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RESEARCH ARTICLE

Environmental quality indicators and financial development in Malaysia: unity in diversity

Arif Alam · Muhammad Azam · Alias Bin Abdullah · Ihtisham Abdul Malik · Anwar Khan · Tengku Adeline Adura Tengku Hamzah · Faridullah · Muhammad Mushtaq Khan · Hina Zahoor · Khalid Zaman

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Abstract Environmental quality indicators are crucial for responsive and cost-effective policies. The objective of the study is to examine the relationship between environmental quality indicators and financial development in Malaysia. For this purpose, the number of environmental quality indicators has been used, i.e., air pollution measured by carbon dioxide emissions, population density per square kilometer of land area, agricultural production measured by cereal production and livestock production, and energy resources considered by energy use and fossil fuel energy consumption, which placed an impact on the financial development of the country. The study used four main financial indicators, i.e., broad money supply (M2), domestic credit provided by the financial sector (DCFS), domestic credit to the private sector (DCPC), and inflation (CPI), which each financial indicator separately estimated with the environmental quality indicators, over a period of 1975–2013. The study used the generalized method of moments (GMM) technique to minimize the simultaneity from the model. The results show that carbon dioxide emissions exert the positive correlation with the M2, DCFC, and DCPC, while there is a negative correlation with the CPI. However, these results have been evaporated from the GMM estimates, where carbon emissions have no significant relationship with any of the four financial indicators in Malaysia. The GMM results show that population density has a negative relationship with the all four financial indicators; however, in case of M2, this relationship is insignificant to explain their result. Cereal production has a positive relationship with the DCPC, while there is a negative relationship with the CPI. Livestock production exerts the positive relationship with the all four financial indicators; however, this relationship with the CPI has a more elastic relationship, while the remaining relationship is less elastic with the three financial indicators in a country. Energy resources comprise energy use and fossil fuel energy consumption, both have distinct results with the financial indicators, as energy demand have a positive and significant relationship with the DCFC, DCPC, and CPI, while fossil fuel energy consumption have a negative relationship with these three financial indicators. The results of the study are of value to both environmentalists and policy makers.

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A. Alam (✉)
Department of Development Studies, COMSATS Institute of Information Technology, Abbottabad, Pakistan
e-mail: arifalam@ciit.net.pk

M. Azam
School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, Sintok, Malaysia

A. B. Abdullah · I. A. Malik
Faculty of Arts and Social Sciences, Department of East Asian Studies, University of Malaya, Kuala Lumpur, Malaysia

A. Khan
Department of Management Sciences, COMSATS Institute of Information Technology, Attock, Pakistan

T. A. A. T. Hamzah
Faculty of Arts and Social Sciences, Department of Geography, University of Malaya, Kuala Lumpur, Malaysia

Faridullah
Department of Environmental Sciences, COMSATS Institute of Information Technology, Abbottabad, Pakistan

M. M. Khan · H. Zahoor
Department of Humanities, COMSATS Institute of Information Technology, Abbottabad, Pakistan

K. Zaman (✉)
Department of Management Sciences, COMSATS Institute of Information Technology, Abbottabad, Pakistan
e-mail: khalidzaman@ciit.net.pk

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Introduction

Since inception, Malaysia has seemingly recorded constant economic growth and it has brought several advantages containing desirable and improved social facilities and a trend towards larger urbanization of the people also. At the same time, this economic growth and development has been added to environmental degradation and unrestricted development. Though, safeguard of the environment has become inevitability rather than an indulgence in order to facilitate public health and happiness as well as to support sustainable economic growth in the country (Pereira et al. 2010; Nurul et al. 2014). Environmental pollution is one of the key issues in the process of sustainable economic growth everywhere. While, the undesirable effect of pollution on the environmental progressions which offer unpolluted air and water naturally makes it an imperative issue to be tackled accordingly. It has been observed that numerous respiratory problems in humans have also been created due to air pollution. In a study, Razak et al. (2013) notes that the upsurge in production of goods and services justifies a lot of energy consumption in Malaysia. Whereas, this energy comes in various form including coal, electricity, gas, petroleum product, and crude oil that influences the quality of air and therefore generate harmful externality. The government of Malaysia has started the initiatives to mitigate the use of extensive energy as well as to condense CO_2 emission through efficient energy consumption and accord of environmental issues mention in the 10th Malaysia Plan. However, Malaysia actively seeks to condense CO_2 amount up to 40 % by year 2020 if compared to 2005 level.

In a report on environmental quality indicators of Malaysia, a self-assessment study of environmental performance index in Malaysia highlighted that various stakeholders acknowledged the necessity to evaluate performance and consider the rising prominence of environmental sustainability in the new Malaysian economic model of completely collecting and developing crucial environmental indicator data. In this regard, the Department of Environment of Malaysia has established many programs in order to observe, assemble and distribute key data relevant to environmental performance, and certify sustainable development in Malaysia. For this purpose, the environmental quality indicators had introduced two monitoring programs that address air and water environmental performance which includes the air pollution index (API) and the river water quality index (WQI) to monitor air, marine, and water quality. The Government of Malaysia, Environmental Quality Report (2010) collected indicator data for the API and WQI, where the data consists of O_3, CO_2, NO_2, SO_2, and PM_{10} for the API and BOD, COD, NH_3, N, SS, and pH for the WQI, respectively. Where, the air pollution levels are shaped following the internationally accepted ambient air quality measuring approach. The API is in ranges of numbers and colors which designates daily air quality positions of different regions across Malaysia. Similarly, the API is in the range from 0–50 (green), 51–100 (yellow), 101–200 (orange), 201–300 (red), and 300 and above (dark red) are good, moderate, unhealthy, very unhealthy, and hazardous, respectively.

Generally, sustainable economic growth and development has been the quintessential macroeconomic objective of all governments in order to boost social welfare. Therefore, the brain-teaser for the policymakers is to detect and espouse the key measures to accelerate a desirable level of economic growth. Maybe there are sundry ways but the modern-day growth theory insists on that financial sectors development affect long-term growth through the rate of technological development and capital formation. A capable and enduring financial sector certifies the upraised capital accumulation, enhances the process of investment, and mitigates in financial risk and borrowing costs and excessive transparency between creditors and borrowers, insurance services, expands saving, and portfolio options, etc., which consequently further strengthen the incoming foreign capital and encourage technological improvement. It is believed that sound financial system increases social welfare and leads to alleviate poverty, reduce income inequality, mobilize savings and lucrative return on investment, and stimulate stable cooperate governance and, therefore, augment economic growth. Moreover, encyclopedic financial services upsurge income growth, enlarging financial services supply which can be achieved by the poor and will foster income growth for the poor, thus having a direct effect on poverty alleviation[1]. Thus, financial development is one of the important factors which play a crucial role in the process of economic growth and economic development. Therefore, financial institutions are considered to be a vigorous facilitator to the economic growth and development in the modern era.

Regarding the significance of financial system, in a seminal work by Levine (1997: 691), he expounds that "To organize the vast literature on finance and economic activity, I break this primary function into five basic functions. Specifically, financial systems –facilitate the trading, hedging, diversifying, and pooling of risk, –allocate resources, –monitor managers and exert corporate control, –mobilize savings, and –facilitate the exchange of goods and services." Erstwhile studies explicate the significance of sound financial sector development for economic growth and poverty alleviation. It has been observed that countries grow rapid and experience rapid cutbacks in poverty levels where the level of financial development is high and endure. Finance is as a result that is not only

[1] Dailami and Aktin (1990); Jalilian and Kirkpatrick (2001) and Ayadi et al. (2013).

pro-growth but also pro-poor; therefore, the management authorities need to consider the importance of financial sector development and devise constructive policy (Beck et al. 2000, 2007, 2008). A vast body of prior studies suggests a strong and positive relationship between financial development and economic growth in both developed and developing countries[2]. According to the DFID (2004) report, theory and evidence reveals that financial sector development has an impact on poverty both directly and indirectly. Thus, indirectly through its positive and strong impact on economic growth and directly to the extent that financial development expands approach to financial services for the poor. In a study, Tadesse (2005) observes that financial development supports technological innovations. In a similar vein, Claessens and Feijen (2007) explore that a well-developed financial sector is mandatory for the carbon trading, which is a process that offers the incentive to diminish the greenhouse gas emissions maximally.

There are many factors explaining financial development which is categorized such as government intervention, institutions, openness policy, political economy factors, the legal tradition and some other factor consisting of macroeconomic factors, like inflation rate, investment, income, and economic growth have been recorded as stimulating financial development. Moreover, some other than these factors could also be considered as determinants of financial development such as culture and geography (Voghouei et al. 2011). In a similar study Levine (1997: 721) notes that "Undoubtedly, the financial system is shaped by nonfinancial developments. Changes in telecommunications, computers, nonfinancial sector policies, institutions, and economic growth itself influence the quality of financial services and the structure of the financial system." As in a study, Levine (1997) notes that there are also many other nonfinancial factors influencing financial development; following that, the main focus of this study is on the agriculture production, population density, carbon dioxide (CO_2) emission, and energy use in the context of Malaysia. Ensuring desirable level of economic growth and development should be on the top priority of Malaysian government, where like other factors the agriculture, energy, CO_2 emission, and population need to be given an active importance. In fact, real sector development is influenced by many factors including financial development which is determined by the various factors discussed above and to be considered in the present study.

The study of Sadorsky (2010) mentions that usually financial development refers to as a vital driver of economic growth in embryonic economies and, therefore, financial development has a tendency to influence energy demand. Financial development fuels many undertakings including enhanced foreign direct investment (FDI) and expansions in banking activity and enlarges stock market activity which causes energetic economics and will increase energy demand as a result. Financial development is imperative because it can upsurge the economic effectiveness and proficiency of a country's financial structure. While demand for energy can be affected by financial development through many ways including the direct way where financial development helps the consumers to borrow money to buy energy consumption items like automobiles, houses, air conditioners refrigerators, and washing machines, etc., the provision of easy to borrow from bank consequently increased the demand for energy. On the other hand, more borrowing can further encourage financial development and such as has a positive impact on the financial development.

Energy is also one of the important factors like other factors of production and has a close relationship to financial development. It has been observed that several emerging economies are improving at rapidity relatively quicker than were estimated in the past. Therefore, the use and demand for energy has been largely expanded gradually. Liu et al. (2006) expounds that the significance of financial development and stability had been increased since the financial crisis broke out in East Asia. Financial sector development for Malaysia is undeniably of great importance for the enhanced level of sustainable economic growth, and also Malaysia was being categorized as a newly industrialized growing economy. Though Malaysia's economic performance in the region is optimistic but with the increasing integration of the global financial system, Malaysia has to be vigilant in terms of the challenges for the Malaysian financial system and properly deal with the mutable market. Malaysia has a sound past regarding financial sector reforms and such as the government brought a sequences of financial reformation programs that intended at promoting the financial system had been set up since the 1970s. Straightaway after the Asian financial crisis which critically affected the country during 1997–98, whereas, at the same time several macroeconomic policy responses including capital controls and deflationary policy have been carried in the country[3]. IMF (2014) has reported that Malaysian asset quality has been getting better during the last 5 years. Stable and sustainable financial positions and risk

[2] Some previous studies, for example Bagehot (1873), explores that finance plays a key role in economic growth. The study of Schumpeter (1911) highlights the prominence of the banking system in economic growth. The studies of Goldsmith (1969), McKinnon (1973), and Shaw (1973) implied that financial system be supposed to have performed a key role in economic growth, where McKinnon (1973) and Shaw (1973) models indicate that financial development can increase saving, capital accumulation, and consequently economic growth. While in a study of Lucas (1988), finance is considered to be an "over-stressed" factor of economic growth. In contrast, the study of Robinson (1952) explicates that finance does not cause economic growth, while Saint-Paul (1992) suggests that financial development can attenuate economic growth.

[3] Yusof et al. (1994); Athukorala and Sen (2002); Ang and McKibbin (2007).

management ability have facilitated local banking groups to follow overseas enlargements, particularly within the region. Financial system of Malaysia encompasses banking intermediaries, capital market intermediaries, and insurance companies. Alongside, Malaysia's Islamic finance industry is also working from the last almost 30 years, and it is recorded that in 2011, the Malaysia's Islamic banking total assets touched MYR 297 billion (US$ 99 billion). The IMF report further demonstrates that according to "The Banker" while Malaysia holds a share of 10 % of worldwide Islamic banking assets, ranking 3rd after Iran and the Kingdom of Saudi Arabia.

This study aims to evaluate the impacts of various factors, namely agriculture production, population density, emission, and energy resources on financial development in Malaysia. For empirical investigation, annual time series data ranging from 1975–2013 would be used. Malaysia is an upper middle income country and makes constant efforts to bring reform in the banking sector in the repercussion of the Asian financial crisis during 1997–1998. Though, rapid growth in Malaysia's financial sector has been observed over the last decade[4]. Presently, Malaysian banks are well capitalized with appropriate tier 1 capital ratios[5]. Therefore, there is a dire need to conduct an empirical study and investigate factors determining financial development in Malaysia. The outcome of this study certainly guides the policy makers to devise appropriate and effective policy which further helps to strengthen the financial sector in Malaysia and boost economic growth and development. According to our knowledge, there is yet no close and pertinent study on the influence of these factors on the financial development. Presumably, these factors are expected to have strong effects on the financial development in the context of Malaysia. This study is unique in the sense that it is the first study which represents a first step in dealing with the key issues related to Malaysian financial development. Second, this study identifies further nonfinancial factors determining financial development. Third, the portfolio set of regressors is unique and longevity of data time period is relatively long. Finally, this study uses more holistic time series analysis approach in order to obtain relatively precise and robust results. Therefore, this study contributes to the existing literature on Malaysian financial development in particular and can be extended to other countries.

This study is structured as follows: section 1 above shed some lights on the introduction and significance of the study. Section 2 presents a review of the available studies in this area of research. Section 3 explains the data and empirical methodology. Section 4 interprets empirical results. Finally, section 5 provides concluding remarks.

[4] Julian (2013)
[5] IMF (2014)

Literature review

The existing literature reveals that though there are numerous studies explaining financial development but empirical studies on the factors to be considered in this study are undeniably scarce. Though, in the choice of the control variables for financial development, this study follow the erstwhile studies, in particular those on the determinant of financial development, for example Beck et al. (2008) and Allen et al. (2013). In particular, the study of Beck et al. (2008) uses explanatory variables, namely GDP per capita, poverty gap, population size, population density, fuel exports, and an offshore as indicators of financial development. In a similar study, Allen et al. (2013, 2014) added some additional regressors, namely natural resources, inflation rate, current account balance to GDP ratio, institutional development index, manufacturing, and secondary/primary school enrolments.

The study of Brunnschweiler (2009) finds that financial development measured by commercial banking has a close positive impact on the amount of renewable energy produced for 119 Non-OECD countries during 1980–2006. Yandan and Liwung (Yandan and Lijun Z 2009) observe that Guangdong primary energy consumption is Granger reason of the financial development during 1985–2006. Afangideh (2010) investigates that financial development has direct and indirect causal effect on agricultural performance through gross national savings, bank lending to agriculture, investment in agriculture, and agricultural output. The findings suggest that bank lending to agriculture has a significantly positive impact on real gross national saving and real output of agricultural sub-sector in Nigeria during 1970–2005. The empirical findings of Sadorsky (2010) indicate significantly positive connection between financial development and energy consumption for 22 emerging countries during 1990–2006 and employ generalized method of moments estimation approach. In another study, Sadorsky (2011) finds a positive and significant linkage between financial development and energy consumption for nine central and eastern European frontier economies during 1996–2006. Likewise, Jalil and Feridun (2011) investigate the long-run equilibrium linkage between financial development and environmental pollution and find that financial development in China has not taken place at the cost of environmental pollution. On the contrary, it is found that financial development has led to a decrease in environmental pollution in China during 1953–2006 and uses ARDL approach.

In a study, Al-mulali and Sab (2012a) suggests that energy consumption had played a vital role to spur both economic growth and the financial development of 30 sub-Saharan African countries during 1980–2008 but all on the cost of high pollution. Chtioui (2012) finds that in the long term, there exists a unidirectional causality going of energy consumption growth to credit to the private sector as a proxy used for financial development in Tunisia during 1972–2010, while

employs the cointegration and vector error correction models for Granger causality tests. On the short term, only the variable energy consumption growth to financial development exhibits the interest to incorporate this variable in the energy-growth nexus. Islam et al. (2013) finds that energy consumption is affected by economic growth and financial development in the short- and the long run in Malaysia during 1971–2009, while using vector error correction model (VECM). Shahbaz et al. (2013)show that the Granger causality analysis is in favor of bidirectional causality between agricultural growth and financial development in Pakistan during 1971–2011 and uses the autoregressive distributed lag (ARDL) bounds testing approach. The findings of Allen et al. (2013; 2014) reveal that population density is significantly an important factor for financial development along with other macroeconomic variables for Africa and sub-Saharan Africa. Mahalik and Mallick (2014) empirically evaluate the linkage between energy consumption, economic growth, and financial development in India during 1971–2009 and find that energy consumption is negatively and significantly impacted by financial development. In a study, Tang and Tan (2014) examine the linkage among energy consumption, economic growth, relative price, financial development, and FDI in Malaysia during 1972–2009. The empirical results reveal that energy use is a salient resource for financial sector development, where the findings further suggest that energy consumption Granger causes financial sector development in Malaysia during the period under the study. Similarly, Zeren et al. (2014) observe in case of seven newly industrialized countries during 1971–2010, both positive and negative shocks exist for Malaysia and Mexico, where causality running from energy consumption to financial developments only for the Philippines during negative shocks. Moreover, bidirectional causality resulted for India, Turkey, and Thailand, while no any causality exists for South Africa.

On the other studies, for example, Le et al. (2014) failed to find any causal relationship between energy consumption and financial development in the USA during 1966–2011 and employ VECM techniques. However, the forgoing studies affirm that there are no such inclusive empirical studies which have considered the nonfinancial determinants of financial development, while this is the broad objective of the present study to investigate it in the context of Malaysia. A brief summary of the prior studies on the impacts of various factors on financial development is reported in Table 1.

Data source and methodological framework

The study exercised on a number of variables in the following categories, i.e., agricultural production in terms of cereal yield in kilogram per hectare and livestock production index (2004–2006=100); population density in terms of people per square kilometer of land area; air pollution in terms of CO_2 emissions in kilotons (kt); energy resources in terms of energy use in kilotons of oil equivalent and fossil fuel energy consumption in percent of total; and financial development indicators includes broad money supply (% of GDP), domestic credit provided by financial sector (% of GDP), domestic credit to private sector (% of GDP), and inflation-consumer prices (annual %). The time series annual data from 1975–2013 was taken from *World Development Indicators* published by World Bank (2014). Figure 1 shows the data trend of the variables for ready reference.

This study extended the economic theory of growth which were suggested previously by Barro, and Sala-i-Marin (2004) in which economic growth is correlated with the set of variables including initial values of variables and control variables, i.e.,

$$g_{it} = \gamma_{it} + \alpha_t + \beta f_{it} + \gamma_i C_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Where, g is the dependent variable which shows the economic growth, having a set of regressor including initial values of some variables marked by γ_{it}, control variables marked by f_{it} and C_{it} represented the set of conditioning variables, ε is a white noise error with zero mean, and μ is a country-specific component of the error term that does not necessarily have a zero mean. The parameter α_i is the country-specific intercept which may vary across countries.

The focus of this study is based upon the financial indicators which depends upon the set of variables including initial values of finical indicators, i.e., γ_{it}; control variables, i.e., f_{it} market by air pollution and population density, while conditioning variables is marked by C_{it} which represents agricultural production and energy resources in a country. As the study is country bounded, therefore, there are no specific countries that intercept in the model, i.e., α_i.

For the above reasons, this study used the generalized method of moments (GMM) technique for evaluating the impact of air pollution, population density, agricultural production, and energy resources on four financial development indicators, namely broad money supply, domestic credit provided by financial sector, domestic credit to private sector, and inflation in Malaysia. The GMM technique is used for evaluating simultaneous equations in order to minimize the problem of simultaneity in the model. The advantage of this GMM methodology is that it observed the endogeniety of the independent variables in lagged-dependent variable models. This method permits the relaxing of the assumption of strong exogeneity of the explanatory variables by allowing them to be correlated with current and previous realizations of the error terms. The stability of the GMM estimator depends on the strength of the instruments used in the model as well as the assumption that the error term does not exhibit serial correlation. For this purpose, the study formulates four different

Table 1 Selected prior empirical studies on various factors effects on financial development

Author(s)	Data, countries	Estimator(s)	Response variable(s)	Regressors	Findings
Raza et al. (2014)	1990–2012[a]	Fixed-effects model	Financial development	Population growth, agriculture sector share in GDP, real GDP growth, trade openness, FDI, government current spending, index of democracy, and rule of law	All exogenous variables aside from FDI and index of rule of law have significant impacts on financial development
Wakeel and Bello (2014)	1990–2010 sub-Saharan Africa	Pooled, fixed and random effect model	Financial sector development	Gross capital formation, labor force, and energy use.	Energy use has negative impact on financial sector performance
Allen et al. (2013)	1990–2006	OLS	Financial development	Population density and size, population × per capita, natural resources, offshore center, per capita income, real GDP growth rate, inflation, current account balance, institutional development, manufacturing, secondary/ primary school enrolments	Population density has statistically significant positive impact on financial development
Al-mulali and Sab (2012b)	1980–2008 19 countries	Panel unit and panel Granger causality	Financial development and GDP per capita	Total primary energy consumption per capita, and per capita carbon dioxide emissions	Energy use has positive impact on economic growth and financial development, while CO2 has a negative impact
Boopen et al. (2011)	1970–2008 Mauritius	ARDL approach	Financial development	FDI, gross fixed capital formation, trade, inflation, value of credits to the private sector, human capital, and per capita income	Trade and investment are the main determinants of financial development
Beck et al. (2008)	2000–2006 for 103 countries	Structural regressions	Financial development indicators	GDP per capita, poverty gap, population density, and size, fuel exports and an offshore dummy	Population density has a positive impact on financial development
Ang and Mckibbin (2007)	1960–2001 Malaysia	Causality and multivariate cointegration	Financial development	Real GDP per capita, gross domestic savings, trade, gross investment, and real interest rate	Output growth causes financial depth in the long run

Low and middle income and African countries, excluding South Africa

[a] Study includes 27 developed and 30 developing countries

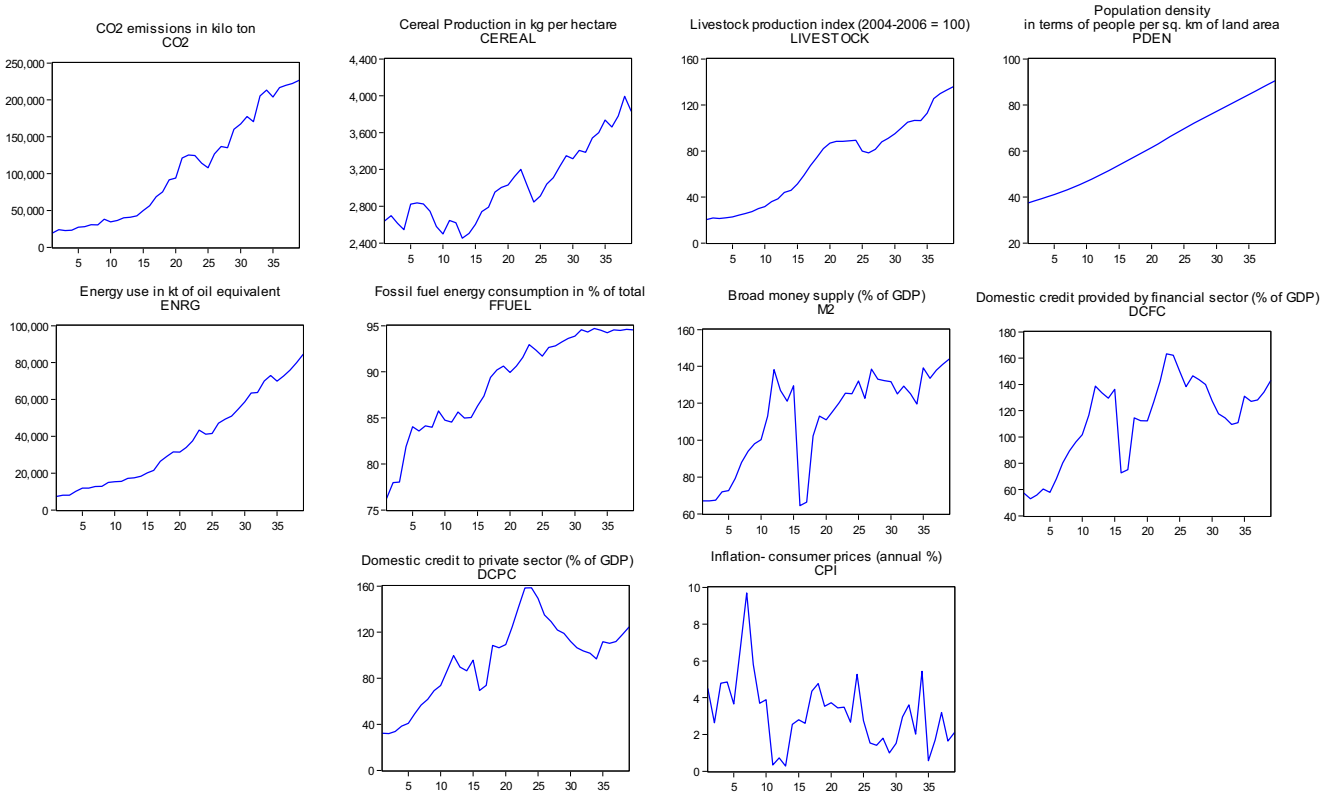

Fig. 1 Data trend of the selected variables. Source: World Bank (2014)

models with respect to financial development indicators and explanatory variables in the model, i.e.,

Model 1 Broad money supply, carbon emissions, agriculture production, and energy resources

$$\begin{aligned}\mathrm{Log(M2)}_t &= \beta_0 + \beta_1 \mathrm{Log(M2}_{t-1})_t + \beta_2 \mathrm{Log}(CO2)_t \\ &+ \beta_3 \mathrm{Log(PDEN)}_t + \beta_4 \mathrm{Log(CEREAL)}_t \\ &+ \beta_5 \mathrm{Log}(LIVESTOCK)_t + \beta_6 \mathrm{Log(ENRG)}_t \\ &+ \beta_7 \mathrm{Log(FFUEL)}_t + \varepsilon_t\end{aligned}$$

Model 2 Domestic credit provided by financial sector, carbon emissions, agriculture production, and energy resources

$$\begin{aligned}\mathrm{Log}(DCFC)_t &= \beta_0 + \beta_1 \mathrm{Log(DCFC}_{t-1})_t + \beta_2 \mathrm{Log}(CO2)_t \\ &+ \beta_3 \mathrm{Log(PDEN)}_t + \beta_4 \mathrm{Log(CEREAL)}_t \\ &+ \beta_5 \mathrm{Log(LIVESTOCK)}_t + \beta_6 \mathrm{Log}(ENRG)_t \\ &+ \beta_7 \mathrm{Log(FFUEL)}_t + \varepsilon_t\end{aligned}$$

Model 3 Domestic credit to private sector, carbon emissions, agriculture production, and energy resources

$$\begin{aligned}\mathrm{Log}(DCPC)_t &= \beta_0 + \beta_1 \mathrm{Log(DCPC}_{t-1})_t + \beta_2 \mathrm{Log}(CO2)_t \\ &+ \beta_3 \mathrm{Log}(PDEN)_t + \beta_4 \mathrm{Log}(CEREAL)_t \\ &+ \beta_5 \mathrm{Log}(LIVESTOCK)_t + \beta_6 \mathrm{Log}(ENRG)_t \\ &+ \beta_7 \mathrm{Log}(FFUEL)_t + \varepsilon_t\end{aligned}$$

Model 4 Inflation, carbon emissions, agriculture production, and energy resources

$$\begin{aligned}\mathrm{Log}(CPI)_t &= \beta_0 + \beta_1 \mathrm{Log(CPI}_{t-1})_t + \beta_2 \mathrm{Log}(CO2)_t \\ &+ \beta_3 \mathrm{Log}(PDEN)_t + \beta_4 \mathrm{Log}(CEREAL)_t \\ &+ \beta_5 \mathrm{Log}(LIVESTOCK)_t + \beta_6 \mathrm{Log}(ENRG)_t \\ &+ \beta_7 \mathrm{Log}(FFUEL)_t + \varepsilon_t\end{aligned}$$

Where, M2 represents broad money supply, M2 $_{t-1}$ represents lag value of broad money supply, CO_2 represents carbon dioxide emissions, PDEN represents population density, CEREAL represents cereal production, LIVESTOCK represents livestock index, ENRG represents energy use, FFUEL represents fossil fuel energy consumption, DCFC represents domestic credit provided by financial sector, DCFC $_{t-1}$ represents lag value of Domestic credit provided by financial sector, DCPC represents domestic credit to private sector, DCPC $_{t-1}$ represents lag value of domestic credit to private sector, CPI represents inflation rate, CPI $_{t-1}$ represents lag value of inflation rate, Log represents natural logarithm, ε represents error term, and t represents time period from 1975–2013.

Results

This section deals with the empirical results of the study comprises descriptive statistics of the variables, correlation between the variables, and generalized method of moments (GMM) technique for simultaneous equation modeling. Table 2 shows the descriptive statistics of the variables.

The statistics show that carbon dioxide emissions have a minimum value of 19,446.10 kt and a maximum value of 226, 598.0 kt, while the mean value is 103,843 kt with standard deviation of 70,792.75 kt. Agricultural production comprises cereal production and livestock production index, both variables have a positive mean value, i.e., 3030.854 yield in kilogram per hectare and 70.61769 production index, respectively. Population density has a minimum value of 37.47308 km^{-2} of land area to maximum value of 90.44884 with mean value of 62.28430 km^{-2} ha^{-1}. Energy demand and fossil fuel energy consumption have a positive mean value with standard deviation of 24108.75 kt of oil equivalent and 5.313029 percentage of total energy, respectively. Financial development comprises broad money supply (M2), domestic credit provided by financial sector (DCFC), domestic credit to private sector (DCPC), and inflation (CPI), all have a positive mean value; however, M2, DCFC and DCPC have a negative skewed, while CPI has a positively skewed distribution. Figure 2 shows the data trend at first difference which indicates the growth rate of the variables.

Table 3 shows the correlation matrix for all four financial development models in Malaysia. The results show that in model 1, money supply has a positive and high correlation with the carbon dioxide emissions, population density, cereal production, livestock production index, energy use, and fossil fuel energy consumption, as the correlation coefficient values are greater than 0.50 among all the variables. The results indicate that along with the increase in broad money supply, there has been an increase in the air pollution, agricultural production, population density, and energy resources in Malaysia which concludes that Malaysian government compromises on environmental degradation due to reaping of benefits from agricultural production which is highly dependent upon the energy and fossil fuel resources in a country. In model 2, another financial indicator, i.e., domestic credit provided by the financial sector has a strong and positive association with the air pollution, population density, agricultural production, and energy resources in a country. The results suggest that due to easy monetary policy in Malaysia, domestic credit has been popular among the citizens who further deteriorate the environment in the economy; however, agricultural factors and energy resources both contributed to the Malaysian economy for reaping social benefits from the society that further lead to the increase in population density in a country. In model 3, due to expansionary monetary policy when banks provided loans to the private sector to develop their businesses, especially agricultural businesses (as the correlation coefficient values of cereal production and livestock production values are 0.504 and 0.754, respectively) in a country by using high yield varies of seeds, easy installments tractors, threshers, cheap energy, and fossil fuel energy resources bring prosperity to the country; however, side by side, this activity led down the environment and built the population pressure per hectare. Finally, model 4 shows that there is a negative correlation between inflation and rest of the variables (i.e., carbon emissions, agricultural production, population density, and energy resources) in a country. The results conclude that along with the increase in the price level countrywide, population density decreases which further decrease the carbon emissions in a country. This is the positive side of the story; however, there has been some serious consequences that emerged in this scenario, i.e., along with the increase in the price level, it decreases the agricultural production which ultimately impact on the energy and fossil fuel energy utilization in the country.

Table 4 shows the GMM estimates of the following four models. The results indicate the significance of initial or lagged variable of broad money supply which has a positive coefficient value, i.e., 0.700 indicates the monetary convergence effect. Similarly, livestock production has a significant and positive relationship with the money supply in a country, as if 1 % increases in livestock production, money supply increases by 0.424 percentage points. This result indicates the

Table 2 Descriptive Statistics

	CO_2	CEREAL	LIVESTOCK	PDEN	ENRG	FFUEL	M2	DCFC	DCPC	CPI
Mean	103843.0	3030.854	70.61769	62.28430	37247.42	88.97753	111.8759	113.2848	96.04361	3.183254
Maximum	226598.0	3993.700	135.8200	90.44884	84526.90	94.70309	144.1264	163.3545	158.5048	9.700000
Minimum	19446.10	2450.900	20.28000	37.47308	7347.092	76.25783	64.37765	52.94601	31.94870	0.290008
Standard Deviation	70792.75	423.8204	36.17106	16.62532	24108.75	5.313029	25.45927	31.61308	34.86725	1.898302
Skewness	0.395921	0.608600	0.043117	0.107434	0.445250	−0.694642	−0.725571	−0.561262	−0.290079	1.007097
Kurtosis	1.744994	2.313275	1.802278	1.703780	1.838502	2.466372	2.129502	2.205519	2.334487	4.894047
Observations	39	39	39	39	39	39	39	39	39	39

Source: authors' estimations

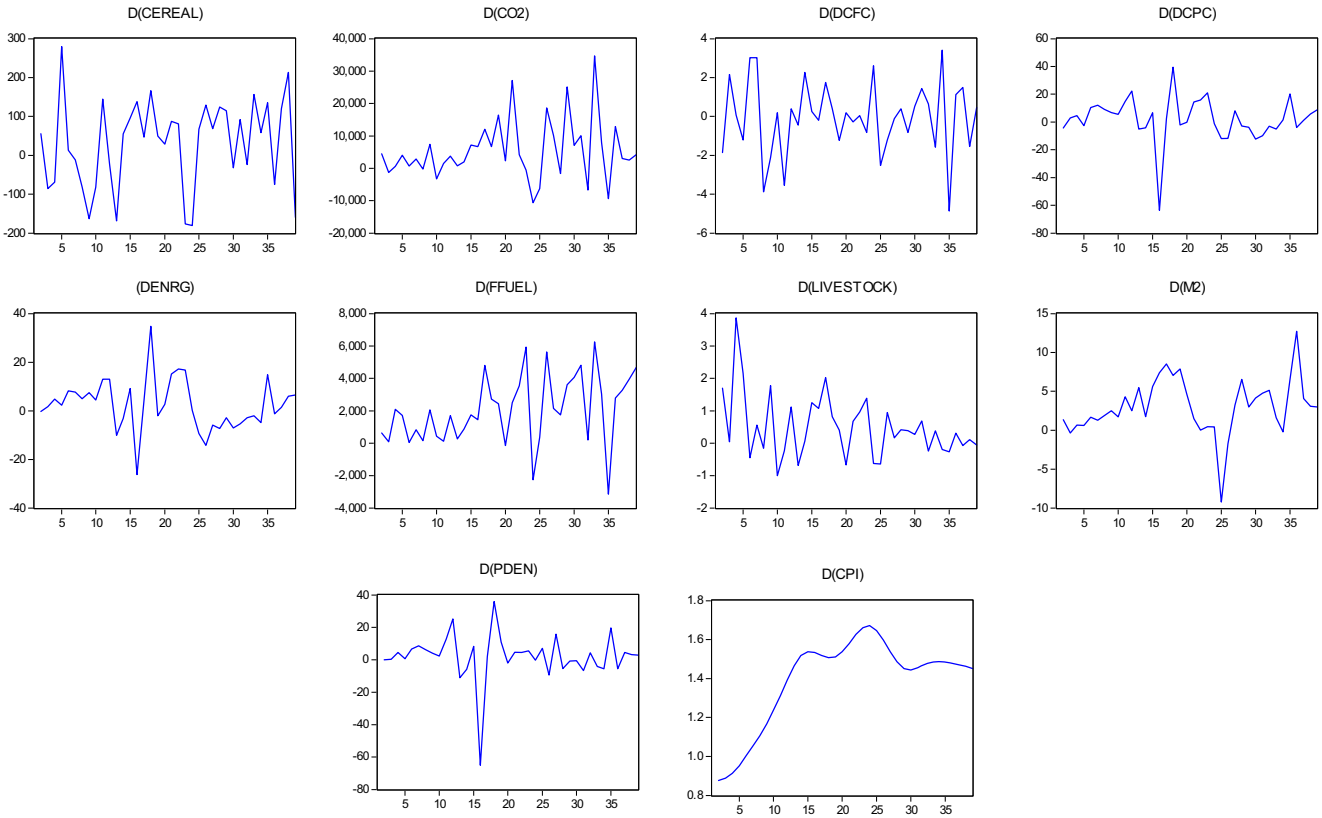

Fig. 2 Data trend at their first difference. Source: World Bank (2014). *D* represents fist difference

importance of money supply in agriculture sector, where livestock production increases along with the increase in money supply nationwide. Qureshi et al. (2014) concluded that air pollution and energy consumption both act as a strong contributor to influence Malaysian growth. For balancing the air pollution, environment, and other financial services required strong policies outlooks to sustain Malaysian economy. In model 2, domestic credit provided by financial sector (DCFS) has a significant and positive relationship with the initial value of financial indicator, livestock production, and energy demand in Malaysia; however, there is an indirect relationship with the population density and fossil fuel energy consumption in a country. Population density and fossil fuel energy consumption have a greater magnitude in decreasing domestic credit as compared to both the livestock production and energy demand to increase domestic credit in Malaysia. The results endorse the statement of Ladd (1992) which conclude that increased population density is good in a sense that high density planned development is resulted in large savings to government by reducing environmentalist costs and operating cost of the financial sector to liberalize their policies effectively.

Model 3 shows that domestic credit given to the private sector have some positive and negative consequences on the Malaysian economy, as carbon emissions, population density, and fossil fuel energy consumption have a negative and significant relationship with the credit given to the private sector, while there is a positive and significant association with the agricultural production and energy demand in a country. Both the cereal production and energy demand have a positive and more elastic relationship with the financial indicator, while population density and fossil fuel have a negative and more elastic relationship with the financial indicator, as the coefficient value tends to be greater than 1. The results indicate that agricultural production and energy demand both are interlinked with each other in the process of financial development of Malaysia. Final model indicates the consequences of changes in the price level countrywide, as along with the increase in the price level, there is a decrease in the cereal production and fossil fuel energy consumption in a country; however, the changing price level decreases the burden of population in the country. Further, changes in price level emerged some positive impact on livestock production and energy consumption which is a good sign of recovery during the study period. The results indicate that higher price level in a country may affect the population density and fossil fuel energy consumption, therefore, better financial management is required for agricultural production, especially for livestock production, which positively exerts with the financial development in a country.

Table 3 Correlation matrix

Model 1: broad money supply, carbon emissions, agriculture production, and energy resources							
	M2	CO_2	PDEN	CEREAL	LIVESTOCK	ENRG	FFUEL
M2	1.000						
CO_2	0.719	1.000					
PDEN	0.780	0.982	1.000				
CEREAL	0.597	0.955	0.911	1.000			
LIVESTOCK	0.737	0.964	0.976	0.906	1.000		
ENRG	0.733	0.994	0.987	0.947	0.958	1.000	
FFUEL	0.770	0.896	0.939	0.803	0.927	0.898	1.000
Model 2: domestic credit provided by financial sector, carbon emissions, agriculture production, and energy resources							
	DCFC	CO_2	PDEN	CEREAL	LIVESTOCK	ENRG	FFUEL
DCFC	1.000						
CO_2	0.572	1.000					
PDEN	0.665	0.982	1.000				
CEREAL	0.407	0.955	0.911	1.000			
LIVESTOCK	0.652	0.964	0.976	0.906	1.000		
ENRG	0.580	0.994	0.987	0.947	0.958	1.000	
FFUEL	0.730	0.896	0.939	0.803	0.927	0.898	1.000
Model 3: domestic credit to private sector, carbon emissions, agriculture production, and energy resources							
	DCPC	CO_2	PDEN	CEREAL	LIVESTOCK	ENRG	FFUEL
DCPC	1.000						
CO_2	0.653	1.000					
PDEN	0.735	0.982	1.000				
CEREAL	0.504	0.955	0.911	1.000			
LIVESTOCK	0.754	0.964	0.976	0.906	1.000		
ENRG	0.649	0.994	0.987	0.947	0.958	1.000	
FFUEL	0.831	0.896	0.939	0.803	0.927	0.898	1.000
Model 4: inflation, carbon emissions, agriculture production, and energy resources							
	CPI	CO_2	PDEN	CEREAL	LIVESTOCK	ENRG	FFUEL
CPI	1.000						
CO_2	−0.354	1.000					
PDEN	−0.411	0.982	1.000				
CEREAL	−0.244	0.955	0.911	1.000			
LIVESTOCK	−0.366	0.964	0.976	0.906	1.000		
ENRG	−0.365	0.994	0.987	0.947	0.958	1.000	
FFUEL	−0.344	0.896	0.939	0.803	0.927	0.898	1.000

Source: authors' estimations

Conclusion

The objective of the study is to examine the relationship between air pollution, population density, agricultural production, energy resources, and their resulting impact on financial development indicators in Malaysia, during the period of 1975–2013. The study employs GMM technique for simultaneous equations modeling, i.e., each financial indicator separately estimated with the environmental quality indicators in a country. For this purpose, four equations has been developed to asses the impact of environmental indicators on financial development. The following conclusions were drawn from this exercise, i.e.,:

- Financial indicators except CPI show the financial convergence effect, i.e., the significance of initial or lagged value of financial indicators in Malaysia.
- Carbon dioxide emissions have a positive correlation with the M2, DCFC, and DCPC, while with the CPI, the correlation results reverted.
- Population density has a negative and more elastic relationship with the three financial indicators except M2; as

Table 4 GMM Results

Model 1: broad money supply, carbon emissions, agriculture production, and energy resources.
Dependent variable: Log(M2)
Method: generalized method of moments

Variable	Coefficient	S. E.	t-statistic	Prob.
C	20.711	19.947	1.038	0.308
Log(M2(-1))	0.700	0.286	2.444	0.021
Log(CO_2)	−0.825	0.501	−1.645	0.111
Log(PDEN)	−1.905	2.629	−0.725	0.475
Log(CEREAL)	−0.524	0.569	−0.920	0.365
Log(LIVESTOCK)	0.424	0.227	1.870	0.072
Log(ENRG)	1.688	1.269	1.331	0.194
Log(FFUEL)	−3.803	4.585	−0.829	0.414
AR(1)	0.045	0.296	0.151	0.881
AR(2)	−0.248	0.108	−2.277	0.030
R-squared	0.637	Mean dependent variable		4.728
Adjusted *R*-squared	0.530	S.D. dependent variable		0.226
S.E. of regression	0.155	Sum squared residual		0.646
Durbin-Watson statistic	1.810	J-statistic		0.104

Model 2: domestic credit provided by financial sector, carbon emissions, agriculture production, and energy resources
Dependent variable: Log(DCFC)
Method: generalized method of moments

Variable	Coefficient	S. E.	t-statistic	Prob.
C	71.834	39.508	1.818	0.080
Log(DCFC(-1))	0.737	0.292	2.521	0.018
Log(CO_2)	0.144	0.431	0.334	0.741
Log(PDEN)	−12.865	5.251	−2.450	0.021
Log(CEREAL)	−1.701	1.353	−1.257	0.219
Log(LIVESTOCK)	0.484	0.224	2.159	0.040
Log(ENRG)	6.622	3.046	2.174	0.039
Log(FFUEL)	−22.305	9.779	−2.281	0.031
AR(1)	0.193	0.219	0.883	0.385
AR(2)	−0.355	0.088	−4.028	0.000
R-squared	0.734	Mean dependent variable		4.7199
Adjusted *R*-squared	0.658	S.D. dependent variable		0.2920
S.E. of regression	0.171	Sum squared residual		0.8163
Durbin-Watson statistic	2.096	J-statistic		0.0846

Model 3: domestic credit to private sector, carbon emissions, agriculture production, and energy resources
Dependent variable: Log(DCPC)
Method: generalized method of moments

Variable	Coefficient	S. E.	t-statistic	Prob.
C	31.440	8.444	3.723	0.001
Log(DCPC(-1))	0.685	0.097	7.072	0.000
Log(CO_2)	−0.666	0.237	−2.809	0.009
Log(PDEN)	−3.032	1.223	−2.479	0.020
Log(CEREAL)	1.205	0.265	4.548	0.000
Log(LIVESTOCK)	0.643	0.145	4.422	0.000
Log(ENRG)	1.284	0.506	2.537	0.018
Log(FFUEL)	−7.848	2.157	−3.638	0.001
AR(3)	0.701	0.097	7.247	0.000

Table 4 (continued)

Model 1: broad money supply, carbon emissions, agriculture production, and energy resources.
Dependent variable: Log(M2)
Method: generalized method of moments

R-squared	0.856	Mean dependent variable	4.590
Adjusted *R*-squared	0.811	S.D. dependent variable	0.321
S.E. of regression	0.139	Sum squared residual	0.505
Durbin-Watson statistic	0.958	J-statistic	0.111

Model 4: inflation, carbon emissions, agriculture production, and energy resources
Dependent variable: Log(CPI)
Method: generalized method of moments

Variable	Coefficient	S. E.	t-statistic	Prob.
C	150.131	59.645	2.517	0.018
Log(CPI(-1))	0.037	0.152	0.240	0.812
Log(CO_2)	0.290	0.878	0.330	0.744
Log(PDEN)	−14.414	4.872	−2.959	0.006
Log(CEREAL)	−1.374	1.622	−0.847	0.405
Log(LIVESTOCK)	1.485	0.406	3.658	0.001
Log(ENRG)	5.825	3.269	1.782	0.086
Log(FFUEL)	−33.021	13.559	−2.435	0.022
AR(2)	0.213	0.077	2.755	0.010
R-squared	0.412	Mean dependent variable		0.903
Adjusted *R*-squared	0.391	S.D. dependent variable		0.782
S.E. of regression	0.889	Sum squared residual		21.318
Durbin-Watson statistic	1.879	J-statistic		0.126

Source: authors' estimations

Cochrane-Orcutt iterative process is applied for the robust standard errors and t-statistics. The instruments in this case are chosen from the lagged endogenous and explanatory variables

with the case of M2, this relationship is insignificant to build any relationship.

- Cereal production in terms of yield has a significant and positive relationship with the DCPC; however, negative relationship has been observed with the CPI.
- Livestock production shows a positive relationship with the financial indicators in Malaysia, however, CPI among the financial indicators which exerted the greater magnitude, i.e., 1.485 percentage points.
- Energy demand increases along with the increase in financial development, while fossil fuel energy consumption decreases along with the increase in the financial indicators of a country.

The overall results indicate the serious challenges posed with the climatic factors for a sustainable development of Malaysia, as most of the emissions including carbon dioxide resulting from energy sector which has been subsidized by the financial sector in terms of easy loan accessibility and subsidized/leased capital goods. Malaysian government

should have to pay attention on the loaning power of the financial sector to assess the environmental performance of the industries. In addition, population density is noticeably more important for financial development, as urbanization creates increasing pressure on energy supply and the natural environment; for remedial measures, it is necessary to publicize subsidized farming for healthy Malaysia. Policy makers should have to address sound financial stability by agricultural reforms and cheap energy sources in a country, and it is possible when research and developmental expenditures exercised on green technology and sustainable farming practices in order to reduce the consumption of fossil fuels. A greater usage of renewable energy can be achieved by fuel switching from fossil fuels to renewables. We may not overlook the importance of sound institutional frameworks which are prerequisite for Malaysian government in order to secure sustained economic growth without forfeiting its environment.

References

Afangideh UJ (2010) Financial development and agricultural investment in Nigeria: historical simulation approach. J Econ Monet Integr 1: 74–97

Allen, F., Carletti, E., Cull, R., Qian, J., Senbet, L., and Valenzuela, P., (2013). Resolving the African financial development gap: cross-country comparisons and a within-country study of Kenya. Policy Research Working Paper 6592, The World Bank. Forthcoming in NBER Volume on African Economic Successes, (University of Chicago Press; eds., S. Edwards, S. Johnson, and D. Weil)

Allen F, Carletti E, Cull R, Qian J, Senbet L, and Valenzuela P (2014) The African financial development and financial inclusion gaps. Policy Research Working Paper, 7019. World Development Group, The World Bank

Al-mulali U, Sab CNBC (2012a) The impact of energy consumption and CO_2 emission on the economic growth and financial development in the Sub Saharan African countries. Energy 39(1):180–186

Al-mulali U, Sab CNBC (2012b) The impact of energy consumption and CO_2 emission on the economic and financial development in 19 selected countries. Renew Sustain Energy Rev 16:4365–4369

Ang JB, McKibbin WJ (2007) Financial liberalization, financial sector development and growth: evidence from Malaysia. J Dev Econ 84: 215–233

Athukorala P, Sen K (2002) Saving, investment and growth in India. Oxford University Press, UK

Ayadi, R., Arbak, E., Naceur, S. B., and De Groen, W. P., (2013). Determinants of financial development across the Mediterranean. MEDPRO Technical Report No. 29/February 2013. Available at www.medpro-foresight.eu

Bagehot W (1873) Lombard Street (1962 Edition). Richard D, Irwin, Homewood, IL

Baro R, Sala-i-Martin X (2004) Economic growth, 2nd edn. MIT Press, London

Beck T, Levine R, Loayza N (2000) Finance and the sources of growth. J Financ Econ 58:261–300

Beck T, Asli D-K, Levine R (2007) Finance, inequality, and the poor. J Econ Growth 12:27–49

Beck T, Feyen E, Ize A, Moizeszowicz F (2008) Benchmarking financial development, Policy Research Working Paper 4638. The World Bank, Washington DC

Boopen S, Kesseven P, Jashveer H and Binesh S (2011). Determinants of financial development: the case of Mauritius. Finance and Corporate Governance Conference 2011 Paper. Available at SSRN: http://ssrn.com/abstract=1724404 or http://dx.doi.org/10.2139/ssrn.1724404 (accessed on 11th June, 2014

Brunnschweiler CN (2009) Finance for renewable energy: an empirical analysis of developing and transition economies. Working Paper 09/117, CER-ETH – Center of Economic Research at ETH Zurich

Chtioui S (2012) Does economic growth and financial development spur energy consumption in Tunisia? J Econ Int Finan 4(7):150–158

Claessens S and Feijen E (2007) Financial sector development and the millennium development goals. World Bank Working Paper No. 89. The World Bank

DFID (2004) The importance of financial sector development for growth and poverty reduction. Policy Division Working Paper, Ref no: PD 030. Financial Policy Division, Department for International Development. Available at www.dfid.gov.uk

Goldsmith RW (1969) Financial structure and development. Yale University Press, New Haven

IMF (2014) Malaysia: financial sector assessment program financial sector performance, vulnerabilities and derivatives—technical note, IMF Country Report No. 14/98. International Monetary Fund Publication Services, Washington

Islam F, Shahbaz M, Ahmed AU, Alam MM (2013) Financial development and energy consumption nexus in Malaysia: a multivariate time series analysis. Econ Model 30:435–441

Jalil A, Feridun M (2011) The impact of growth, energy and financial development on the environment in China: a cointegration analysis. Energy Econ 33(2):284–291

Jalilian H and Kirkpatrick C (2001) Financial development and poverty reduction in developing countries. Working Paper No. 30, IDPM, Manchester University

Julian T.S. C. (2013). (IMF) in the context of the 2013 Malaysia FSAP. Available at http://www.imf.org/external/pubs/ft/scr/2013/cr1352.pdf (accessed on 27th September, 2014)

Ladd HF (1992) Population growth, density and the costs of providing public services. Urban Stud 29(2):273–295

Le, Kim-Song and Hassan K, Gasbarro D, and Cullen G., (2014). The relation between financial development, energy consumption and economic growth: empirical evidence for the United States. Available at SSRN: http://ssrn.com/abstract=2484279 or http://dx.doi.org/10.2139/ssrn.2484279 DOI:10.2139/ssrn.2484279#_blank (accessed on 15th July, 2014)

Levine R (1997) Financial development and economic growth: views and agenda. J Econ Lit XXXV:688–726

Liu W-C, Hsu C-M (2006) The role of financial development in economic growth: the experiences of Taiwan, Korea, and Japan. J Asian Econ 17:667–690

Lucas RE (1988) On the mechanics of economic development. J Monet Econ 22:3–42

Mahalik MK, Mallick H (2014) Energy consumption, economic growth and financial development: exploring the empirical linkages for India. J Dev Areas 48(4):139–159

McKinnon RI (1973) Money and capital in economic development. Brooking Institution Press, Washington, DC

Nurul M A, Paul O and Deo P (2014) Application of sustainability indicators and rating tools: envisioning 'Life Cycle' assessment for buildings in Malaysia. WSB14 programme - World Barcelona

Pereira JJ, Tiong TC, Komoo I (2010) Mainstreaming climate change adaptation and disaster risk reduction: a Malaysian approach.Community. Environ Disaster Risk Manag 5:147–167

Qureshi MI, Rasli AM, Awan U, Ma J, Ali G, Alam A, Zaman K (2014) Environment and air pollution: health services bequeath to grotesque menace. Environ Sci Pollut Res. doi:10.1007/s11356-014-3584-2

Raza SH, Shahzadi H, Akram M (2014) Exploring the determinants of financial development (using panel data on developed and developing countries). J Financ Econ 2(5):166–172

Razak MIM, Ahmad I, Bujang I, Talib AH, Ibrahim Z (2013) Economics of air pollution in Malaysia. Int J Humanit Soc Sci 3(13):173–177

Robinson J (1952) The generalization of the general theory. In: Violet J (ed) The Rate of Interest, and Other Essays. Macmillan, London, pp 67–142

Sadorsky P (2010) The impact of financial development on energy consumption in emerging economies. Energy Policy 38(5):2528–2535

Sadorsky P (2011) Financial development and energy consumption in central and eastern European frontier economies. Energy Policy 39: 999–1006

Saint-Paul G (1992) Technological choice, financial markets and economic development. Eur Econ Rev 36:763–781

Schumpeter JA (1911) The theory of economic development. Harvard University Press, Cambridge

Shahbaz M, Shabbir MS, Butt MS (2013) Effect of financial development on agricultural growth in Pakistan. Int J Soc Econ 40(8):707–728

Shaw ES (1973) Financial deepening in economic development. Oxford University Press, New York

Tadesse S (2005) Financial development and technology. William Davidson Institute Working Paper No. 749

Tang CF, Tan BW (2014) The linkages among energy consumption, economic growth, relative price, foreign direct investment, and financial development in Malaysia. Qual Quant 48(2):781–797

Voghouei H, Azali M, Jamali MA (2011) A survey of the determinants of financial development. Asian-Pacific Econ Lit 25:1–20. doi:10.1111/j.1467-8411.2011.01304.x

Wakeel I, Bello AK (2014) Energy demand and financial sector performance in sub-Saharan African region. Int J Sustain Energy Environ Res 3(1):16–33

World Bank (2014) World development indicator. World Bank, Washington

Yandan and Lijun Z (2009) Financial development and energy consumption: an empirical research based on Guangdong Province. Paper presented at International Conference on Information Management, Innovation Management and Industrial Engineering, 2009, ICIII, 3. pp: 102-105. DOI 10.1109/ICIII.2009.334

Yusof ZA, Hussin AA, Alowi I, Lim C, Singh S (1994) Financial reform in Malaysia. In: Caprio G, Atiyas I, Hanson JA (eds) Financial Reform: Theory and Experience. Cambridge University Press, UK, pp 276–320

Zeren F, Koc M (2014) The nexus between energy consumption and financial development with asymmetric causality test: new evidence from newly industrialized countries. Int J Energy Econ Policy 4(1): 83–91