reveals the result of the test. All the probability values of the test are less than 0.05, which reject the null hypothesis of a Random Effect model. Stated differently, the Fixed Effect model is appropriate for all the regressions. It suggests that the differences between cross sections can be accommodated from different intercepts; the dummy variable technique is used to capture the differences (Zulfikar, n.d.).

Table 11: Hausman Test

Hausman Test H_0 = Random Effect Model			
	P-value		
	Regression 1	Regression 2	Regression 3
Cross-section random	0.0001	0.0026	0.0000

4.4.1 Impacts of Digital Payments on Economic Growth in All CPMI Countries

Finally, Table 12 indicates the result of Regression 1 – the overall impacts of digital payments on economic growth in all CPMI countries. Typically, the coefficients and probability values are observed to interpret the relationships between each of the independent variables and economic growth. Based on the table, all digital cashless payments (DEBIT, CREDIT and E-MONEY) are positively related to economic growth in CPMI countries. Notwithstanding the positive coefficient, only e-money payment has a significant relationship with economic growth. Both card payments have no significant relationship with economic growth in CPMI countries as the probability values are larger than 0.1, which fails to reject the null hypotheses 1 and 2. The R-squared value is at 0.8431, which implies that over 84% of the changes in the dependent variables are successfully explained by the independent and control variables.

Table 12: Fixed Effect Panel Data Regression 1

Fixed Effect Panel Data Model Dependent Variable = GDP				
Independent/Control Variables	Coefficient	Standard Error	t-Statistic	Probability Value
C	2.9217	0.3415	8.5547	0.0000
DEBIT	0.0084	0.0112	0.7483	0.4561
CREDIT	0.0114	0.0070	1.6421	0.1038
E-MONEY	0.0009	0.0005	1.7880	0.0769
INFLATION	-0.2193	0.0327	-6.6971	0.0000
D(POPULATION,2)	-0.0062	0.3451	-0.3212	0.7487
INTERNET	-0.0062	0.0147	-0.4194	0.6759
GDP(-1)	-0.0642	0.0927	-0.6927	0.4902
R-squared = 0.8431				

The result of the regression model shows that economic growth in CPMI countries is statistically affected by e-money payment. Thus, alternative Hypothesis 3 is supported. As observed, economic growth in CPMI countries will increase by 0.0009 percent when the

transaction volume of e-money payment increases by 1 percent. This result conforms with the study by Grzelczak and Pastusiak (2020), who also find that e-money payment facilitates economic growth in Western European countries. However, some of the previous studies have a contrasting result (Hasan *et al*., 2012; Zandi *et al*., 2013). They find that e-money payment is not as important as card payments in the relationship with economic growth. Lau *et al*. (2020) also reveal that e-money payment has no significant effect on economic growth in some OECD countries. These contrasting results may be due to the different sampling periods. The sampling periods taken by Grzelczak and Pastusiak (2020) as well as this paper are later than the three studies above, which focus on the late 2010s. In contrast, the sampling period taken by those three studies is before the year 2016. According to the World Payments Report by Capgemini (2018), e-money usage is proliferating in the late 2010s, especially in the wake of the fast development of the e-commerce market and the technology advancement. Several studies (Zandi *et al*., 2016; Grzelczak and Pastusiak, 2020; Aldaas, 2020) also find a positive relationship between digital payments and technology development. As the technology becomes more advanced in the late 2010s, the transaction of e-money payment is more secured, thereby increasing the usage of e-money. In fact, this statement is supported by the data collected in this paper, where the transaction volume of e-money has the highest average growth rate in CPMI countries from 2013 to 2019. Briefly, in the light of the development in the e-commerce market and technology, the usage of e-money payment increases and ultimately boosts private consumption and economic growth.

On the other hand, Table 12 shows no significant nexus between card payments and economic growth in CPMI countries. These results are contrary to the previous researches, where most of the earlier studies have found that debit card (Lau *et al*., 2020; Hasan *et al*., 2012; Zandi *et al*., 2013) and credit card payments (Hasan *et al*., 2012; Zandi *et al*., 2013) accelerate economic growth. There are a few reasons that may explain the outcome of the regression analysis. For debit card payment, one possible explanation for failing to reject the null Hypothesis 1 may be the substitution effect between e-money payment and debit card payment. The major payment method varies over time; Hasan *et al*. (2012) propose that cheque payment is being substituted by card payments since the 2000s due to the convenience of using cards. While debit card and e-money payments have similar functions where both of them help the users to store money and make transactions conveniently. However, the similarities stop there. E-money payment provides faster transactions and various rewards to the users. According to Pachpande and Kamble (2018), debit card payment requires access to the POS terminals or an ATM counter while e-money payment can be done anywhere, anytime without carrying the cards. Besides, consumers nowadays tend to use e-money payments to collect loyalty points in order to claim the rewards provided by the merchants or e-wallet applications. Lee *et al*. (2020) who study the factors affecting e-wallet adoption, have found that rewards that are used by retailers to retain customers' loyalty to have a positive significant relationship with e-wallet adoption. Therefore, in this context, it can be deduced that e-money payment has substituted debit card payment in the late 2010s. Remarkably, this argument corresponds with the descriptive statistics in Table 3, where the mean of the E-MONEY is more than double compared to DEBIT. Thus, the effect of debit card payment on economic growth is shrunk due to its decreasing usage in CPMI countries during the sampling period.

For credit card payment, its function is slightly different from debit card and e-money payments. A credit card does not pay from the user's saving account, but it charges to the user's credit line. One of the reasons that null Hypothesis 2 cannot be rejected is the low usage of credit cards as mentioned in Section 4.1, where some people seldom use credit cards to avoid paying debt. The second reason may be the offsetting effect of the positive and negative impacts of credit card payment as proposed by Lau *et al*. (2020). The credit card provides an

immediate credit to the users, causing an increase in their purchasing power and subsequently increasing the aggregate demand in the economy, thereby facilitating economic growth (Zandi *et al*., 2016). Nevertheless, it also brings negative effects to the economy on the other hand. The accumulated household debt increases when the usage of credit card payments increases. Several studies (e.g. Lombardi *et al*., 2017; Samad *et al*., 2020) have proved that household debt is negatively related to economic growth in the long run. According to the Global Financial Stability Report by IMF (2017), the increase in household debt is likely to boost unemployment and drag down economic growth in three to five years. Therefore, it is inferred that the immediate positive effect of credit card payment is offset by its negative effect in the long run, leading to the insignificant relationship between credit card payment and economic growth in CPMI countries.

In general, the overall result of the regression analysis is moderately in line with the hypotheses made in this study. As mentioned above, all the digital payments are found positively correlated with GDP growth. This validates the estimation of this paper, in which digital payments can positively influence economic growth through the three transmission channels as described in Section 2. However, only one out of three alternative hypotheses is achieved, which is the significant relationship between e-money payment and economic growth. Other than the reasons stated above, the insignificant relationships and low coefficients of the other two hypotheses may be explained by the conclusion obtained by several scholars including Tee and Ong (2016), Narayan (2019), Aldaas (2020), and Sreenu (2020) who conclude that cashless payment will only have a significant effect on economic growth in the long run. This is because the transformation to a cashless society will not be achieved in near future, so the impact of cashless payments will be affected by the current payment method (Tee and Ong, 2016). This limits the impact of cashless payments on economic growth in the short run. Besides, Tee and Ong (2016) and Sreenu (2020) also find that the adoption of one type of cashless payment will be affected by another type of cashless payment in the short run. This explains the results of this study, where the decrease in bank card usage leads to an increase in e-money usage, thereby causing a significant relationship between e-money and economic growth in the short run.

4.4.2 Comparison Between The Impacts of Digital Payments on Developed Economies and Developing Economies in CPMI

Table 13 shows the regression analysis for the relationship between digital payments and economic growth in 18 developed CPMI countries. As expected, all digital payments have a positive effect on economic growth. Remarkably, it is found that debit card and e-money payments have a p-value below 0.1, suggesting a statistically significant (albeit weak) relationship with economic growth in the developed countries.

Table 13: Fixed Effect Panel Data Regression 2

Fixed Effect Panel Data Model Dependent Variable = GDP				
Independent/Control Variables	Coefficient	Standard Error	t-Statistic	Probability Value
C	3.4431	0.3806	9.0471	0.0000
DEBIT	0.0391	0.0170	2.2935	0.0253
CREDIT	0.0054	0.0049	1.1095	0.2716
E-MONEY	0.0007	0.0004	1.6733	0.0908
INFLATION	-0.6827	0.0898	-7.6055	0.0000
D(POPULATION,2)	-0.1368	0.2333	-0.5863	0.5598
INTERNET	-0.0260	0.0244	-1.0657	0.2907
GDP(-1)	-0.0497	0.1048	-0.4745	0.6369
R-squared = 0.8147				

On the other hand, Table 14 indicates the outcomes of the regression analysis for the relationship between digital payments and economic growth in 9 developing CPMI countries. Similarly, all digital payments are positively correlated to economic growth. However, none of these digital payments is found to have a significant relationship with economic growth in the developing countries.

Table 14: Fixed Effect Panel Data Regression 3

Fixed Effect Panel Data Model Dependent Variable = GDP				
Independent/Control Variables	Coefficient	Standard Error	t-Statistic	Probability Value
C	3.9670	0.9886	4.0128	0.0005
DEBIT	0.0053	0.0219	0.2429	0.8101
CREDIT	0.0563	0.0552	1.0207	0.3172
E-MONEY	0.0033	0.0048	0.6881	0.4977
INFLATION	-0.1996	0.0487	-4.0978	0.0004
D(POPULATION,2)	-1.8379	7.2144	-0.2548	0.8010
INTERNET	-0.0016	0.0233	-0.0671	0.9470
GDP(-1)	-0.1800	0.1749	-1.0289	0.3134
R-squared = 0.8890				

By comparing both Regression 2 and Regression 3, it can be concluded that the impacts of digital payments on the developed economies are greater than the developing economies. Thus, null Hypothesis 4 cannot be rejected. This result is contradicting to the earlier expectation in Section 4.1, where the average growth rate of digital payment transaction volumes in the developing countries is much higher than the developed countries in CPMI. However, it goes in line with the results from previous studies such as Zandi *et al.* (2016) and Aldaas (2020), who also find that cashless payments in advanced countries have a larger impact on economic growth.

One of the possible reasons that developed countries have a lower growth rate in digital payments may be due to its maturity stage in the e-payment market. For example, cashless payments have been popular in the developed countries such as the United States and the United Kingdom since 20 years ago, but they have slowly started to be known in developing countries in the 2010s, which is almost one decade behind the developed countries in term of the information technology (Sacco, 2020). According to Pelletier *et al*. (2014), it is found that developing countries tend to have faster growth in digital payments compared to the developed countries. This is because the financial services in developing countries tend to be more expensive, causing many citizens to use digital payments rather than banking services.

In spite of the faster growth rates, digital payments in developing CPMI countries are found to have no influence over economic growth. This may be resulted by the lower internet penetration rates in the developing CPMI countries. Looking at Figure 6, most of the developing countries such as Indonesia, India, South Africa and Mexico are found to have a lower internet penetration within the nation. Although the growth rates of digital payments in these countries are rapid, there are still many rural areas inside the country that have no access to the internet. Therefore, it is inferred that the transaction volumes of digital payments in these developing countries account for only a tiny proportion of their GDP, thereby digital payments have no significant relationship with economic growth.

5. Conclusion

5.1 Closing Remarks

This paper studies the relationships between three types of digital cashless payments and economic growth in CPMI countries from 2013 to 2019. Most of the existing articles mainly

focus on European countries or a single country, the results of those findings may not be applicable to the CPMI countries due to the differences in the economic model, technology, payment habit and so forth. By employing new evidence, this paper is able to provide new insights on the impacts of digital cashless payments on economic growth in CPMI countries which include APAC countries such as Singapore, China, Indonesia, Japan, and South Korea that are seldom investigated by previous studies. Besides, the sampling period of this study is also later than the previous papers, thus providing the latest findings in this research area which is varied from the previous results because of the changing consumer payment habits and technology development over time.

The empirical results of this paper show that all three digital payments – debit cards, credit cards and e-money are positively correlated to GDP growth in CPMI countries. Particularly, there is a significant relationship between e-money and economic growth which means that e-money payment is found to facilitate the economy of CPMI countries. In contrast, both card payments are found to have no significant relationship with economic growth due to the substitution effect and the offsetting effect as described in the last section. Besides, it is believed that the impacts of digital payments on economic growth will be stronger in the longer period since no country has fully transformed into a cashless society to date. On the other hand, the results also indicate that the impacts of digital payments on economic growth in the developed countries are greater than in the developing countries in CPMI. Debit card and e-money payments are found to have a significant relationship with the economic growth in developed CPMI countries. In contrast, for the developing CPMI countries, none of the digital payments are found to have a significant relationship with economic growth.

5.2 Implications and Recommendations

E-money payment is found to have a significant nexus with economic growth. This result indicates that the initiatives implemented by the CPMI countries are necessary, especially in the era that is adapting rapidly to the development of information technology. As aforementioned in Section 1, the central banks have put a lot of efforts into the improvement of the cybersecurity of digital payments to decrease the rates of cybercrimes and advocate the usage of digital payments. In spite of that, the efforts that have been enforced to date may seem to be not as effective as expected in terms of spurring the economic growth. Thus, the central banks in CPMI membership should take additional actions in the future to enhance the positive impacts of digital payments on economic growth.

The primary action that should be implemented by the central banks is to bring up the awareness of using digital payments to the public, especially the older generations. Vaportzis *et al*. (2017) who study older adult perceptions of technology find that there are several barriers that stop the elder generations to use the new technologies. One of the main barriers is the lack of instructions and guidance. The study states that most of the younger people tend to directly complete the digital tasks for the elderly when asked for assistance, instead of guiding them to complete the digital tasks. Besides, the study by Liébana-Cabanillas *et al*. (2015) also reveals that the older population tends to avoid the use of mobile payment due to their lower technology propensity and the higher requirement of the influence from other people. Therefore, the central banks should join hands with different parties such as the government, mass media, and education institutions to propagate the essentials of using e-payments by providing the public with guidance and instructions on using those digital payment applications. For example, the Singapore government becomes an exemplar and is doing well in guiding its senior population to use e-payments and empowering them to use the technology confidently and securely in their daily life. The Infocomm Media Development Authority (IMDA) of Singapore convened volunteers to assist the senior users in using the applications and learning about different modes of e-payments (Leonards, 2019).

Moreover, the central banks are highly recommended to encourage the merchants in the nation to adopt the digital payment system for their customers. As described previously, implementing a digital payment system can bring various benefits to retailers. However, the developing country in CPMI such as India is facing relatively low adoption of the digital payment system by the small retail stores. Several studies (Seethamraju and Diatha, 2018; Ligon *et al*., 2019; Priya and Fathima, 2021) find that many small retail stores in India still refuse to adopt digital payment system even though the government has made substantial efforts to decrease the use of cash. Seethamraju and Diatha (2018) conclude that the main factor of the low adoption is the low confidence in changing the consumer habits which may threaten their survival due to the loss of loyal customers. Besides, Ligon *et al*. (2019) provide the reasons from another aspect. Their study shows that most of the small retailers refuse to use the digital payment system due to the taxation policy. As the transaction records are trackable after digitalizing the payment system, the merchants may be required to register for the goods and services tax (GST). The charging of GST may cause the business to become more competitive and the retailers are required to pay more taxes. To facilitate the adoption of digital payments by the retailers, the policymakers can provide subsidies to the retailers in order to satisfy the costs of the installation of the system. Most importantly, raising the consumers' awareness of using digital payments is essential so that the retailers are confident to adopt the system.

5.3 Limitations and Future Research

There are some limitations of the study that may affect the accuracy of the results. The available period of data is only from 2013 to 2019, which is relatively short. The short sampling period may weaken the precision of the estimation. Moreover, our study does not include the presence of the Covid-19 pandemic which has the severe impacts on the economy since 2020. According to several pieces of studies (such as Sornaganesh *et al*., 2020; United Nations Conference on Trade and Development, 2020; KPMG, 2020), the usage of digital payments is boosted during the Covid-19 pandemic due to the lockdown in many countries and the rise of various e-commerce activities. The results could have been significantly changed if the effect of the Covid-19 pandemic is accounted into the dataset. In addition, this paper only studies three types of digital cashless payment methods due to the limitation of the available data. Nevertheless, there are many other types of digital payment methods such as internet banking, charge cards, direct debits, pre-paid cards, etc. The inclusion of more types of digital payment methods will increase the preciseness and the robustness of the impacts of digital payments on economic growth.

Future research may analyze the effects of digital payments on each of the determinants of GDP (i.e. household consumption, private investment and government expenditures). This will provide a more direct relationship and insights of the impacts of digital payments as they first affect the determinants of GDP before influencing the economic growth via the transmission channels of digital payments as mentioned in Section 2.

References

Adriana, B. R., & Linnea, H. J. (2020). *How contactless payments are influencing consumer are influencing consumer consumption in a cash-free society?*

Alaeddin, O., Altounjy, R., Abdullah, N., Zainudin, Z., & Kantakji, M. H. (2019). The future of curruption in the era of cashless society. *Humanities & Social Sciences Reviews*, *7*(2), 454-458.

Aldaas, A. (2020). A study on electronic payments and economic growth: Global evidences. *Accounting*, *7*, 409-414.

Asteriou, D., & Hall, S. G. (2011). Autocorrelation. In D. Asteriou, & S. G. Hall, *Applied Econometrics* (2nd ed.). Palgrave Macmillan.

Backman, M. (2017). *Americans prefer debit cards to credit cards. Here's why that's a mistake*. https://www.usatoday.com/story/money/personalfinance/2017/09/15/americans-prefer-debit-cards-to-credit-cards-heres-why-thats-a-mistake/105594064/

Bank for International Settlement & International Organization of Securities Commissions. (2016). *Guidance on cyber resilience for financial market infrastructures.*

Bank for International Settlements. (2020). *BIS Annual Economic Report.* https://www.bis.org

Bank for International Settlements. (n.d.). *History of the CPMI*. https://www.bis.org/cpmi/history.htm

Bezhovski, Z. (2016). The future of the mobile payment as electronic payment system. *European Journal of Business and Management*, *8*(8), 127-132.

Bhandari, P. (2021, April 19). *Control variables explained*. https://www.scribbr.com/methodology/control-variable/

Bolt, W., Humphrey, D., & Uittenbogaard, R. (2008). Transaction pricing and the adoption of electronic payments: A cross-country comparison. *International Journal of Central Banking*, *4*(1), 89-123.

Capgemini, R. (2018). *World payments report 2018*. Capgemini.

Capgemini, R. (2020). *World payments report 2020*. Capgemini.

Cheque & Credit Clearing Company (2013). *From Handwritten to Printed Cheques*. https://www.yumpu.com/en/document/read/12300789/cheques-and-cheque-clearing-an-historical-perspective

Cojocaru, L., Falaris, E. M., Hoffman, S. D., & Miller, J. B. (2016). Financial system development and economic growth in transition economies: New empirical evidence from the CEE and CIS countries. *Emerging Markets Finance and Trade*, *52*(1), 223-236.

Daoud, J. I. (2017). Multicollinearity and regression analysis. *Journal of Physics Conference Series*, *949*(1).

Deloitte. (2013). *The economic impact of online payments. https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/about-deloitte/deloitte-uk-economic-impact-of-online-payments-tmt.pdf*

Durusu-Ciftci, D., Ispir, M., & Yetkiner, H. (2016). Financial development and economic growth: Some theory and more evidence. *Journal of Policy Modeling*, *39*(2), 290-306.

Eom, T., Lee, S., & Xu, H. (2007). Introduction to panel dataanalysis: Conceptsand practices. *Miller/Handbook of Research Methods in Public Administration*, 571-589.

Frankenfield, J. Frost (2021). *Digital Transaction*. Retrieved from Investopedia: https://www.investopedia.com/terms/d/digital-transaction.asp

Frost & Sullivan (2017). *"Going cashless" as catalyst for the Asia-Pacific mobile payments market.* Frost & Sullivan. https://www.frost.com/wp-content/uploads/2017/09/GOING-CASHLESS-%E2%80%93-MOBILE-PAYMENTS-IN-ASIA_Aug17_FINAL-to Editing_QML.pdf

Fuente, A. D. (2000). Convergence across countries and regions: Theory and empirics. *EIB Papers*, *5*(2), 25-45.

G4S Global. (2018). *World cash report 2018*. G4S Cash Solutions.

Global Insight (2003). *The virtuous circle: Electronic payment and economic growth. file:///C:/Users/Office/Downloads/silo.tips_electronic-payments-and-economic-growth.pdf*

Greunen, J. V., Heymans, A., Heerden, C. V., & Vuuren, G. V. (2014). The prominence of stationarity in time series forecasting. *Journal for Studies in Economics and Econometrics*, *38*(1), 1-16.

Grzelczak, M., & Pastusiak, R. (2020). Cashless payments and economics growth in selected European countries. *Annales Universitatis Mariae Curie-Skłodowska sectio H Oeconomia*, *3*, 33-46.

Hasan, I., Renzis, T. D., & Schmiedel, H. (2012). *Retail payments and economic growth.* Bank of Finland Research.

Herranz, E. (2017). Unit Root Tests. *Wiley interdisciplinary reviews: Computational statistics, 9*(3).

Immordino, G., & Russo, F. F. (2016). *Cashless payments and tax evasion.* Centre for Studies in Economics and Finance.

International Monetary Fund. (2017). *Global Financial Stability Report.*

Keele, L., & Kelly, N. (2006). Dynamic models for dynamic theories: The ins and outs of lagged dependent variables. *Political Analysis*, *14*, 186-205.

Kenton, W. (2021). *Committee on Payment and Settlement Systems (CPSS)*. https://www.investopedia.com/terms/c/committee-payment-settlement-systems-cpss.asp

KPMG. (2020). *Impact of Covid-19 on Digital Payments in India.* https://assets.kpmg/content/dam/kpmg/in/pdf/2020/08/impacting-digital-payments-in-india.pdf

Kumari, N., & Khanna, J. (2017). Cashless payment: A behavioral change to economic growth. *Qualitative and Quantitative Research Review*, *2*(2), 82-103.

LaMorte, W. W. (2019). *Diffusion of innovation theory*. https://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories4.html

Lau, W.-Y., Wong, T.-L., & Yip , T.-M. (2020). Cashless payments and economic growth: Evidence from selected OECD countries. *Journal of Central Banking Theory and Practice*, 189-213.

Lee, K. L. Y., Jais, M., Wen, C. C., Zaidi, N. S. (2020). Factor affecting adoption of e-wallet in Sarawak. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, *10*(2), 244-256.

Leonards, A. (2019). *Are we sleepwalking into a cashless future?* https://www.raconteur.net/finance/pensions/financial-inclusion-cashless-society/

Levin, A., Lin, C.-F., & Chu, C.-S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, *108*(1), 1-24.

Liébana-Cabanillas, F., Sánchez-Fernández,, J., & Muñoz-Leiva, F. (2015). Influence of age in the adoption of new mobile payment systems. *Revista Brasileira de Gestao de Negocios*, *17*(58), 1390-1407.

Ligon, E., Malick, B., Sheth, K., & Trachtman, C. (2019). *What explains low adoption of digital payment technologies? Evidence from small-scale merchants in Jaipur, India.* Center for Effective Global Action.

Lombardi, M., Mohanty, M., & Shim , I. (2017). *The real effects of household debt in the short and long run* . Bank for International Settements.

Martins, F. S., Serra, F. A., & Cunha, J. d. (2018). Secondary data in research – uses and opportunities. *Revista Ibero-Americana de Estratégia*, *17*(4), 1-4.

Moss, R. (2019). *The History of Cashless Society*. https://www.totalprocessing.com/blog/history-of-cashless-society-infographic

Muyiwa, O., Tunmibi, S., & John-Dewole, T. A. (2013). Impact of cashless economy in Nigeria. *Greener Journal of Internet, Information and Communication Systems*, *1*(2), 40-43.

Narayan, S. W. (2019). Does fintech matter for Indonesia's economic growth?. *Bulletin of Monetary Economics and Banking*, *22*(4), 437-456.

Ng, S. H. (2014). How does group affiliation affect the diversification performance of family-controlled firms in Malaysia? – A governance perspective. *Asian Academy of Management Journal of Accounting and Finance*, *10*(2), 87-116.

Oyewole, O. S., El-Maude, Gambo, J., Abba, M., & Onuh, M. E. (2013). Electronic payment system and economic growth: A review of transition to cashless economy in Nigeria. *International Journal of Scientific Engineering and Technology*, *2*(9), 913-918.

Pachpande, B. R., & Kamble, A. A. (2018). Study of e-wallet awareness and its usage in Mumbai. *Journal of Commerce and Management Thought*, *9*(1), 33-45.

Park, D., & Shin, K. (2015). *Economic growth, financial development, and income inequality*. Asian Development Bank.

Parmar, R. (2018). A study of cashless system and cashless society: Its advantages and disadvantages. *Indian Journal of Applied Research, 8*(4), 10-11.

Pelletier, A., Khavul, S., & Estrin, S. (2014). *Mobile payment services in developing countries*. International Growth Centre.

Priya, M., & Fathima, Y. (2021). A study of the adoption of digital payment by small retail stores. *International Journal of Creative Research Thoughts*, *9*(4), 1749-1753.

Ravikumar, T., Suresha, B., Sriman, M., & Rajesh, R. (2019). Impact of digital payments on economic growth: Evidence from India. *International Journal of Innovative Technology and Exploring Engineering*, *8*(12), 533-577.

Rolfe, A. (2020, May 27). *Europe's top 10 cashless countries*. https://www.paymentscardsandmobile.com/europes-top-10-cashless-countries/

Sacco, F. (2020, September 29). *The history of digital wallets*. https://blog.717cu.com/resources/education/financial-education-blog/the-history-of-digital-wallets

Samad, K. A., Mohd Dali, N. S., & Daud, S. M. (2020). Household debt and economic growth. *International Journal of Academic Research in Business & Social Sciences*, *10*(4), 539-551.

Schneider, F. (2013). *The shadow economy in Europe, 2013.* A.T. Kearney.

Schneider, F., & Enste, D. (2002). *Hiding in the shadows: The growth of the underground economy*. IMF Economic Issues.

Seethamraju, R., & Diatha, K. S. (2018). Adoption of digital payments by small retail stores. In *Australasian Conference on Information Systems 2018* (pp. 1-11). Sydney.

Shapiro, R. J., & Hassett, K. A. (2012, June 19). *The Economic Benefits of Reducing Violent Crime*. https://www.americanprogress.org/issues/economy/reports/2012/06/19/11755/the-economic-benefits-of-reducing-violent-crime/

Siyanbola, T. T. (2013). The effect of cashless banking on Nigerian economy. *eCanadian Journal of Accounting and Finance*, *1*(2), 8-18.

Sornaganesh, V., Ganesh, S., Sathish, M. T., & Chellamma, A. V. (2020). Impact of Covid-19 outbreak in digital payments. *International Journal for Innovative Research in Multidisciplinary Field*, *6*(8), 159-164.

Sreenu, N. (2020). Cashless payment policy and its effects on economic growth of India: An exploratory study. *ACM Transactions on Management Information Systems*, *11*(3).

Tee, H.-H., & Ong, H.-B. (2016). Cashless payment and economic growth. *Financial Innovation*, *2*(4).

The World Bank (2019). *Individuals using the Internet (% of population).* https://data.worldbank.org/indicator/IT.NET.USER.ZS?name_desc=false

The World Bank (2019). *Mobile Cellular Subscriptions*. https://data.worldbank.org/indicator/IT.CEL.SETS

United Nations Conference on Trade and Development. (2020). *Covid-19 and E-commerce: Impact on Business and Policy Responses.* https://unctad.org/system/files/official-document/dtlstictinf2020d2_en.pdf

Vaportzis, E., Clausen, M. G., & Gow, A. J. (2017). Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers: A Focus Group Study. *Front Psychol*, *8*. Vaportziz et al. (2017)

VISA Inc. (2018). *Digital Transformation of SMBs: The Future of Commerce.*

Worldpay (2021). *Global Payments Report*. https://www.fisglobal.com/en/insights/merchant-solutions-worldpay/article/2020-global-payments-report-five-ecommerce-takeaways

Zandi , M., Koropeckyj, S., Singh, V., & Matsiras , P. (2016). *The Impact of electronic payments on economic growth.* Moody's Corporation.

Zandi, M., Singh, V., & Irving, J. (2013). *The Impact of electronic payments on economic growth*. Moody's Analytics.

Zellermayer, O. (1996). *The pain of paying.* Carnegie Mellon University.

Zhao, Y. & Ng, S. H. (2021). Dividend payout policies in the pre and post split share structure reform in China. *Cogent Economics & Finance*, *9*, 1923620.

Zulfikar, R. (n.d.). *Estimation model and selection method of panel data regression: An overview of comman effect, fixed effect and random effect model*. Universitas Islam Kalimantan MAB Banjarmasin.

Zyl, J. M. (2011). The laplace likelihood ratio test for heteroscedasticity. *International Journal of Mathematics and Mathematical Sciences*, 1-7.

Capital Markets Review Vol. 30, No. 2, pp. 91-106 (2022)

Efficiency and Competition in QISMUT Banking Sector

Noor Shazreen Mortadza[1] & Rossazana Ab-Rahim[1*]
[1]*Faculty of Economics and Business, Universiti Malaysia Sarawak, Malaysia*.

Abstract: Research Question: Theoretically, the rapid growth of the banking sector fosters competition and eventually competition influences the efficiency performance of the banks. The issue that we would like to highlight, whether efficiency and competition are interrelated in the QISMUT banking sector. **Motivation:** In the context of QISMUT, these countries recorded 80 percent of shares of the global Islamic banking industry (Ernst and Young, 2014). Due to the rapid growth of Islamic banks in QISMUT, it is important for them to operate efficiently in their performance to compete with conventional banks. Hence, this study aims to assess the nexus of efficiency and competition of QISMUT (Qatar, Indonesia, Saudi Arabia, Malaysia, United Arab Emirates and Turkey) banking sector. Interestingly, there is no study related to investigating the nexus of efficiency and competition of the QISMUT banking sector. **Idea:** Competition and efficiency are important as it is reflecting the performance of the banking sector. Since competition causes the banks to perform better in terms of efficiency. It can be seen that there is a relationship between competition and efficiency. **Data:** The period of the data is from 2006 to 2016. It consists of 60 conventional and 32 Islamic banks. **Method/Tools:** The measurement to measure the efficiency is Data Envelopment Analysis (DEA) whilst for the competition, Lerner Index is used. In order to test the relationship between competition and efficiency, the Generalized Method of Moments (GMM) is employed due to its advantages such as overcoming the endogeneity problem. **Findings:** The findings indicate Islamic banks are more efficient than conventional banks in QISMUT. The results also show there is an insignificant competition-efficiency whereas efficiency-competition is significant for the conventional banking sector in QISMUT. The results imply that the banking authorities should monitor the conventional banking sector as the finding shows a high concentration compared to Islamic because these countries aim to become an Islamic international financial hub. **Contributions:** This study contributes to the new evidence of QISMUT banking sector regards on efficiency, competition and the impact of banks-specific variables.
Keywords: Competition, efficiency, Islamic banks, conventional, banking.
JEL Classification: X10, X12, X14

1. Introduction

QISMUT Islamic banking sector signifies the rapid growth market in Islamic finance and services (Ernst and Young, 2016). As a result, it triggers competitiveness in the banking sector. Interestingly, conventional banks are also established in QISMUT even the population

* Corresponding author: Rossazana Ab-Rahim. Tel.: +6082-584455.
Email: arrossazana@unimas.my

Received 22 July 2021; Final revised 27 Jan 2022; Accepted 25 March 2022; Available online 30 Sep 2022.
To link to this article: https://www.mfa.com.my/cmr/v30_i2_a5/

of QISMUT is a Muslim majority. This increases competition among Islamic and conventional banks. Furthermore, penetration of foreign banks is one of the factors that affect the banking sector. This statement has been supported by Rajan and Zingales (2003) which mentioned the entry of foreign banks can trigger competition in the countries. In addition, competition affects the performance of the banks in terms of efficiency (Andries and Capraru, 2012). Apergis and Polemis (2016) mentioned that the efficiency of banks has been triggered by competition in the European banking scenario. Efficiency reflects on how banks manage their cost and inputs to produce outputs. The efficiency of the banks is influenced by the competition which also affects the market power (Arrawatia and Mishra, 2012; Pruteanu-Podpiera *et al*., 2008). Competition and efficiency are important as it is reflecting the performance of the banking sector. Since competition causes the banks to perform better in terms of efficiency. It can be seen that there is a relationship between competition and efficiency. In the context of QISMUT, these countries recorded 80 percent of shares of the global Islamic banking industry (Ernst and Young, 2014). Due to the rapid growth of Islamic banks in QISMUT, it is important for them to operate efficiently in their performance to compete with conventional banks. Hence, the competition in the banking sector of QISMUT is affected. This is the issue that we would like to highlight, whether efficiency and competition are interrelated in the QISMUT banking sector. Another contribution of this study is to examine whether efficiency causes competition or vice-versa. In this study, we investigate a similar relationship in the context of QISMUT banking sectors due to both sectors operating simultaneously in respective countries. QISMUT was selected in this study due to its rapid growth in the global Islamic banking industry, hence, this hampers the performance in terms of the efficiency and also the competition.

The structural approach mainly consists of traditional structure-conduct-performance (SCP), concentration ratio (CR), Herfindahl-Hirschman Index (HHI) and the efficiency-structure (ES) hypothesis. Secondly, non-structural approaches are developed from the structural approach and consist of the Panzar-Rosse model and the Lerner Index (LI). The structural approach mostly used by the researcher to analyze the market structure is the structure-conduct-performance (SCP) paradigm. Mason (1939) is the researcher that developed SCP paradigm. SCP gained more attention from researchers including Bain (1951, 1956). In SCP, the performance was influenced by conduct. The measurements consist of concentration ratios (CR), Herfindahl-Hirschman Index (HHI) and 'efficiency structure hypothesis (ES)'. The non-structural approach is the new method known as the New Empirical Industrial Organisation (NEIO) that is related to the SCP paradigm. NEIO shows that conduct such as in SCP leads to pressure in the competition. Under NEIO, there are several measures to examine the competitive environment and determine the market structure. However, the market structure determined by market shares cannot reflect the competitiveness level in the industry. Two common non-structural assessments are Panzar and Rosse (PR-H) also known as H-statistics and Lerner Index.

According to Hicks (1935) in the 'quiet life hypothesis', firms or banks that have market power tend to neglect the activities of the organization and this causes the firms or banks inefficient. However, in contrast, Demsetz (1973) came out with an 'efficient structure hypothesis (ES)'. This gist of the ES is the efficient banks or firms would create high profits which reflects the extraordinary performance. Mkrtchyan (2005) studied the competition in Armenia by using the Panzar-Rosse approach. The author found that the banking sector in Armenia is under monopolistic competition from the year 2001 to 2003. Bhatti and Husain (2010) assessed the structure-conduct-performance (SCP) of commercial banks in Pakistan. It was found that concentration ratio and profitability are a positive relationship. Apart from that, the author found that market share and profitability are a negative relationship which does not support the ES hypothesis. Gajurel and Pradhan (2012) studied the concentration and

competition in the Nepal banking sector. The results show that there was high competition in the interest-based market compare to the total market. Besides, Macit (2012) found Turkish banking sector is under monopolistic competition and it consistent with Sekmen *et al*. (2015). In another region such as Africa, Simatele (2015) also found the African banking sector operates under monopolistic competition by using similar methodology from previous studies which are Panzar-Rosse (PR-H) and the concentration ratio (CR). As for Middle East and North Africa (MENA), Anzoategui *et al*. (2010) used PR-H and Lerner Index (LI) to determine the market competition. The findings indicate the banking sector in MENA is under monopolistic competition and concentrated. An extended study by Hamza and Kachtouli (2014) shows conventional and Islamic banking sector is also under monopolistic competition. Besides, the authors used LI to examine the market power and it was found that Islamic banks have market power. The finding was consistent with Ariss (2010) and Weill (2011) which also found Islamic banks are concentrated compared to conventional. Other than that, numerous studies examine the conventional and Islamic banking sector over the period of the global financial crisis. Kabir and Worthington (2017) found competition in conventional banks lower during the financial crisis. In contrast, Islamic banks were found to perform better compared to conventional during the crisis.

Hassan *et al*. (2009) studied the efficiency in Middle East banks consists of Islamic and conventional. The result from this study is conventional and Islamic banks reported no significant differences between the overall efficiency score. The banks in the organization of the Islamic Conference (OIC) are more efficient in cost efficiency compare to profit and revenue efficiency. Ahmad *et al*. (2010) examine the efficiency of Islamic banks. It was found that Islamic banks' pure technical efficiency (PTE) more efficient compare to their scale efficiency (SE). Apart from that, the authors found from the results that in determining the technical efficiency, it was pure technical efficiency affecting it. Kablan and Yousfi (2011) studied the efficiency of conventional and Islamic banks in 17 countries in the Middle East. The authors found that the size of the banks insignificant meanwhile for market power and profitability had a negative impact on efficiency. Ab-Rahim *et al*. (2013) found that Islamic domestic banks are inefficient compare to Islamic foreign banks in terms of allocative efficiency and pure technical efficiency. In addition, the authors also found that allocative efficiency is the main contributor to cost-efficiency for Malaysian Islamic banks. Sillah and Harrathi (2015) examine the banks' efficiency in Gulf Cooperation Council Countries (GCC) from the year 2006 to 2012. The method that the authors use to analyzed the efficiency is Data Envelopment Analysis (DEA) which is a non-parametic approach. The authors found that conventional banks perform well in terms of their efficiency score during the financial crisis in 2008 compare to Islamic banks. It is consistent with Alqahtani *et al*. (2017) and Srairi (2010) findings which show that Islamic banks experienced cost-efficient during the global financial crisis compare to conventional. Moreover, Safiullah and Shamsuddin (2020), Albaity *et al*. (2019), Batir *et al*. (2017) and Abdul-Majid *et al*. (2010) also examine the efficiency of conventional and Islamic banks, the findings indicate Islamic banks recorded inefficient compared to its counterparts. In the Asian region, the majority of Islamic banks were found more scale inefficient (Rosman *et al*., 2014).

Ningaye *et al*. (2014) found that competition affected profit efficiency positively than cost efficiency. Andries and Capraru (2012) examined the competition and efficiency in European banking systems. The authors used Granger causality to investigate the relationship between competition and efficiency. In this study, it was found that efficiency positively affected competition or granger causes competition. Ab-Rahim (2016) studied the competition and efficiency of commercial banks for the year 1996 to 2011. The author found that there was an increase in concentration faced by Malaysian commercial banks with a low level of competition and is a positive effect of competition towards the efficiency in terms of technical

efficiency and pure technical efficiency. In addition, there are recent studies examining the market structure and efficiency specifically in the QISMUT banking sector by Mortadza *et al*. (2019). Since these countries are dual banking sectors, the conventional and Islamic banks have to compete and perform better. The authors found that the conventional banking sector in QISMUT is concentrated compared to its counterpart. As for the performance, the authors found that Islamic banking sector is more efficient compared to the conventional. From the study, it indicates that a less competitive environment influences inefficiency. Meanwhile, as for Islamic banking sector, it shows that competition leads to better performance in terms of efficiency. Other past studies on QISMUT have tended to focus on efficiency performance but none has focused on the relationship between competition-efficiency in the QISMUT banking industry. For instance, Mammadov and Mukhtarov (2018) assessed the impact of prices of oil in QISMUT's Islamic banking industry and Yildirim (2015) focused on the efficiency of Islamic banks in QISMUT.

On the contrary, Pruteanu-Podpiera *et al*. (2008) found negative causality from competition to efficiency by using Granger causality analysis. Furthermore, Casu and Girardone (2009) assessed a similar study and the findings indicate negative for efficiency to competition whilst positive from competition to efficiency. This result consistent with Apergis and Polemis (2016) which is also found negative causality from efficiency to competition in the MENA banking sector. Repkova and Stavarek (2013) studied the efficiency and its relationship with the competition in the banking industry. It was found that efficiency and competition are a positive relationship which also contradicts to 'Quiet Life Hypothesis'. Mugume (2007) examines the performance and the market structure in Uganda's banking sector. The author found that efficiency causes market share and concentration which also affects the probability of the banks.

Previous studies had focused on efficiency and competition in the banking sector in a specific region, especially Islamic banking (Yildirim, 2015). As an illustration, the previous studies investigate the Islamic banking sector in the Middle East and North Africa (MENA) and Asian countries. There are a few studies focused on the QISMUT banking sector. According to Ernst and Young (2016), QISMUT recorded rapid growth in compound annual growth rate (CAGR) and this reflects that QISMUT is strived and compete which affects the performance of the banks. According to Mongid *et al*. (2012) emphasized that the efficiency of the banks is important for financial stability. More specifically, this study focuses on the relationship of efficiency and competition due to several issues. First, the rapid growth of Islamic banks in QISMUT influences the performance and the competition in the banking sector. Other than that, conventional banks in QISMUT also will be affected due to the growth of Islamic banking sector. Second, efficiency and competition are the important factors in the banking industry. Based on theories such as 'Efficient-Structure', efficient banks have the benefits and influence the market structure of the banking sector. On the contrary, in 'Quiet-Life Hypothesis', it states that dominant banks tend to become inefficient due to their negligence on the organization's management. Moreover, competition is also known as the factor that affects the performance of the banking sector such as in theory of 'competition-stability/fragility'. Based on the theoretical studies, it indicates that efficiency and competition play a significant role in the banking sector. The questions of this study are whether competition and efficiency have a significant relationship? Interestingly, there is no study related to investigating the nexus of efficiency and competition of the QISMUT banking sector.

2. Methodology

The measurement to examine the efficiency score of pure technical efficiency (PTE), technical efficiency (TE) and scale efficiency (SE) are by using Data Envelopment Analysis

(DEA). In order to know the degree of the market power in the banking sector, Lerner Index (LI) was also used in this study and Generalized Methods of Moments (GMM) for testing the relationship of efficiency and competition. The period of the study involved is from the year 2006 to 2016 and the data are extracted from Orbis Database. It involved 60 conventional and 32 Islamic banks in QISMUT.

2.1 Efficiency

In efficiency measurement, inputs and outputs variables are includes. The intermediation approach is used for Data Envelopment Analysis (DEA). The efficiency score is the maximum ratio of outputs to inputs (Ab-Rahim *et al*., 2013). Variables involved as input and output are similar to the previous studies such as in Apergis and Polemis (2016), Giustiniani and Ross (2008), Castellanos and Garza-Garcia (2013), Ab-Rahim (2015), Abdul-Majid and Hassan (2011) and Abdul-Majid *et al*. (2010). The variables for inputs are deposits including short-term funding and personnel expenses whereas variables for outputs are total loans and other earnings assets.

$$\begin{aligned} &\text{Max } u,v\ (u'yi/v'xi),\\ &\text{s.t } uyj/v'xj \leq 1\\ &u, v \geq 0\ j=1,2,\ldots N\\ &xi = \text{virtual inputs (single)}\\ &yi = \text{virtual outputs (single)} \end{aligned} \tag{1}$$

Decision-Making Units (DMU) will be evaluated from the number of different inputs (K) that will produce different outputs (M). DEA and DMU measure efficiency in terms of overall technical efficiency. xi and yi are the K times N input matrix and K times M output matrix for ith DMU. X which is K times N and Y is K times M for all data, N of DMUs. Finding the value of u and v are to prevent the problem of the infinite number if the efficiency of ith DMU is maximized.

$$\begin{aligned} &\text{Constant constraint } (pxi = 1).\\ &\text{Max}u, v\ (u'yi),\\ &\text{s.t } p\ xi = 1\\ &u\ yj - p'xj \leq 0\\ &j=1,2,\ldots N\\ &u, p \geq 0 \end{aligned} \tag{2}$$

u and p are from the transformation value of u and v. Linear programming difficulties from the envelopment are shown as below:

$$\begin{aligned} &\text{Min}\theta, \theta\\ &\text{s.t. } yi + Y\lambda \geq 0,\\ &\theta_{xi} - X\lambda \geq 0\\ &j=1,2,...N \end{aligned} \tag{3}$$

θ is a scalar while λ is N times 1 which is vector of constants. The efficiency of the score in ith DMU represent by the value of θ and this can be solved by N.

$$\begin{aligned} &\min\lambda,\ xi * wixi,\\ &\text{s.t. } -yi + Y\lambda \geq 0,\\ &xi - X\lambda \geq 0,\\ &N1\ \lambda = 1\\ &\lambda \geq 0, \end{aligned} \tag{4}$$

N1 is an N time 1. Technical efficiency (TE) scores are from constant return to scale (CRS) model and pure technical efficiency (PTE) scores are from a variable return to scale (VRS). Scale efficiency (SE) is from CRS to VRS.

2.2 Lerner Index

Lerner Index (LI) is used to measure the degree of market power of competition in the banking sector. Leon (2014) stated that LI is great at measuring market power in banking. The variables involved in computing the LI depends on the approach that the researcher use. In this study, the variables are chosen based on the intermediation approach.

$$\begin{aligned} Ln(TC_{it}) &= \beta_0 + \beta_1 LnQ_{it} + \frac{\beta_2}{2} Ln(Q^2_{it}) \sum_{k=1}^{3} \gamma_{kt}\, Ln(W_{k,it}) + \sum_{=1}^{3} \varphi_k LnQ_{it}\, Ln(W_{k,it}) \\ &+ \sum_{k=1}^{3} \sum_{j=1}^{3} Ln(W_{k,it}) Ln(W_{j,it}) + \varepsilon_{it} \\ MC_{it} &= \frac{TC_{it}}{Q_{it}} \left[\beta_1 + \beta_2 LnQ_{it} + \sum_{k=1}^{3} \gamma_{kt}\, Ln(W_{k,it}) \right] \\ LI_{it} &= \frac{P_{it} - MC_{it}}{P_{it}} \end{aligned} \tag{5}$$

TC = Interest expense and Non-Interest expenses;
W_L = Personnel expenses / Total assets = Labour costs;
W_F = Interest expenses / Total deposits = Costs of funds;
W_P = Non-Interest expenses / Total assets = Costs of capital;
P = Total revenue / Total assets; and
Q = Total Assets.

All the variables listed above are similar to the previous studies by Weill (2004), De Guevara *et al*. (2005) and Hamza and Kachtouli (2014). W_L, W_F and W_P are the prices of inputs (W_k) according to the intermediation approach which involved the labour, funding and capital to create the outputs.

2.3 Generalized Method of Moments (GMM)

In order to measure the relationship of competition and efficiency, the Generalized Method of Moment (GMM) by Arellano and Bover (1995) is used in this study. Below is the general estimation for GMM.

$$\text{Efficiency} = C + \gamma\, \text{Efficiency}_{t-1} + \beta_1\, \text{Competition} + \beta_2\, \text{banks variable} + \beta_4\, \text{Macro variable} + \varepsilon_{it} \tag{6}$$

$$\text{Competition} = C + \gamma\, \text{Competition}_{t-1} + \beta_1\, \text{Efficiency} + \beta_2\, \text{banks variable} + \beta_4\, \text{Macro variable} + \varepsilon_{it} \tag{7}$$

Efficiency and competition are the dependent variables for the estimation of the QISMUT banking sector. Efficiency represents the efficiency score measured by DEA meanwhile Lerner Index is used as competition. The bank variables are equity to total assets (EQTA),

total deposits to total assets (TDTA) and total loans to total assets (TLTA). These variables have been used from previous studies by Coccorese and Pellechia (2010), Chortareas *et al*. (2011), Bakour and Gallali (2013), Schaeck and Cihak (2008) and Giustiniani and Ross (2008). The macro variable for this study is Gross Domestic Products (GDP) per capita similar to Ariss (2010) and Liyanagamage (2014).

Dynamic panel data is used in this study because of the nature of the sample which is dynamic. The are several advantages of using system GMM in estimations such as the regression would be less biased. This is because system GMM overcome several problems that occurred in ordinary least square estimates. For instance, the problem of endogeneity and simultaneity. Since this study examine the relationship of efficiency and competition, system GMM is used to overcome potential bias in the estimations. Besides, based on the theoretical studies such as 'Efficient-Structure Hypothesis' and 'Quiet-Life Hypothesis', competition, and concentration of the market structure influence the efficiency of the banks and vice-versa. This is another reason why this study employ system GMM.

3. Results

3.1 Efficiency

Table 1: Efficiency of banking sector (Qatar)

Year	Pure Technical Efficiency (PTE)		Technical Efficiency (TE)		Scale Efficiency (SE)	
	CB	IB	CB	IB	CB	IB
2006	75.70	87.39	69.62	86.74	89.90	98.94
2007	72.83	76.93	68.13	72.40	92.02	93.43
2008	70.40	84.95	67.43	79.74	92.95	93.13
2009	70.43	83.89	67.99	79.50	93.28	94.26
2010	73.35	79.49	70.49	76.37	94.84	95.85
2011	74.84	92.30	73.63	92.08	96.76	99.72
2012	78.38	93.76	77.44	88.92	97.72	94.93
2013	76.19	96.38	92.85	91.64	99.37	95.19
2014	76.96	90.59	76.29	86.70	98.31	95.77
2015	79.87	94.63	79.34	91.10	98.50	96.26
2016	78.68	97.74	77.77	94.72	98.25	96.98
Mean	75.24	88.91	74.63	85.45	95.63	95.86

Notes: CB is conventional banking sector and IB is Islamic banking sector.

Table 1 shows the efficiency score of both banking sectors in Qatar. In terms of PTE, it was found that Islamic banks are more efficient compare to conventional. This shows their mean where conventional recorded 75.24 and Islamic is 88.91. In addition, it indicates that Islamic banks are utilized their inputs efficiently compared to conventional. For TE, it still Islamic banks that score the highest mean of TE with 85.45 compared to 74.63. This means that the conventional waste a lot of inputs by 25.37 percent compared to 14.55 percent for Islamic. In terms of SE, the mean of Islamic and conventional are not much different which both are operate efficiently in Qatar.

Table 2: Efficiency of the banking sector (Indonesia)

Year	Pure Technical Efficiency (PTE)		Technical Efficiency (TE)		Scale Efficiency (SE)	
	CB	IB	CB	IB	CB	IB
2006	55.33	82.08	47.39	80.97	86.14	98.72
2007	56.33	96.62	49.97	87.18	89.18	90.08
2008	62.15	93.10	56.59	87.87	91.45	93.93
2009	59.49	86.73	52.25	76.06	89.01	87.40
2010	64.79	89.20	57.80	74.85	90.74	84.53
2011	65.31	87.79	55.86	65.42	85.77	75.29
2012	65.69	89.47	56.23	77.34	86.20	86.04
2013	73.97	87.58	62.83	63.84	84.46	74.42
2014	73.01	87.79	61.94	65.54	85.00	75.90
2015	70.46	90.35	61.28	67.95	87.12	75.27
2016	70.41	92.58	58.37	68.82	88.92	74.58
Mean	65.18	89.39	56.41	74.17	87.64	83.29

Notes: CB is conventional banking sector and IB is Islamic banking sector.

For Indonesia, it was found that Islamic banks are efficient compare to conventional in terms of PTE and TE. Conventional banks in Indonesia recorded the highest PTE in the year 2013 (73.97) meanwhile for Islamic banks is 96.62 in 2007. This shows that conventional have improved from the year 2009 to 2013 whereas Islamic banks show a decrease from the year 2008 to 2009 due to crisis. In terms of TE, the highest TE scored by conventional with 62.83 (2013) whereas for Islamic is 87.87 in 2008. For SE, the highest SE is 91.45 for conventional in 2008 and 98.72 in 2006 for Islamic banks. From the value of the mean, it shows that Islamic banks are more efficient in managing their inputs whereas conventional are more efficient in their operating.

Table 3: Efficiency of banking sector (Saudi Arabia)

	Pure Technical Efficiency (PTE)		Technical Efficiency (TE)		Scale Efficiency (SE)	
Year	CB	IB	CB	IB	CB	IB
2006	95.01	100.00	89.15	100.00	94.08	100.00
2007	93.52	100.00	89.92	100.00	96.34	100.00
2008	95.11	100.00	93.83	93.17	98.66	93.17
2009	92.01	100.00	88.25	88.99	96.12	88.99
2010	95.48	99.97	91.34	91.91	95.77	91.94
2011	94.88	100.00	92.87	96.22	97.94	96.22
2012	95.25	100.00	93.66	97.67	98.36	97.67
2013	96.46	100.00	95.86	100.00	99.40	100.00
2014	97.58	100.00	97.03	100.00	99.38	100.00
2015	96.84	100.00	95.37	99.73	98.48	99.73
2016	97.72	100.00	96.49	99.19	98.69	99.19
Mean	95.44	100.00	93.07	95.54	97.57	95.54

Notes: CB is conventional banking sector and IB is Islamic banking sector.

Next, for Saudi Arabia, Islamic banks score a perfect 100 from the year 2006 to 2016 in PTE except the year 2010. Surprisingly, the conventional banking sector of Saudi Arabia PTE above 90 percent which is also efficient. This indicates that conventional and Islamic are efficient in managing their inputs. In terms of TE, Islamic banks still recorded the highest efficiency score compare to conventional. For SE, the mean shows that conventional is more efficient compare to Islamic banks in Saudi Arabia.

Table 4: Efficiency of banking sector (Malaysia)

Year	Pure Technical Efficiency (PTE)		Technical Efficiency (TE)		Scale Efficiency (SE)	
	CB	IB	CB	IB	CB	IB
2006	72.50	69.65	49.58	57.58	70.30	85.78
2007	69.86	63.18	49.14	56.75	70.40	90.66
2008	74.09	81.89	51.27	75.21	70.17	92.84
2009	72.88	79.14	50.79	72.36	70.70	91.91
2010	71.91	81.74	49.57	76.53	69.29	94.02
2011	74.89	71.73	51.58	65.85	68.58	89.84
2012	76.82	80.61	52.58	76.17	69.53	91.99
2013	75.88	84.35	51.93	80.94	69.28	96.26
2014	80.11	90.74	53.29	87.26	68.21	96.22
2015	82.06	88.26	57.19	85.05	69.00	96.50
2016	82.22	91.14	56.91	87.18	68.93	95.46
Mean	75.75	80.34	52.16	74.71	69.49	92.80

Notes: CB is conventional banking sector and IB is Islamic banking sector.

In Malaysia, the efficiency score trend is almost similar to Qatar, Indonesia and Saudi Arabia which shows that Islamic banks are efficient than conventional. The efficiency score of PTE of the conventional show an improvement towards the year 2016 meanwhile for Islamic is inconsistent throughout the year. In terms of TE, Islamic banks still efficient whereas conventional is inefficient where the score is only below 60 percent. For SE, it is obvious that Islamic banks are efficient compare to conventional banks.

Table 5: Efficiency of banking sector (UAE)

	Pure Technical Efficiency (PTE)		Technical Efficiency (TE)		Scale Efficiency (SE)	
Year	CB	IB	CB	IB	CB	IB
2006	87.67	94.98	77.03	91.47	87.90	96.47
2007	80.98	84.07	72.49	82.71	89.15	98.35
2008	83.00	95.05	77.29	85.12	93.70	88.41
2009	78.89	91.67	73.15	90.60	93.29	98.86
2010	78.58	90.64	73.80	89.82	94.25	99.05
2011	78.62	78.01	73.30	71.42	93.29	87.50
2012	76.99	88.73	71.27	86.27	93.01	97.13
2013	77.61	87.91	71.53	85.36	93.09	97.08
2014	78.99	92.84	73.55	88.98	93.92	95.93
2015	79.21	94.13	74.06	90.75	94.24	96.44
2016	86.33	94.48	79.91	91.96	92.94	97.22
Mean	80.62	90.23	74.31	86.77	92.62	95.68

Notes: CB is conventional banking sector and IB is Islamic banking sector.

For UAE, the efficiency score in terms of PTE shows that once again Islamic banks are efficient except in the year 2011 where the conventional banks efficient. For TE, the situation also similar where the conventional is efficient in 2011 compare to Islamic. In terms of SE, it was found that Islamic is efficient in operating. Overall, for the mean, it is obvious that Islamic banks are efficient in managing their inputs.

Table 6: Efficiency of banking sector (Turkey)

Year	Pure Technical Efficiency (PTE)		Technical Efficiency (TE)		Scale Efficiency (SE)	
	CB	IB	CB	IB	CB	IB
2006	66.74	99.01	53.40	78.38	83.77	79.20
2007	60.68	98.18	49.57	87.89	85.39	89.46
2008	57.20	93.15	47.99	84.74	85.48	90.85
2009	64.90	88.64	57.15	80.84	88.40	90.87
2010	64.40	89.03	57.09	82.47	89.02	92.81
2011	64.89	94.33	55.50	88.10	88.58	93.28
2012	61.38	84.15	51.63	81.75	87.22	96.99
2013	50.59	88.94	43.71	85.43	88.23	95.96
2014	48.01	91.43	42.71	88.90	90.61	97.31
2015	56.97	90.34	46.93	88.79	87.72	98.22
2016	61.45	96.02	46.98	94.13	81.96	97.86
Mean	59.75	92.11	50.24	85.58	86.94	92.98

Notes: CB is conventional banking sector and IB is Islamic banking sector.

The Turkish banking sector in Table 6 shows that conventional banks quite inefficient in PTE compare to Islamic banks. In terms of TE, Islamic banks score the highest efficiency score compare to conventional which the score is below 60 percent. It shows that conventional waste inputs more than Islamic banks. In terms of SE, Islamic recorded the highest score compared to conventional.

Table 7: Efficiency of banking sector (QISMUT)

	Pure Technical Efficiency (PTE)		Technical Efficiency (TE)		Scale Efficiency (SE)	
Year	CB	IB	CB	IB	CB	IB
Qatar	75.24	88.91	74.63	85.45	95.63	95.86
Indonesia	65.18	89.39	56.41	74.17	87.64	83.29
Saudi Arabia	95.44	100.00	93.07	95.54	97.57	95.54
Malaysia	75.75	80.34	52.16	74.71	69.49	92.80
UAE	80.62	90.23	74.31	86.77	92.62	95.68
Turkey	59.75	92.11	50.24	85.58	86.94	92.98
Mean	75.33	90.16	66.80	83.70	88.31	92.69

Notes: CB is conventional banking sector and IB is Islamic banking sector.

Table 7 shows the efficiency of QISMUT. In terms of PTE, the highest efficiency score is from CB in Saudi Arabia (95.44) followed by UAE (80.62), Malaysia (75.75), Qatar (75.24), Indonesia (65.18) and Turkey (59.75). This shows that conventional banks in Saudi Arabia successfully managing their inputs efficiently whereas Turkey inefficient in organizing their inputs to creates the outputs. In the case of Islamic banks, once again Saudi Arabia recorded a perfect 100 percent, meanwhile, Malaysia is scored the lowest efficiency score compare to other countries. For TE, the most efficient in the banking sector is Saudi Arabia with 93.07 in CB followed by Qatar (74.63), UAE (74.31), Indonesia (56.41), Malaysia (52.16) and Turkey (50.24). Meanwhile, for IB, the highest score in TE is Saudi Arabia (95.54) followed by UAE (86.77), Turkey (85.58), Qatar (85.45), Malaysia (74.71) and Indonesia (74.17). Indonesian Islamic banks waste more inputs than other countries. For SE, the highest score for CB is by Saudi Arabia again with 97.57 followed by Qatar (95.63), UAE (92.62), Indonesia (87.64), Turkey (86.94) and Malaysia with 69.49. In contrast, for IB, the highest SE is by Qatar with 95.86 followed by Saudi Arabia (95.54) and UAE (95.68), Turkey (92.98), Malaysia (92.80) and Indonesia with only 83.29. Conventional banks of Malaysia and Indonesian Islamic banks are inefficient in operating. Overall, Saudi Arabia recorded the highest efficiency score in PTE and TE compare to other QISMUT countries.

3.2 Competition

Table 8: Lerner Index (LI) of banking sector

Year	Qatar		Indonesia		Saudi Arabia		Malaysia		UAE		Turkey	
	CB	IB	CB	IB	CB	IB	CB	IB	CB	IB	CB	IB
2006	0.78	0.32	0.27	0.10	0.62	0.94	0.66	0.08	0.75	0.48	0.49	0.42
2007	0.73	0.25	0.28	0.10	0.68	0.53	0.68	0.08	0.72	0.70	0.51	0.13
2008	0.79	0.26	0.31	0.54	0.70	0.65	0.65	0.10	0.71	0.54	0.49	0.14
2009	0.80	0.20	0.33	0.41	0.52	0.16	0.69	0.09	0.60	0.38	0.65	0.14
2010	0.88	0.21	0.35	0.48	0.31	0.20	0.70	0.09	0.56	0.26	0.59	0.13
2011	0.30	0.38	0.45	0.47	0.45	0.24	0.68	0.15	0.51	0.21	0.57	0.16
2012	0.28	0.40	0.37	0.14	0.47	0.50	0.61	0.12	0.56	0.20	0.61	0.15
2013	0.24	0.56	0.35	0.15	0.31	0.29	0.67	0.19	0.40	0.21	0.60	0.34
2014	0.22	0.42	0.43	0.33	0.35	0.26	0.64	0.15	0.29	0.22	0.60	0.45
2015	0.17	0.37	0.57	0.15	0.34	0.25	0.37	0.14	0.39	0.18	0.53	0.44
2016	0.46	0.28	0.58	0.24	0.35	0.33	0.32	0.14	0.31	0.18	0.54	0.44
Mean	0.51	0.33	0.39	0.28	0.46	0.39	0.61	0.12	0.53	0.33	0.56	0.27

Notes: CB is conventional banking sector and IB is Islamic banking sector.

According to the mean in Table 8, the highest LI for CB is from Malaysia with 0.61 followed by Turkey (0.56), UAE (0.53), Qatar (0.51), Saudi Arabia (0.46) and Indonesia with only 0.39. The higher the Lerner Index, it reflects lower competition in the banking sector. From the results, it was found that Malaysia CB has the market power meanwhile Indonesian CB is competitive than others. For IB, the highest mean is from Saudi Arabia with 0.39 followed by Qatar and UAE (0.33), Indonesia (0.28), Turkey (0.27) and Malaysia (0.12). Saudi Arabia recorded the highest Lerner index in IB among others, however, it still shows that the Islamic banking sector is facing high competition whereas Malaysia, is more competitive than other QISMUT.

Table 9: Relationship of competition-efficiency based on GMM

Dependent: Efficiency	CB	IB	All Banks
Efficiency (t-1)	0.493**	0.056	0.209**
	(2.45)	(0.25)	(1.72)
Lerner Index	0.005	-0.049	0.01
	(0.26)	(-0.58)	(0.71)
EQTA	-0.127	-0.476	-0.09
	(-0.87)	(-1.49)	(-0.74)
TDTA	-0.224**	-0.387**	-0.512**
	(-2.56)	(-3.25)	(-5.55)
TLTA	0.202**	0.663**	0.479**
	(2.42)	(3.48)	(5.44)
TA	0.014	0.005	0.007
	(1.35)	(0.22)	(1.01)
GDP	0.023	0.025	-0.015
	(1.05)	(0.85)	(-0.77
Constant	0.144	0.524	0.842**
Wald Test	42.35**	18.02**	89.91**
AR(1)	-2.394**	-1.196	-2.687**
AR(2)	1.238	0.621	1.490
Sargan Test	50.61	25.57	56.93
N	598	294	892

Notes: Asterisks denote the significance ** (0.05) level, figure in parentheses are t-statistics.

Table 10: Relationship of efficiency-competition based on GMM

Dependent: Lerner Index	CB	IB	All Banks
Lerner Index (t-1)	0.437**	0.579**	0.508**
	(3.76)	(3.45)	(4.72)
Efficiency	0.362**	-0.156	0.126
	(2.01)	(-0.66)	(0.72)
EQTA	0.993**	-0.399	0.865
	(1.98)	(-0.55)	(1.90)
TDTA	0.673**	0.659**	0.383**
	(3.28)	(2.52)	(2.22)
TLTA	-0.661**	0.015	-0.387**
	(-3.39)	(0.08)	(-2.49)
TA	0.004	-0.022	-0.005
	(0.15)	(-0.68)	(-0.32)
GDP	-0.196**	0.005	-0.103**
	(-2.86)	(0.09)	(-1.74)
Constant	1.617**	-0.224	0.943
Wald Test	99.32**	63.22**	60.76**
AR(1)	-2.990**	-2.131**	-3.464**
AR(2)	0.8095	1.571	1.034
Sargan Test	55.14	26.73	73.77**
N	598	294	892

Notes: Asterisks denote the significance ** (0.05) level, figure in parentheses are t-statistics.

Table 9 shows the results of relationship competition-efficiency by using GMM. The lag dependent shows significant for conventional and all banks. Variables TDTA and TLTA have a significant relationship to efficiency. TDTA has negative and significant on efficiency for conventional, Islamic and all banks meanwhile TLTA has positive and significant for all three models. The LI has positive coefficients for conventional and all banks meanwhile it is negative coefficients for the Islamic. In Table 10, we also tested the relationship of efficiency on market power which is represented by LI. The lag dependent results show positive and significant which current Lerner index has been impacted by the previous year. For conventional, efficiency was recorded positively and significantly on LI. It means that with the higher efficiency, the Lerner index would be higher (less competition). Variable such as EQTA also found significant and positive for conventional. TDTA is significant and also positive for conventional, Islamic and all banks whereas TLTA is negative and significant for conventional and all banks. The macro variable which is GDP per capita shows negative and significant for conventional and all banks which implies to higher GDP led to lower market power (high competition).

In this study, we focus on the relationship of efficiency and competition in QISMUT. Based on the regression results in Table 9 and Table 10 for conventional (CB), it was found that efficiency had a significant impact on the LI whilst LI was found insignificant on the efficiency. In other words, efficient banks have a negative influence on the competition as the higher value of LI indicates lower competition (higher market power). This finding is consistent with 'Efficient-Structure' where it states that efficient banks can gain higher market share, hence, it affects the market power. In the context of QISMUT, it shows that efficient dominant conventional banks influence the market structure or competition in the banking sector. In contrast, the regression results for Islamic (IB) and all banks were found insignificant for the relationship between efficiency and competition. The results indicate that both factors such as competition and efficiency are independent. It means that competition and efficiency do not have significant influence on each other in the QISMUT Islamic banking sector. From the regression results, it was only conventional to have significant results between the relationship of efficiency and competition.

Next, as for the banks-specific variables, only certain variables show significance on the efficiency and competition. In Table 9, for CB, TDTA was recorded significant and negative

on the efficiency whilst in Table 10, it was recorded positive and significant on LI. From this finding, it indicates that the share of total deposits has a significant role in efficiency and competition although the signs of coefficient are different. More specifically, TDTA is recorded to have a negative impact on the efficiency in Table 9 for CB and negative influences on competition in Table 10. In other words, higher shares of total deposits lead to lower efficiency and competition in the conventional banking sector in QISMUT. Following variables such as TLTA and EQTA in Table 10 (CB), both variables were found positive and significant on LI. It reflects that share of total loans and capitalization in CB have a negative influence on competition. Conventional banks in QISMUT that recorded higher share of total loans and were well-capitalized tend to increase the market power and shares. Hence, the competition in conventional banking in QISMUT is reduced. Meanwhile for IB, TDTA and TLTA recorded significant on the efficiency whilst only TDTA was found significant on the competition. As or IB, total share of deposits was found negative and significant on efficiency meanwhile share of total loans recorded positive. Based on these results, in order to achieve efficiency, Islamic banks have to increase the share of their total loans and reduce the shares of total deposits. In addition, increasing the total deposits also can lead to lower competition, based on results of IB in Table 10. It indicates that dominant Islamic banks may record the highest share of total deposits as it can exercise their market power in the banking sector.

The regression results of all banks in Table 9 and Table 10 recorded that banks-specific variables such as TDTA and TLTA have significant impact on the efficiency and competition. More specifically, banks in QISMUT that recorded a high share of total loans and low share of total deposits improve the efficiency. As for the competition, high share of total deposits and low share of total loans owned by the banks in QISMUT lead to a concentrated market (less competition). It proves that banks that own the highest deposits are dominant banks and cause the banking sector in QISMUT to become concentrated. Based on the regression results, the relationship of efficiency and competition are significant in the conventional banking sector in QISMUT. As for Islamic banking sector, the insignificant result shows that there is an insignificant impact between efficiency and competition. The results consistent with with Apergis and Polemis (2016), Ab-Rahim (2016), Andries and Capraru (2012), Ningaye *et al*. (2014) and Ajisafe and Akinlo (2014) for conventional banking in QISMUT. Besides, this study does not support 'Quiet Life Hypothesis' by Hicks (1935) and also previous studies by Casu and Girardone (2009) which stated that firms that have market power would lead to inefficiency of the firms. However, it was not found that there is a relationship of competition on efficiency as shown in Table 9 and the results in line with Fungacova and Weill (2012) where the authors do not find the relationship between two variables. Furthermore, in this study, we also examine the efficiency and competition of conventional and Islamic banks in QISMUT by using DEA and LI. It was found that Islamic banks are likely to score higher efficiency scores than conventional. As for competition, the finding indicates the Islamic banking sector faced higher competition than conventional.

4. Conclusion

This study contributes to the new evidence of QISMUT banking sector regards on efficiency, competition and the impact of banks-specific variables. Due to the excellent performance of the Islamic banking sector in QISMUT, our study examines the competition and efficiency for both banking sectors. It was found that the competition in QISMUT is not affected by the performance (efficiency) of the banks as we expect that competition could influence the efficiency of the banks and vice-versa. Based on our findings, we found that the significant relationship between efficiency and competition only occurs in the conventional banking sector. The insignificant relationship between efficiency and competition may be due to factors such as government support and assistance which we did not include in the regression.

This might be our limitation of the study. The policymakers in QISMUT should monitor both banking sectors as they efficiently have a significant role in competition. Excessive competition may contribute to financial stability or instability.

References

Abdul-Majid, M., & Hassan, M. K. (2011). The impact of foreign-owned Islamic banks and Islamic bank subsidiaries on the efficiency and productivity change of Malaysian banks. *Journal of King Abdulaziz University: Islamic Economics*, *24*(2), 177-206.

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2010). Efficiency in Islamic and conventional banking: an international comparison. *Journal of Productivity Analysis*, *34*(1), 25-43.

Ab-Rahim, R. (2015). Ranking of malaysian commercial banks: super-efficiency data envelopment analysis (dea) approach. *Asian Academy of Management Journal of Accounting & Finance*, *11*(1), pp.124-143.

Ab-Rahim, R. (2016). Does competition foster efficiency? Empirical evidence from Malaysian commercial banks. *Asian Academy of Management Journal of Accounting & Finance*, *12*(1), pp.2-23.

Ab-Rahim, R., Kadri, N., & Ismail, F. (2013). Efficiency performance of Malaysian Islamic banks. *Munich Personal RePEc Archive*, pp.1-10.

Ahmad, N. H. B., Noor, M. A. N. M., & Sufian, F. (2010). Measuring Islamic banks efficiency: The case of world Islamic banking sectors. *Journal of Islamic Banking and Finance*, 27(4), pp.1-24.

Ajisafe, R. A., & Akinlo, A. E. (2014). Competition and Efficiency of Commercial Banks: An Empirical Evidence from Nigeria. *American Journal of Economics*, *4*(1), pp.18-22.

Albaity, M., Mallek, R. S., & Noman, A. H. M. (2019). Competition and bank stability in the MENA region: The moderating effect of Islamic versus conventional banks. *Emerging Markets Review*, *38*, 310-325.

Alqahtani, F., Mayes, D. G., & Brown, K. (2017). Islamic bank efficiency compared to conventional banks during the global crisis in the GCC region. *Journal of International Financial Markets, Institutions and Money*, *51*, 58-74.

Andries, A. M., & Căpraru, B. (2012). *How Does EU banking competition impact financial stability?*. http://www. opf. slu. cz/kfi/icfb/proc2011/pdf/01_Andries. pdf (2011)

Anzoategui, D., Peria, M. S. M., & Rocha, R. R. (2010). Bank competition in the Middle East and Northern Africa region. *Review of Middle East Economics and Finance*, *6*(2), pp.1-23.

Apergis, N., & Polemis, M. L. (2016). Competition and efficiency in the MENA banking region: a non-structural DEA approach. *Applied Economics*, *48*(54), 5276-5291.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, *68*(1), 29-51.

Ariss, R. T. (2010). Competitive conditions in Islamic and conventional banking: A global perspective. *Review of Financial Economics*, *19*(3), 101-108.

Arrawatia, R., & Mishra, A. (2012). Competition in banking industry: A literature review. *International Journal of Commerce, Business and Management*, *1*(3), 120-126.

Bain, J. (1951). Relation of profit rate to industry concentration. *Quarterly Journal of Economics*, *65*, 293-324.

Bain, J. (1956). *Barriers to New Competition*. Harvard Press.

Bakour, A., & Gallali, M. I. (2013). Competition and efficiency: Comparative analysis between Islamic and conventional banks of MENA region. *International Journal of Business and Commerce*, *5*(3), 20-40.

Batir, T. E., Volkman, D. A., & Gungor, B. (2017). Determinants of bank efficiency in Turkey: Participation banks versus conventional banks. *Borsa Istanbul Review*, *17*, 86-96.

Bhatti, G. A., & Hussain, H. (2010). Evidence on structure conduct performance hypothesis in Pakistani commercial banks. *International Journal of Business and Management*, *5*(9), 174-187.

Castellanos, S., & Gaza-García, J. G. (2013). *Competition and Efficiency in the Mexican Banking Sector* (Working Paper 13/29). BBVA Bancomer.

Casu, B., & Girardone , C. (2009). *Does Competition Lead to Efficiency? The Case of EU Commercial Banks* (Working Paper Series). Cass Business School.

Chortareas, G. E., Garza-Garcia, J. G., & Girardone, C. (2011). Banking sector performance in Latin America: Market power versus efficiency. *Review of Development Economics*, *15*(2), 307-325.

Coccorese, P., & Pellecchia, A. (2010). Testing the 'quiet life'hypothesis in the Italian banking Industry. *Economic Notes*, *39*(3), 173-202.

De Guevara, J. F., Maudos, J., & Perez, F. (2005). Market power in European banking sectors. *Journal of Financial Services Research*, *27*(2), 109-137.

Demsetz, H. (1973). Industry structure, market rivalry and public policy. *Journal of Law and Economics*, *16*, 1-10.

Ernst, & Young. (2016). *The world Islamic banking competitiveness Report 2015- 2016*. https://www.ey.com

Fungacova, Z., Pessarossi, P., & Weill, L. (2012). *Is competition detrimental to efficiency?Evidence from China* (Discussion Paper). Bank of Finland.

Gajurel, D. P., & Pradhan, R. S. (2012). Concentration and competition in Nepalese banking. *Journal of Business Economics and Finance*, *1*(1), 5-16.

Giustiniani, A., & Ross, K. (2008). Bank competition and efficiency in the FYR Macedonia. *South Eastern Europe Journal of Economics*, *6*(2), 146-167.

Hamza, H., & Kachtouli, S. (2014). Competitive conditions and market power of Islamic and conventional commercial banks. *Journal of Islamic Accounting and Business Research*, *5*(1), 29-46.

Hassan, T., Mohamad, S., & Bader, M. K. I. (2009). Efficiency of conventional versus Islamic banks: Evidence from the Middle East. *International Journal of Islamic and Middle Eastern Finance*, *2*(1), 46-65.

Hicks, J. (1935). The theory of monopoly. *Econometrica*, *3*, 1-20.

Kabir, M. N., & Worthington, A. C. (2017). The 'competition–stability/fragility'nexus: A comparative analysis of Islamic and conventional banks. *International Review of Financial Analysis, 50*, 111-128.

Kablan, S., & Yousfi, O. (2011). Efficiency of Islamic and conventional banks in countries with Islamic banking. *Munich Personal RePec Archive*.

Leon, F. (2014). *Measuring competition in banking: Acritical review of methods* (Working Papers). http://publi.cerdi.org

Liyanagamage, H. D. D. C. (2014). Rethinking the nexus between competition and efficiency in emerging economies: Evidence from Sri Lankan banking sector. *International Journal of Economics, Business and Finance*, *2*(5), 1-15.

Macit, F. (2012). Recent evidence on concentration and competition in Turkish banking sector. *Theoretical and Applied Economics. 19*(573), 19-28.

Mammadov, E., & Mukhtarov, S. (2018). The impact of oil price shocks on Islamic banking: Evidence from QISMUT plus 3 countries. *In Proceedings of New York International Business and Social Science Research Conference, 13*, 14.

Mason, E. (1939). Price and production policies of large-scale enterprise. *The American Economic Review*, *29*(1), 61-74.

Mkrtchyan, A. (2005). The evolution of competition in banking in a transition economy: An application of the Panzar-Rosse model to Armenia. *The European Journal of Comparative Economics*, *2*(1), 67-82.

Mongid, A., Tahir, I. M., & Haron, S. (2012). The relationship between inefficiency, risk and capital:

Evidence from commercial banks in ASEAN. *International Journal of Economics and Management, 6*(1), 58-72.

Mortadza, N. S., Ab-Rahim, R., & Dee, A. (2019). Market structure and efficiency of QISMUT banking sector. *International Journal of Academic Research in Business and Social Sciences*, *9*(6), 383-392.

Mugume, A. (2007). Market structure and performance in Uganda's banking industry. *African Econometrics Society.*

Ningaye, P., Mathilde, M. Y., & Luc, N. N. (2014). Competition and banking efficiency in the CEMAC zone. *International Journal of Economics and Finance*, *6*(6), 1-27.

Pruteanu-Podpiera, A., Weill, L., & Schobert, F. (2008). Banking competition and efficiency: A micro-data analysis on the Czech banking industry. *Comparative Economic Studies*, *50*(2), 253-273.

Rajan, R. G., & Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics*, *69*(1), 5-50.

Repkova, I., & Stavarek, D. (2013). Relationship between competition and efficiency in the Czech banking industry. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *61*(7), 2701-2707.

Rosman, R., Wahab, N. A., & Zainol, Z. (2014). Efficiency of Islamic banks during the financial crisis: An analysis of Middle Eastern and Asian countries. *Pacific-Basin Finance Journal*, *28*, 76-90.

Safiullah, M., & Shamsuddin, A. (2020). Technical efficiency of Islamic and conventional banks with undesirable output: Evidence from a stochastic meta-frontier directional distance function. *Global Finance Journal*, 100547.

Schaeck, K., & Cihak, M. (2008). *How does competition affect efficiency and soundness in banking? New empirical evidence* (European Central Bank Working Paper 932). European Central Bank.

Sekmen, T., Akkus, O., & Siklar, I. (2015). Competitive conditions in the Turkish banking Systems. *Journal of Business Economics and Finance*, *4*(1), 52-68.

Sillah, B. M. S., & Harrathi, N. (2015). Bank efficiency analysis: Islamic banks versus conventional banks in the Gulf Cooperation Council Countries 2006-2012. *International Journal of Financial Research*, *6*(4), 143-150.

Simatele, M. (2015). Market structure and competition in the South African banking sector. *Procedia Economics and Finance*, *30*, 825-835.

Srairi, S. A. (2010). Cost and profit efficiency of conventional and Islamic banks in GCC countries. *Journal of Productivity Analysis*, *34*(1), 45-62.

Weill, L. (2004). On the relationship between competition and efficiency in the EU banking sectors. *Kredit und Kapital*, 329-352.

Weill, L. (2011). Do Islamic banks have greater market power?. *Comparative Economic Studies*, *53*(2), 291-306).

Yildirim, I. (2015). Financial differences and similarities of Islamic banks: A study on QISMUT Countries. *Journal of Business, Economics and Finance*, *4*(2), 232-249.

PAST MFA CONFERENCE

The MFA is proud to be the pioneer in organizing a national-level conference that specializes in finance. Since its inaugural workshop in 1999, the meeting of finance academicians and practitioners has developed to become an annual symposium and today, owing to the overwhelming response, the meeting is now known as an annual conference. The conference is hosted by local institutions of higher learning, both public and private, on rotational basis.

The conference is a great platform for academicians and practitioners to discuss and exchange ideas pertaining to issues related to finance. It also provides an avenue for researchers to share their findings on financial issues relevant to Malaysia. Selected papers from the conference are published in the Capital Market Review which is an official publication of Bursa Malaysia and Research Institute of Investment Analysts Malaysia (RIIAM).

Previous MFA Annual Conference:

1999: THE MALAYSIAN FINANCE ASSOCIATION 1ST ANNUAL WORKSHOP
Theme: The Inaugural MFA Workshop
Host: Universiti Kebangsaan Malaysia (UKM)

2000: THE MALAYSIAN FINANCE ASSOCIATION 2ND ANNUAL SYMPOSIUM
Theme: The Malaysian Financial Crisis and its Recovery
Host: Universiti Malaya (UM)

2001: THE MALAYSIAN FINANCE ASSOCIATION 3RD ANNUAL SYMPOSIUM
Theme: Malaysian Capital Markets: Challenges for the New Millennium
Host: Universiti Islam Antarabangsa Malaysia (UIAM)

2002: THE 4TH ANNUAL MALAYSIAN FINANCE ASSOCIATION SYMPOSIUM
Theme: Globalization and Malaysian Financial Market: Strategies for Sustainable Growth
Host: Universiti Sains Malaysia (USM)

2003: MALAYSIAN FINANCE ASSOCIATION'S (MFA'S) 5TH ANNUAL SYMPOSIUM
Theme: Competitiveness and Stability Financial Strategies in Malaysia
Host: Multimedia University (MMU)

2004: THE MALAYSIAN FINANCE ASSOCIATION 6TH ANNUAL SYMPOSIUM
Theme: Revitalising the Financial Market: The Tasks Ahead
Host: Universiti Utara Malaysia (UUM)

2005: THE MALAYSIAN FINANCE ASSOCIATION 7TH ANNUAL CONFERENCE
Theme: Consolidation and Prudent Financial Management: Roads to Malaysian Economic Prosperity
Host: Universiti Teknologi MARA (UiTM), Terengganu

2006: THE MALAYSIAN FINANCE ASSOCIATION 8TH ANNUAL CONFERENCE
Theme: Managing Finance for Global Business Growth
Host: Universiti Malaysia Sabah (UMS)

2007: THE MALAYSIAN FINANCE ASSOCIATION 9TH ANNUAL CONFERENCE
Theme: Positioning Malaysia as A Premier Financial Market
Host: Universiti Teknologi MARA (UiTM)

2008: THE MALAYSIAN FINANCE ASSOCIATION 10TH ANNUAL CONFERENCE
Theme: Strengthening Malaysia's Position as a Vibrant, Innovative and Competitive Financial Hub
Host: Faculty of Economics and Business, Universiti Malaysia Sarawak (UNIMAS)

2009: THE MALAYSIAN FINANCE ASSOCIATION 11TH ANNUAL CONFERENCE
Theme: Financial Markets, Governance and Growth: Issues & Challenges
Host: Faculty of Economics and Management and the Graduate School of Management, Universiti Putra Malaysia (UPM)

2010: THE MALAYSIAN FINANCE ASSOCIATION 12TH ANNUAL CONFERENCE
Theme: Re-Engineering the Financial System towards a Global Innovation Economy
Host: Taylor's University College

2011: THE MALAYSIAN FINANCE ASSOCIATION 13TH ANNUAL CONFERENCE
Theme: Financial Innovation & Transformation in the 21st Century World Conference
Host: UKM-Graduate School of Business, Universiti Kebangsaan Malaysia (UKM)

2012: THE 14TH MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Emerging Markets and Financial Resilience: Decoupling Growth from Turbulence
Host: Graduate School of Business (GSB), Universiti Sains Malaysia (USM)

2013: THE 15TH MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Financial Challenges and Economic Growth – The Way Forward
Host: Graduate Studies Department, INCEIF

2014: THE 16TH MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Financial Systems Re-Generation: MAPS, GAPS and TRAPS
Host: Universiti Malaya (UM)

2015: THE 17TH MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Financial Inclusion as A Means to Minimize Fragility
Host: Universiti Teknologi MARA (UiTM), Sabah

2016: THE 18TH MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Towards a Vibrant Social Finance for A Sustainable Banking and Financial System
Host: Universiti Sains Islam Malaysia (USIM)

2017: THE 19TH MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Challenges and New Directions amidst Global Financial Uncertainty
Host: Universiti Tunku Abdul Rahman (UTAR)

2018: THE 20TH MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Innovative Ecosystem for Financial Revolution
Host: Universiti Utara Malaysia (UUM)

2019: THE 21ST MALAYSIAN FINANCE ASSOCIATION CONFERENCE
Theme: Charting A New Course in Financial Innovation and Education
Host: Sunway University

2020: THE 22ND MALAYSIAN FINANCE ASSOCIATION CONFERENCE [VIRTUAL CONFERENCE]
Theme: Financial Sustainability During the Era of Covid-19 Pandemic
Host: Malaysian Finance Association (MFA)

2021: THE 23RD MALAYSIAN FINANCE ASSOCIATION INTERNATIONAL CONFERENCE [VIRTUAL CONFERENCE]
Theme: Sustainability of Business and Finance: Embracing the New Norms Amidst Covid-19
Host: Universiti Sains Malaysia (USM)

2022: THE 24TH MALAYSIAN FINANCE ASSOCIATION INTERNATIONAL CONFERENCE
Theme: Global Finance: Evolving and Impacting the Post Pandemic World
Host: Universiti Malaysia Sabah (UMS)

MFA

Malaysian Finance Association

OBJECTIVES

The objectives of MFA are to stimulate public interest in finance related studies, to encourage the research and discussion of finance related issues with special reference to Malaysia, to issue Malaysian finance Journals and other publications with the prior approval of the relevant authorities, to promote and organize conferences, forums, dialogues and activities between private and public sectors on current finance issues of national and international concerns; and to undertake such management, economic, and other activities as the Association deems appropriate for the furtherance, promotion and execution of its aforesaid objectives.

MEMBERSHIP

Membership is open to academicians, professionals and students in the area of Finance, Banking, Economics, Insurance, Real Estate, Accounting and other finance related area.

There are three types of membership: Ordinary Membership, Associate Membership and Life Membership.

Ordinary Membership

The Ordinary Membership is open to all academicians and working person in the field of Accounting, Banking, Business Administration, Economics, Finance, Financial Engineering, Actuarial Science, Data Science, Insurance and other finance related area. Ordinary member is eligible to attend and vote at all general meetings of the Association.

Associate Membership

The Associate Membership is open to foreign professionals / scholars / postgraduates in the field of Finance, Banking, Economics, Insurance, Real Estate, Accounting and other finance related area. The associate members are entitle to all general meetings, but are not eligible to hold an office and to vote.

Life Membership

The Life Membership is open to Malaysian academicians, an extension of ordinary membership and entitles to all the rights and privileges of ordinary members.

Membership Fee

Ordinary member	RM 100 per year
Associate member	RM 100 per year
Life member	RM 600

Payment can be remitted via bank draft, cheque, money order made payable to "PERSATUAN KEWANGAN MALAYSIA (BARU)" or direct payment to BANK MUAMALAT MALAYSIA BERHAD: **1205-0003606-71-1**.

Please notify us your application by sending the application form and proof of payment to mgt@mfa.com.my.
Note: Ordinary and Associate Membership expires every 31 December each year.

Inquiries should be forwarded to:

SECRETARY,
Malaysian Finance Association (MFA)
c/o: Faculty of Business and Management (FBM)
UNIVERSITI TEKNOLOGI MARA (UiTM)
40450 Shah Alam Selangor MALAYSIA

For further information, please contact:
Tel : +603 7651 4197
Email : mansorhi@inceif.org
wahida@uitm.edu.my
Website : https://www.mfa.com.my/

MFA MEMBERSHIP FORM

Please write in CAPITAL letters and √ where required

Name: _____

NRIC/Passport No: _____

Nationality: _____

Sex: ☐ Male ☐ Female

Occupation: _____

Position: _____

Organization/Company name & Address:

_____

_____

Tel: _____ Fax: _____

Email: _____

For Student Only

Institution: _____

Address: _____

_____

☐ Undergraduate ☐ Masters ☐ Phd

Tel: _____ Fax: _____

Email: _____

Membership
Type of membership (Annual membership runs from Jan to Dec)

☐	Ordinary Membership	RM100 per year
☐	Associate Membership	RM100 per year
☐	Life Membership	RM600

Office Use Only:

Date received: ____/____/____

Membership No: _____

☐ Cheque ☐ Money order ☐ Bank draft

☐ Prove of Payment (for Direct Payment)

Approved by: _____

Contact Us

President
Malaysian Finance Association
c/o Prof. Dr. Mansor Ibrahim
Director of Research Management
Deputy President Academic & Dean
International Centre for Education in Islamic Finance (INCEIF)
Lorong Universiti A, Petaling Jaya
59100 Kuala Lumpur
Federal Territory of Kuala Lumpur, Malaysia
Tel: 603-76514197
Fax: 603-76514094
Email: mansorhi@inceif.org

Enquiries relating to Capital Markets Review (CMR) should be addressed to:

Chief Editor
Capital Markets Review
c/o Prof. Dr. Chee-Wooi Hooy
School of Management
Universiti Sains Malaysia
11800 Gelugor
Penang, Malaysia
Tel: 604-6533889
Fax: 604-6577448
Email: cwhooy@usm.my

Capital Markets Review

IN PUBLICATION SINCE 1993

INSTRUCTION FOR AUTHORS

1. The cover page should contain the title of the manuscript, the author(s) and their affiliation(s). Title should be typewritten in bold and in 14pt fonts. Author's name and affiliation should be typewritten in single spacing using 8pt fonts with affiliations typed in italics. All text on this page should be centre aligned. Contact of corresponding author and acknowledgement should be mentioned in the footnote in 8pt fonts with a symbol *. Author must provide complete correspondence information – Author's name, telephone number and email address.
2. Manuscripts may be written in either Bahasa Melayu or English. Only original and unpublished works will be considered. The first page of text shows the title of the manuscript with an abstract of about 300-350 words and a maximum of 6 keywords identifying the main topics of the manuscript. JEL classification numbers should be included after the keywords.
3. Structured Abstract (300-350 words)
   Research Question: In one sentence, define the key features of the research question or problem statement. **Motivation:** In a few sentences, capture the core scholarly motivation for the study. If relevant, identify a 'puzzle' that this research aims to resolve. Identify up to 3 key papers upon which the research builds. What's new? Highlight where novelty exists in the study; how does it improve or build on existing literature? So what? Outline the primary reason why it is important to know the answer to your research question. **Idea:** Articulate the core idea behind the research – what specifically does the study do? If relevant: articulate the central hypothesis; highlight key independent variables and dependent variable(s). **Data:** Provide an overview of what data were collected/analysed/used in the study; including data source(s), time period, sample size and measurement tool(s). **Method/Tools:** Provide a brief summary of the empirical framework, research design and approach. **Findings:** Highlight the key takeaway points. Highlight any novel result – how do the findings agree/disagree with existing literature? What do the findings add? Highlight any important implications this research has for influence in real-world decisions/behaviour/activity. **Contributions:** Outline the primary contribution of this paper to the relevant research literature.
4. The paper starts after the JEL classification, with all pages numbered consecutively at the bottom right. Heading of main section (e.g. **1. Introduction**) and headings of subsections (e.g. **3.1 Data Sample**) should be typed in bold. Headings of subsequent subsections (e.g. *3.1.1 Data Source*) should be typed in italics.
5. Tables and figures should be embedded in the text. All tables and figures should be numbered consecutively with Arabic numerals, have a brief title, and be referred to in the text. The entire table should be presented in one page unless too long. Landscape table is acceptable. Vertical lines should not be used in the table. Explanatory notes should be placed at the bottom of the table. The word 'Notes' precedes the table notes. Tables and their respective titles should be aligned to the left. Figures and their respective titles should be aligned to the centre. All figures should be provided as high-quality printouts, suitable for reproduction.
6. The whole manuscript should be typewritten in single spacing using 10pt fonts, except for tables (maximum 9pt fonts), figures (maximum 9pt font), footnotes (8pt fonts), and explanatory notes for the tables (8pt fonts).
7. Responsibilities for the accuracy of bibliographic citations lie entirely with the authors. Submission to Capital Markets Review should follow the style guidelines described in the American Psychological Association (APA).
8. Capital Markets Review welcomes article submissions and does not charge a submission fee. Please email your manuscript to Professor Dr. Chee-Wooi Hooy, Chief Editor, Capital Markets Review: cmr@mfa.com.my (cc: cmr.mfa@gmail.com).

Published by:

MFA
Malaysian Finance Association

Sponsored by:

BURSA MALAYSIA

The Capital Markets Review (CMR) was formerly published by the Kuala Lumpur Stock Exchange (now known as Bursa Malaysia) and the Research Institute of Investment Analysts Malaysia (RIIAM). Beginning 2004, the Malaysian Finance Association (MFA) has been given the privilege to take over the publication of CMR and MFA is now the official publisher of CMR.

Published twice a year in March and September, CMR contains papers in both English and Bahasa Melayu. CMR publishes double-blind refereed articles in various aspects of finance, including Asset Pricing, International Finance, Corporate Finance, Banking, Risk and Insurance, Market Microstructure and Islamic Banking and Finance. The journal welcomes empirical and theoretical contributions that have not been previously published.

CMR is listed and indexed in ABDC Journal Quality List, Research Papers in Economics (RePEc), and MyJurnal by Citation and Infometrics Centre (formerly known as Malaysia Citation Centre (MCC)).

Enquiries relating to CMR should be addressed to:
Chief Editor, Malaysian Finance Association
c/o Professor Dr. Chee-Wooi Hooy
School of Management
Universiti Sains Malaysia
11800 Penang
Malaysia
Tel: +604-6533889
Email: cmr@mfa.com.my

eISSN 2805-430X
9 772805 430009