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IMPACT OF GLOBALISATION ON ENVIRONMENT AND ENERGY CONSUMPTION

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By

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IMPACT OF GLOBALISATION ON ENVIRONMENT AND ENERGY CONSUMPTION

By

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Globalisation, particularly from the perspective of economic globalisation is notably the most profound and debated issues that have a ubiquitous influence on the environment and energy consumption. The distributional impact of globalisation has affected the environment and led to the rise of unsustainable energy consumption patterns attributed to demographic pressures and rapidly evolving technological frontiers across the globe. Presently, limited literature has incorporated globalisation variables from the revised KOF Globalisation Index (2018) to examine its impact on the environment and energy consumption. Thus, this study intends to investigate the impact of the segregated trade and financial globalisation policies that encompasses distinctive dimensions of economic globalisation on environmental degradation, environmental sustainability and energy consumption.

This study utilised the two-step system generalised-method-of-moments (GMM) methodology framework to examine the three research objectives of this study. The first objective investigates the impact of globalisation on carbon emission per capita, based on a panel of 143 countries (full sample) spanning over a period from 1994 – 2014. The full panel is further segregated into the low income and lower-middle income (LLMI) sample comprising 63 countries and the upper-middle-income, and high income (UMIHI) sample consisting of 80 countries. For the second and third research objective, the impact of globalisation on the ecological footprint of consumption per capita and energy consumption per capita were examined respectively, based on a panel of 137 countries spanning over a period from 1994 – 2014. The full panel was further segregated into low income and lower-middle income (LLMI) comprising 62 countries and the upper-middle-income, and high income (UMIHI) consisting of 75 countries.

Findings from the first objective have illustrated that existing trade and financial globalisation policies have led to the degradation of the environment, from the perspective of the full panel, the LLMI panel and the UMIHI panel. Present globalisation policies have not been able to advocate sustainable economic development via technology transfers and failed to execute effective trade and investment restrictive policies to deter the establishment of pollution-emitting industries, particularly amongst nations within the LLMI panel. From the second objective, the findings postulate that existing globalisation policies have led to unsustainable practices pertaining to livestock production, deforestation and overfishing attributed to intensified agricultural production and energy consumption which threatens environmental sustainability. Across all the examined panels of study, it is evident that existing globalisation policies have caused a decline in ecological reserves, as natural resources have been exploited beyond sustainable scales.

Findings from the third objective vary between the income panels. From the perspective of the LLMI panel, the findings posit that existing trade and financial globalisation policies have not been instrumental towards advocating sustainable energy consumption trends amongst nations within this panel. However, the globalisation policies have been empowering nations within the UMIHI panel, with trade and investment initiatives that have focused on the growth of renewable energy, green technology and infrastructure to attain sustainable economic development. In proposing sustainable policy recommendations, the suggestions were geared towards the instrumental roles that international organisations and policymakers play by collaborating effectively to undertake transformative globalisation initiatives geared towards attaining sustainable economic development. To address the environmental crisis, integrating sustainable globalisation policies are vital to minimise further degradation of the environment, address declining ecological deficits attributed to resource extractions and depletion and mitigate unsustainable energy consumption trends, which adversely affects the ecosystem of the planet.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KESAN GLOBALISASI TERHADAP ALAM SEKITAR AND PENGGUNAAN TENAGA

Oleh

YASMIN YASHODHA

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Globalisasi, terutamanya dari perspektif globalisasi ekonomi adalah isu yang paling mendalam dan diperdebatkan yang mempunyai pengaruh terhadap alam sekitar dan penggunaan tenaga. Kesan pengagihan globalisasi telah menjejaskan alam sekitar dan membawa kepada peningkatan pola penggunaan tenaga yang tidak mampan yang disebabkan oleh tekanan demografi dan sempadan teknologi yang pesat berkembang di seluruh dunia. Pada masa ini, kesusasteraan yang terhad telah memasukkan pembolehubah globalisasi dari Indeks Klobal Globalisasi (2018) yang telah dikaji semula untuk mengkaji kesannya terhadap persekitaran dan penggunaan tenaga. Oleh itu, kajian ini berhasrat untuk menyiasat kesan dasar globalisasi perdagangan dan kewangan yang berasingan yang merangkumi dimensi tersendiri bagi globalisasi ekonomi terhadap kemusnahan alam sekitar, kelestarian alam sekitar dan penggunaan tenaga.

Kajian ini menggunakan rangka kerja metodologi umum sistem dua langkah (GMM) untuk mengkaji ketiga-tiga objektif penyelidikan kajian ini. Objektif pertama menyiasat kesan globalisasi ekonomi terhadap pelepasan karbon per kapita, berdasarkan panel 143 negara (sampel penuh) yang merangkumi tempoh dari 1994 - 2014. Kesemua panel di asingkan kepada dua kelompok iaitu pendapatan rendah dan sederhana (LLMI) yang terdiri daripada 63 negara dan pendapatan menengah atas, dan sampel pendapatan tinggi (UMIHI) yang terdiri daripada 80 buah negara. Untuk objektif penyelidikan kedua dan ketiga, kesan globalisasi ekonomi terhadap kesan ekologi penggunaan per kapita dan penggunaan tenaga per kapita diperiksa masing-masing, berdasarkan panel 137 negara yang merangkumi tempoh dari 1994 - 2014. Kesemua panel di bahagikan kepada pendapatan rendah dan pendapatan menengah rendah (LLMI) yang terdiri daripada 62 negara dan pendapatan menengah atas, dan pendapatan tinggi (UMIHI) yang terdiri daripada 75 negara.

Penemuan dari objektif pertama menggambarkan bahawa dasar globalisasi perdagangan dan kewangan yang sedia ada telah mengakibatkan kemusnahan alam sekitar, dari perspektif panel penuh, panel LLMI dan panel UMIHI. Dasar-dasar globalisasi sekarang tidak dapat menyokong pembangunan ekonomi yang mampan melalui pemindahan teknologi dan gagal melaksanakan dasar-dasar perdagangan dan pelaburan yang berkesan untuk menghalang penubuhan industri pemancaran pencemaran, terutamanya di kalangan negara dalam panel LLMI. Dari objektif kedua, penemuan tersebut menggambarkan bahawa dasar globalisasi yang sedia ada telah membawa kepada amalan tidak mampan berhubung dengan pengeluaran ternakan, penebangan hutan dan penangkapan ikan yang berlebihan yang disebabkan oleh pengeluaran pertanian yang semakin intensif dan penggunaan tenaga yang mengancam kelestarian alam sekitar. Di sebalik semua panel kajian yang diperiksa, jelas bahawa dasar globalisasi yang ada telah menyebabkan penurunan dalam rizab ekologi, kerana sumber semula jadi telah dieksploitasi di luar skala yang mampan.

Penemuan dari objektif ketiga berbeza antara panel pendapatan. Dari perspektif panel LLMI, penemuan itu menyimpulkan bahawa dasar globalisasi perdagangan dan kewangan yang sedia ada tidak berperanan untuk menyokong trend penggunaan tenaga berterusan di kalangan negara-negara dalam panel ini. Walau bagaimanapun, dasar globalisasi telah memperkasa negara dalam panel UMIHI, dengan inisiatif perdagangan dan pelaburan yang memberi tumpuan kepada pertumbuhan tenaga boleh diperbaharui, teknologi hijau dan infrastruktur untuk mencapai pembangunan ekonomi yang mampan. Dalam mencadangkan cadangan dasar yang mampan, cadangan itu diarahkan ke peranan penting yang dimainkan oleh organisasi antarabangsa dan penggubal dasar dengan bekerjasama dengan berkesan untuk melaksanakan inisiatif transformasi globalisasi yang bertujuan untuk mencapai pembangunan ekonomi yang mampan. Untuk menangani krisis alam sekitar, mengintegrasikan dasar globalisasi mampan adalah penting untuk meminimumkan kemusnahan alam sekitar, mengurangkan penggunaan penggunaan tenaga yang tidak lestari dan tekanan ekologi seperti pengekstrakan sumber dan kekurangan, yang menjejaskan ekosistem planet ini.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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BRICS	Brazil, Russia, India, China, South Africa
CO2	Carbon Emissions
ECEEE	European Council for an Energy-Efficient Economy
EEO	Emissions – Energy – Output
EF	Ecological Footprint
EG	Economic Globalisation
EFC	Ecological Footprint Consumption
EKC	Environmental Kuznets Curve
ETS	Emissions Trading Scheme
FDI	Foreign Direct Investment
FEH	Factor Endowment Hypothesis
FGDF	Financial Globalisation (De Facto)
FGDJ	Financial Globalisation (De Jure)
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFN	Global Footprint Network
GMM	Generalised Method of Moments
GSDQ	Global Sustainable Development Quadrant
IMF	International Monetary Fund
IPAT	Impact = Population * Affluence * Technology
IPCC	Intergovernmental Panel on Climate Change
KOF	*Konjunkturforschungsstelle* (Swiss Economic Institute)
LLMI	Lower-income and lower-middle-income
MENA	Middle-East and North Africa
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PHH	Pollution-Haven Hypothesis
SDG	Sustainable Development Goals
STIRPAT	Stochastic Impacts by Regression on Population, Affluence and Technology
TGDF	Trade Globalisation (De Facto)
TGDJ	Trade Globalisation (De Jure)
UMIHI	Upper-middle income and high income
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCC	United Nations Framework Convention on Climate Change
WBG	World Bank Group
WDI	World Development Indicators
WEF	World Economic Forum
WTO	World Trade Organisation

CHAPTER 1

INTRODUCTION

1.1 Background to the study

The globalisation phenomenon encompasses processes and patterns that interconnect world communities through an integrated global network that has changed the economic, social and political landscape in the last five decades. The technology revolution since the 1990s, the diminishing role of sovereign and geopolitical boundaries, the consolidation of corporate power, the transnational movement of goods, services, labour and capital are attributed to the rise of internationalisation, capitalist expansion and modernisation (Bridge, 2002; Rodrik, 2011, 2018). The manifestation of globalisation transcends geopolitical borders which have resulted in the deregulation of the economy which entails the removal of controls on transnational mobility of finance, dismantle of external trade barriers, privatisation and the restructuring of economies to facilitate free-market capitalism (Stiglitz, 2002; Stiglitz, 2017a).

The globalisation concept has been accorded varied definitions due to its multifaceted and complex phenomenon that has led to the increase of homogenisation of consumer preferences, rise in liberal political ideologies, and expansion of capital that has stimulated export-driven growth in varied economies. The dialectical association between its economic, social and political dimensions of globalisation is often viewed to be contradictory between the developed and developing nations (Bhagwati, 2002). Economic globalisation epitomises contemporary structures such as technological developments, mobility of capital and labour, economic and financial markets and communication patterns becoming progressively globalised and international over time. The notion of economic globalisation encapsulates the rise of global commodity chains, concentration of industries amongst large transnational corporations and the development of global regulatory institutions such as the United Nations (UN) and World Trade Organisation (WTO). The technological revolution in the mid-1990s transformed the mobility of capital into entrepreneurship ventures, corporate and personal financing structures and the system of credit which transformed the ideology of consumerism. In 1980, the average daily foreign exchange trading amounted to USD$80 billion (Amin, 1998; Daniels, 1997). According to the Bank for International Settlements (BIS) Triennial Survey, trading in foreign exchange markets reached USD$6.6 trillion per day in April 2019, which increased from USD5.1 trillion in 2016.

From the perspective of social globalisation, as the social world becomes increasingly interconnected, the inimitable local cultures and non-capitalist values will be debilitated, but a convergence of communication patterns arises amongst a diverse group of individuals on a global scale. The rise in homogenisation of consumer preferences as multinational corporations target distinct social groups via ethnicity,

class, gender since the 1970s have been attributed to social globalisation (Stevis, 2005). With the accumulation of detailed patterns on consumer preferences, enabled the efficient transmission of knowledge to marketers in multinational corporations. Global corporations embraced multiculturalism through the power of cultural homogenisation by analysing local cultural lenses towards reducing active citizenship to consumption patterns (Beumer et al., 2018; Escobar, 2004; Goldthorpe, 2002). Political globalisation is attributed to the emergence of global governance and rising contradictions amongst sovereign states.

With the establishment of transnational institutions such as the International Monetary Fund (IMF), World Bank and United Nations (UN), the political tension of globalisation affected the regulatory landscape of global capitalism. The shift in political structures from nation-states to intra-regional and transnational levels is attributed to the rise in political globalisation which is increasingly mediated through global governance (Adamson, 2005). Although the definition of national sovereignty is redefined, core countries such as the nations in the North American and the Western European region controls the global capitalist processes and international regulatory institutions, despite threats to their own sovereignty (Jones, 2013).

Environmental degradation is increasingly raising concerns for mankind over the past decades. With the rise of economic development and mindless consumerism, the distinctive nature of the issue is attributed to anthropogenic human activities as opposed to the natural phenomena (Shrinkhal, 2019). Air pollution concentrations in cities particularly in Asia have exceeded the World Health Organisation levels. It is anticipated that by 2050, the number of premature deaths resulting from exposures to pollutive matters is projected to double, reaching about 3.6 million a year globally (OECD, 2012). Nations across the globe should collaborate effectively to execute future policies to minimise environmental degradation, to minimise global carbon emissions peaking before 2020 and limiting the world's average temperature to increase to 2 °C. The imposition of global carbon price could lower carbon emissions by approximately 70% in 2050. Global economic growth could decline by 0.2 percentage points per year on average, which results in 5.5% of global gross domestic product (GDP) in 2050. However, the costs of global inaction are estimated to be 14% of average world consumption per capita. Furthermore, by adopting carbon emission reductions, particularly amongst emerging nations such as BRICS could outweigh the costs by 10 to 1 by 2050 (OECD, 2015).

Environmental sustainability refers to mankind's capacity to minimise the exhaustion of the world's natural resources, such as soil, water, land and air attributed to human activities. With the disposition of waste that dissipates renewable resources such as forest trees, ocean fisheries and agricultural soil at alarming rates leads to the inability to regenerate these resources to accommodate the rising demand of the human population. The inability of the environment to withstand the negative impacts of human activities threatens the sustainability of the ecosystem of the planet(Ahmed et al., 2015; Baabou et al., 2017). With threatened environmental sustainability, loss in

biodiversity, bioenergy croplands and freshwater biodiversity is projected to decline exponentially by 2050 (OECD, 2015).

Presently, the loss of one-third of global freshwater biodiversity is attributed to the human activities that have exploited the available natural resource to meet the rising demand of mankind. The aggregate loss of biodiversity and ecosystem benefits associated with the global loss of forests is anticipated estimated to be ranging between USD 2 and 5 trillion per year, according to the Economics of Ecosystems and Biodiversity study (OECD, 2012). Furthermore, the availability of freshwater will be strained, with 40% of the global population anticipated to be living in river basins experiencing severe water stress, particularly in the African and Asian regions. Global water demand is projected to increase by 55%, attributed to manufacturing activities (+400%), thermal electricity generation (+140%) and domestic consumption (+130%) (OECD, 2012). With rising unsustainable energy consumption trends, environmental degradation and environmental sustainability ecological pressures such as changes in land-use, resource extractions and depletion attributed to deforestation, adversely affect the ecosystem of the planet (Thorpe & Figge, 2018).

Rising prosperity amongst economies across the globe would boost global energy demand in the next few decades. If energy efficiency initiatives are accelerated, it is projected that global energy demand would likely increase by only one third over the next 25 years. As such, it is pertinent for renewable energy to account for almost 50% of global energy demand by 2040 to address the rising environmental threats (BP Energy Outlook, 2018). To mitigate the present environmental crisis, decarbonisation of the global energy system within the next decade is crucial, as 50% - 90% reductions in global carbon emissions by 2050 (Loftus et al., 2015) must be achieved against a backdrop of rising global population and significant projected increases in demand for energy and energy-related services. The carbon intensity of the global economy must decline at a rate of 4% - 10% per annum, with accelerated decarbonisation initiatives, whilst attaining sustainable economic development (Kriegler et al., 2014). As global carbon intensity merely declined at a rate of just 0.9% per annum from 1990 to 2005, additional efforts should be geared towards implementing wide-ranging green policy initiatives across the globe (Field et al., 2014; IPCC, 2014).

Based on the findings from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (2014), since 1750, anthropogenic greenhouse gas (GHG) emissions have increased to unprecedented levels over the years. The leading contributor to GHG emissions, includes carbon dioxide emissions, with 78% of the total emission spanning over a period from 1970 – 2010. The threat of climate change is further exacerbated by the IPCC's published report in October 2018 which demonstrates the need to address the varied impacts of climate change if global temperature rises above 1.5°C. The report also indicates that humanity generally has about 12 years to adopt aggressive and unprecedented initiatives to reduce global emissions by 45 per cent to limit global warming to 1.5°C. As such, strengthening global collaborative efforts by adopting sustainable trade and financial globalisation

policies should be the way forward to address threats to climate change and attain sustainable development globally.

Globalisation, particularly from the perspective of economic globalisation is notably the most profound and debated issues that have a ubiquitous influence on the environment and energy consumption. In the last two decades, the economic globalisation debate has evolved dramatically between developed and developing nations. During the early 2000s, rising concerns on the implications of multi-lateral trade and investment agreements on the environment and energy consumption trends have been prevailing in emerging and developing economies. According to Stiglitz (2017b), the distributional impact of economic policies attributed to trade and financial liberalisation initiatives have led to greater environmental constraints evidenced by demographic pressures and rapidly evolving technological frontiers across the globe. As such, to ensure the successful implementation of the United Nation's 2030 Agenda, which encompasses 17 Sustainable Development Goals (SDGs) and 169 specific targets, it is crucial for nations across the globe to collaborate effectively by undertaking transformative measures geared towards sustainable economic development. With the implementation of effective and sustainable trade and financial globalisation policies, mitigating climate change and unsustainable energy consumption trends could be resolved particularly for emerging and developing nations.

Several notable scholars (Rodrik, 2018; Stiglitz, 2017b) have been apprehensive towards the notion of economic globalisation. As nations become forthcoming towards market integration, inexorably, a specific degree of democratic self-determination will be compromised, attributed to the forced compliance of international trade rules and institutions. As stipulated by Rodrik (2011), the globalisation paradox has allowed multilateral institutions to attain greater discretion, as the allocation of power is usually skewed towards the interest of developed nations. However, the signing of the Paris Accord in 2015, indicates that world leaders are capable to collaborate effectively towards combating climate change. The Paris Climate Agreement encourages and enforces nationally determined targets via peer monitoring from the international community, that is subject to voluntary adjustments and periodic peer reviews.

Another prevailing issue pertaining to environmental studies is attributed to the bias reporting that are closely aligned with natural sciences that merely includes elements of objectivity and replication. However, to address the existential environmental crisis, integrating economic sustainability policies is necessary to resolve these predicaments and advocating sustainable adaptation practices. To assess the globalisation-environment-energy consumption paradigm, this study examines the impact of globalisation, based on the segregated measures of trade globalisation and financial globalisation de facto and de jure indexes to investigate its impact on environmental degradation, environmental sustainability and energy consumption.

The trade globalisation de facto index encompasses the sum of exports and imports in goods and services as a share of gross domestic product. Furthermore, to encapsulate the geographical distribution of trade, the trade-partner diversification value was incorporated in the index. With respect to the trade globalisation de jure index, the variables that elucidate trade regulations, trade taxes and tariff rates have been incorporated into the index. The financial globalisation de facto index includes variables pertaining to foreign direct investment, portfolio investments, international debt and income payments and international reserves. For the financial globalisation de jure index, the variables include investment restriction and capital account openness of the assessed nations. For this study, the globalisation-environment-energy consumption paradigm is assessed based on the scale, technique and composition effects that arise from the impact of globalisation (You & Lv, 2018).

From the scale effect perspective, foreign trade and investments, within the ceteris paribus condition, are likely to invest in carbon-emitting production facilities to boost economic growth in these nations. The scale effect prevails in economies that have focused on increased production and extraction of natural resources to attain economic progress which inevitability affected environmental quality and the ecosystem. By promoting the growth of pollution-emitting industries, leads to the degradation of the environment and environmental sustainability will be compromised to pursue economic prosperity. If nations merely focused on the economic growth opportunities whilst ignoring their effects on the environment, this predicament is referred to as the composition effect. From the perspective of the composition effect, economic globalisation policies that encouraged the growth of energy-intensive and manufacturing sectors as opposed to environmentally-friendly or service-oriented sectors that focused on sustainable infrastructures also contributed to the rise in carbon emissions and ecological footprints. The shifts in production patterns were instrumental in advocating sustainable consumption patterns amongst consumers to minimise environmental degradation and preserve environmental sustainability.

Although several notable works of literature have indicated that the scale and composition effect of globalisation has affected the environment, the technique effect has been prevalent in certain emerging and developed panel of nations. If the technique effect is evident, nations executing sustainable trade and financial globalisation policies are focused towards adopting cleaner production technologies, developing the growth of renewable energy and improving the ecosystem services for the well-being of mankind for the long-term. Conversely, with the deployment of new technologies and production methods that focuses on mitigating the environmental crisis and advocating sustainable energy consumption trends, this implies the technique effect of globalisation is prevalent within that income panel. To sustain and enhance economic progress across the globe, the implementation of effective globalisation policies are important to adequately expand commercially viable clean or renewable energy sources through varied technological advancements. As such, if the scale effect or composition effect dominates the technique effect, the coefficients would be positive for both, the trade and financial globalisation (de facto) and (de jure) measurement indexes. However, if the technique effect dominates the scale and composition effect,

the coefficients would be negative with respect to the trade and financial globalisation indexes (Ding et al., 2018; Shahbaz et al., 2016b).

Prior literature that has utilised globalisation indexes to assess its impact on the environment and energy consumption (Ding et al., 2018; Lim et al., 2015) have combined both the de facto and de jure measures of economic globalisation as a single index. Intrinsically, the examination on the impact of economic globalisation would be distorted (Dreher et al., 2010; Martens et al., 2015) on issues pertaining to the environment and energy consumption. Furthermore, incorporating economic globalisation indexes, such as trade globalisation and financial globalisation, from both the de facto and de jure basis enables flexible aggregation of varied dimensions and characteristics of economic globalisation (Gygli et al., 2018). The segregation of de facto and de jure measures of trade and financial globalisation could potentially attest to be valuable towards addressing issues surrounding environmental quality and sustainability for policymakers. Furthermore, economic globalisation policies that advocate energy-efficient technologies and development of renewable energy would be instrumental in minimising environmental degradation, preserving the environment and maximise ecological reserves in the long-run. As such, this study could potentially shed some light for policymakers and concur with the existing literature that determining the de facto and de jure measures separately are necessary to avoid biased conclusions pertaining to the globalisation-environment-energy consumption paradigm.

Economic breakthroughs and international collaborations are pertinent to resolve the existential environmental threats that are prevalent across the globe. To achieve the established goal of ensuring a maximum increase of 2° Celsius global temperature prior to 2030, a universal economic framework is pertinent to accelerate initiatives to minimise environmental degradation, achieve environmental sustainability and the propagation of advocating less energy-intensive and low carbon economies. A new phase of international climate change collaborations through sustainable trade and financial globalisation policies should compel governments, economic institutions and policymakers across the globe to cut through the Gordian knot of climate change dilemmas threatening the ecosystem of the planet. Although the Paris Accord in 2015 was developed upon attaining the input from the scientific community and environmental agencies and ministries globally, its successful implementation is dependent upon engaging economic ministries, as well as the business and financial communities (Samans, 2018).

The formulation and execution of sustainable trade and financial globalisation policies would enable environmental economists and policymakers to align policy incentives to achieve greater economies of scale and reduce transaction costs for producers. With the incorporation of sustainable and integrated trade and financial globalisation policies, business and investing communities would be encouraged to shift production processes and consumption patterns by creating affordable low-carbon goods and services globally. The rise in climate-related economic collaborations such as World Trade Organisation (WTO) Environmental Goods negotiations, Carbon Pricing

Leadership Coalition and the Financial Stability Board Task Force on Climate-Related Financial Disclosures, demonstrates the pertinence of executing economically viable climate change initiatives to attain environmental sustainability. As one of the largest funding entities for renewable energy and energy-efficient projects, particularly for developing and middle-income nations, the World Bank Group (WBG) has provided USD$9.5 billion in financing for these projects. Furthermore, WBG has also committed to discontinuing funding for upstream oil and gas investments after 2019, to address the wrath of climate change (World Bank, 2018).

With accelerated and collaborative efforts by The World Bank and the United Nations Framework Convention on Climate Change (UNFCC), nations across the globe are expected to achieve their respective national goals, in accordance to the Paris Agreement on climate change. In a recent announcement by the WBG, climate-related financing and lending volumes reached 32.1 per cent, surpassing its original target of 28 per cent set in 2015, which amounted to USD20.5 billion. As such, the need for current trade and financial globalisation policies to incorporate initiatives for mobilising clean energy, building climate-resilient transport systems, and providing climate information such as early warning systems to address natural disasters such as tsunamis and hurricanes, is necessary to protect the ecosystem. By supplementing the architecture of economic globalisation policies to mitigate climate change in this manner, the targeted goals pertaining to sustainable development elucidated through the Paris Agreement could potentially be realised before 2030.

The present atmosphere pertaining to climate change revolves environmentalists and world leaders confronting the challenging realities and opportunities of this planet's high-energy future. Global energy consumption is expected to double or triple over the next century, as millions would gravitate towards urbanisation. This invariably necessitates the importance to produce and adopt cleaner and cost-effective energy solutions. By successfully dealing with environmental challenges, the world could be more prosperous, with low-carbon cities, and executing technologies capable of decoupling human well-being from ecological impacts. To achieve these objectives, environmentalists, economists and world leaders need the ingenuity and drive to collaborate effectively to create a world that is vastly better than our Holocene ancestors (Breakthrough Institute, 2014). The pertinence of energy efficiency as the key to global climate mitigation has been proven by varied research studies and academic papers (Akizu-Gardoki et al., 2018; Fossati et al., 2016; Moreau & Vuille, 2018). Radical energy efficiency improvements would be conceivable to achieve ambitious emissions reduction targets, allowing for new low-carbon energy generation technologies to plausibly bridge the gaps.

Prior works of literature (Shahbaz et al., 2015a; Shahbaz et al., 2018d; Shahbaz et al., 2016b) have adopted the initial KOF Index by (Dreher, 2006; Dreher et al., 2008a) to examine the impact of globalisation on environmental degradation, environmental sustainability and energy consumption. The initial globalisation and economic globalisation indexes comprised variables that merged measurements pertaining to international trade, foreign direct investment, import barriers, tariff rate taxes on

international trade and capital restrictions. As such, identifying the actual impact of globalisation on the environment and energy consumption proved futile, unlike the potential findings from our study.

Furthermore, literature on environmental impacts and energy consumption arising from the impact of economic globalisation are on individual nations (Arce et al., 2016; Raza et al., 2015; Shahbaz et al., 2017a; Shahbaz et al., 2015a) or cross-country comparisons which are pooled collectively (Koengkan, 2018; You & Lv, 2018) at differing degrees of economic progress and growth. As findings obtained by examining the impact of economic globalisation on environmental degradation, environmental sustainability and energy consumption may be geared towards implementing policies for these individual nations, these results may be constrained by limited observations that fail to capture time-invariant factors that affect environmental studies and rising energy demand trends (Ibrahim & Law, 2014). As our study would be further segregated into the low and low-middle income (LLMI) and the upper-middle-income and high income (UMIHI) panels, issues arising from investigating a heterogeneous global sample are minimised, particularly to address issues arising from spurious regressions and examining individual-specific effects within a pooled sample (Ibrahim, 2018). Furthermore, collaborative efforts to address environmental complexities within these panels may be feasible to formulate coordinated policy responses towards combating this crisis.

To forge ahead sustainably, it is pertinent to analyse the impact of existing trade and financial globalisation policies on environmental degradation, environmental sustainability and energy consumption from a global perspective. The findings derived from this study would enable government leaders, environmental policymakers and industry players to acknowledge the relevance of advocating sustainable trade and financial globalisation policies to address the existential environmental crisis. As such, this study motivates a greater need for nations across the globe to reflect on executing sustainable economic globalisation policies to address climate change in the near future.

1.2 Trend Analysis of Economic Globalisation

The impact of economic globalisation on the environment and energy consumption has been a contentious issue over the last two decades and has garnered interest amongst varied environmental and energy economists, scholars and researchers. The tenets of economic globalisation have dominated and influenced policy developments pertaining to the environment. As such, executing non-conducive policy interventions that adopt unsustainable energy consumption trends would lead to further degradation of the environment and threatens environmental sustainability. By analysing the data on the impact of economic globalisation to address the wrath of the present environmental crisis, policymakers and governments would be able to gauge the trends and patterns arising from this study. Natural disasters such as the tsunami and earthquake in Sulawesi, Indonesia and Super Typhoon Mangkhut affecting Guam, Marshall Islands, the Philippines, and southern China on September 2018, indicates

the pertinence for global collaborative efforts to address issues arising from the environmental crisis through global concerted efforts and collaborations.

This study will analyse the impact of economic globalisation on environmental degradation, environmental sustainability and energy consumption for three income panels, grouped into the full panel, lower and lower-middle-income (LLMI) panel and the upper-middle-income and high income (UMIHI) panels. The first research objective investigates the impact of globalisation, from the perspective of economic globalisation on environmental degradation based on a full sample of 143 countries. The full sample is further segregated into two income groups, namely, the (LLMI) sample comprising 63 countries and the upper-middle-income and high income (UMIHI) sample consisting of 80 countries. The list of countries examined is illustrated in Appendix 1. For the second and third research objective, the impact of globalisation, from the perspective of segregated economic globalisation indexes are examined on environmental sustainability (utilising ecological footprint consumption per capita) and energy consumption based on a full sample of 137 countries respectively. The full panel will be further segregated between two income levels, i.e. the (LLMI) sample comprising 62 countries and the upper-middle-income, and high income (UMIHI) sample which consists 75 countries for both research objectives. Details on the list of countries for the second and third research objectives will be exhibited in Appendix 2.

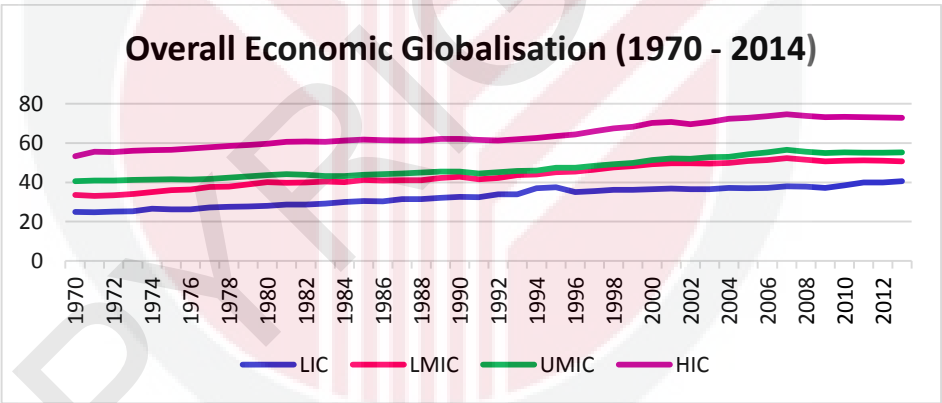

Figure 1.1: Economic Globalisation (Overall Index) for differing Income Levels
Source: The KOF Globalisation Index (2018) – Revisited, KOF Working Paper, No. 439. Accessed on 21st May 2018 at: https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html
Note: LIC – Lower-Income Countries; LMIC – Lower-Middle-Income Countries; UMIC – Upper-Middle-Income Countries; HIC – High-Income Countries.

As illustrated in Figure 1.1, the trends pertaining to the overall economic globalisation index indicates the vast difference between the degrees of economic liberalisation and restrictive policies between the varied income levels. The graphs indicate that the levels of economic globalisation are greater amongst the upper-middle-income and high-income nations compared to the low and lower-middle-income nations.

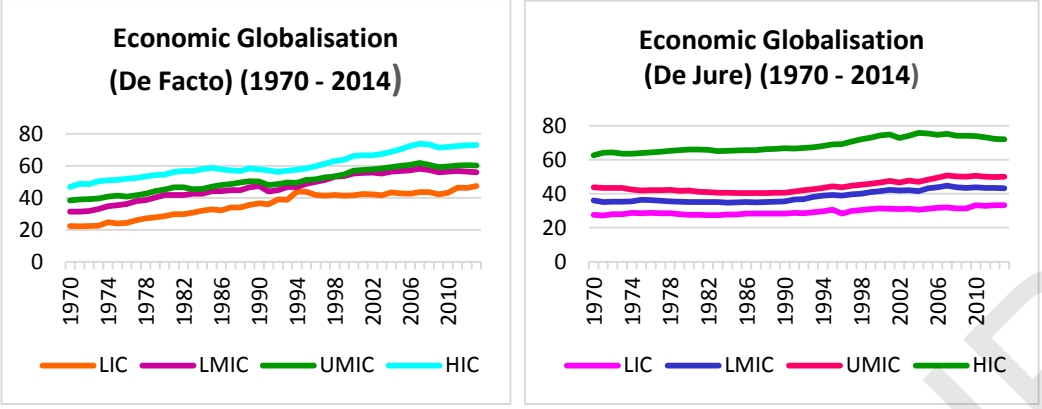

Figure 1.2: Economic Globalisation (Segregated Indexes) for differing Income Levels

Source: The KOF Globalisation Index (2018) – Revisited, KOF Working Paper, No. 439. Accessed on 21st May 2018 at: https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html

Note: LIC – Lower-Income Countries; LMIC – Lower-Middle-Income Countries; UMIC – Upper-Middle-Income Countries; HIC – High-Income Countries.

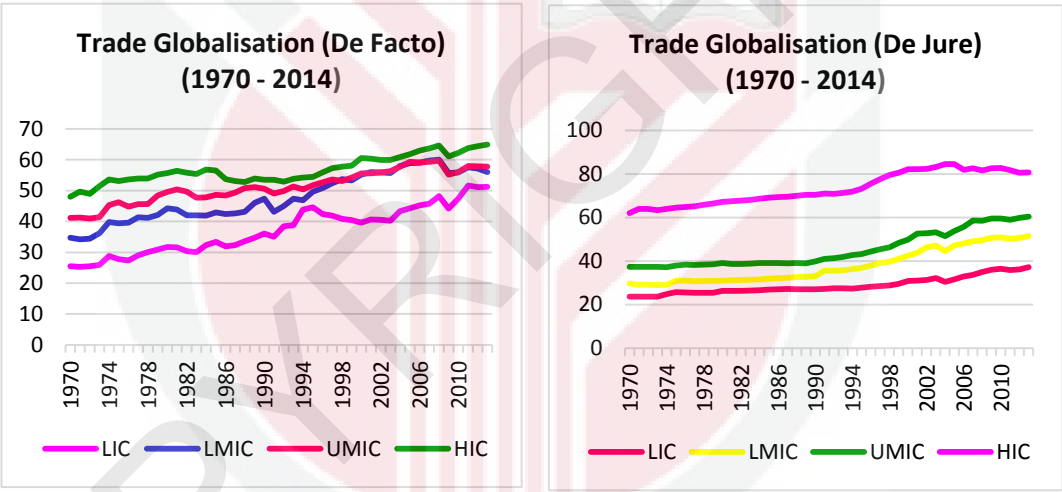

Figure 1.3: Trade Globalisation (Segregated Indexes) for differing Income Levels

Source: The KOF Globalisation Index (2018) – Revisited, KOF Working Paper, No. 439. Accessed on 21st May 2018 at: https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html

Note: LIC – Lower-Income Countries; LMIC – Lower-Middle-Income Countries; UMIC – Upper-Middle-Income Countries; HIC – High-Income Countries.

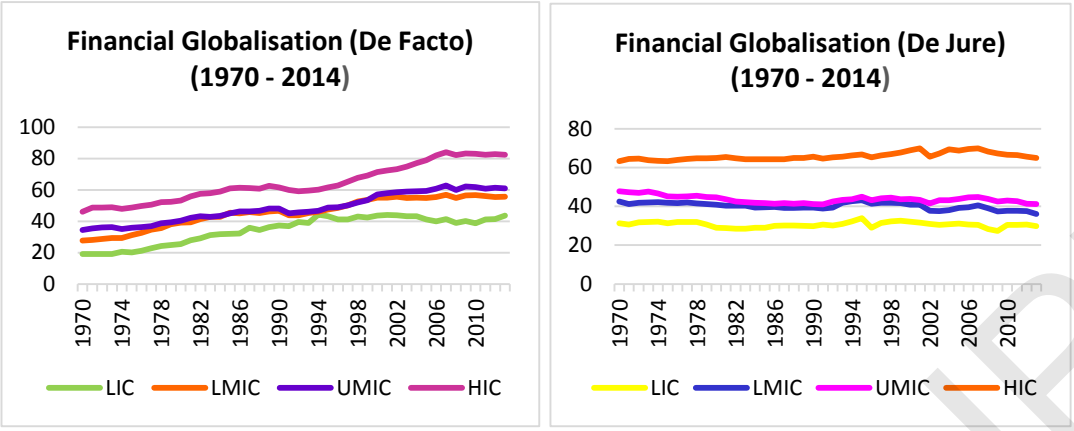

Figure 1.4: Financial Globalisation (Segregated Indexes) for differing Income Levels

Source: The KOF Globalisation Index (2018) – Revisited, KOF Working Paper, No. 439. Accessed on 21st May 2018 at: https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html

Note: LIC – Lower-Income Countries; LMIC – Lower-Middle-Income Countries; UMIC – Upper-Middle-Income Countries; HIC – High-Income Countries.

Upon segregating the nations based on the World Bank Income Classification of 2017, Figure 1.2 to Figure 1.4 demonstrates the trend of the segregated economic globalisation indexes, trade globalisation and financial globalisation indexes. The graphs illustrate that high-income and upper-middle-income nations are more globalised compared to nations from the low and lower-middle-income panels. Based on Figure 1.2, the economic globalisation (de facto) index is considerably higher across all the income panels compared to the economic globalisation (de jure) index. Upon segregating the economic globalisation further into trade globalisation and financial globalisation indexes, varying trends are evident between these indexes. Based on Figure 1.3, the increasing trade globalisation (de facto) index, exhibits that trade liberalisations policies have been on the rise since the mid-1990s, as more nations participated in varied multi-lateral trade collaborations to pursue economic growth. The index also indicates export and import structures have possibly become globally oriented by the mid-2000s, as opposed to merely focusing on regional trade collaborations to attain economic development. However, from the perspective of the trade globalisation (de jure) index, a huge disparity is evident between the higher income panels, compared to other income panels.

From the perspective of financial globalisation, as exhibited in Figure 1.4, the financial globalisation (de facto) index indicates that financial liberalisation policies are more relaxed and deregulated within the higher income panel. Although, during the 1990s, a rising trend was evident, during the global financial crisis between 2008 – 2010, the flow of capital into these nations decreased during these years. Although an increasing trend is pervasive across the financial globalisation (de facto) index from 1970 to 2014, the financial globalisation (de jure) index has remained modest across all the income panels. As evidenced between Figure 1.2 to Figure 1.4, the varying trends between the de facto and de jure measures of economic globalisation demonstrate the need to

examine these indexes on a segregated basis prior to formulating effective economic globalisation policies to address the present environmental crisis.

1.3 Global Trends on the Economic Globalisation-Environment Paradigm

The global agenda of minimising environmental degradation and preserving environmental sustainability have garnered interests amongst scholars and researchers to ensure executed globalisation policies would facilitate sustainable economic development. The notion of cross-border technological diffusion to increase productivity across all income panels is pertinent to mitigate the present environmental crisis and maintain the global temperature at 1.5°C by 2030. This initiative would be in tandem with achieving the 17 Sustainable Development Goals (SDGs) outlined by the United Nations.

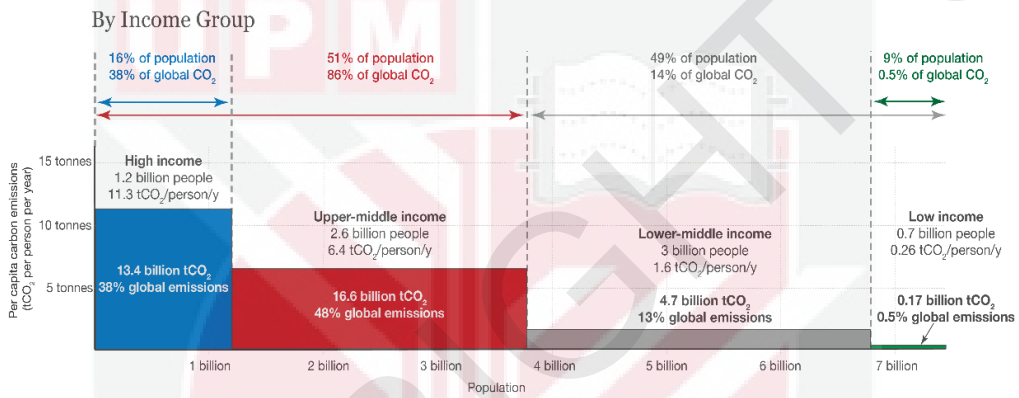

Figure 1.5: Carbon Emissions Per Capita for Differing Income Panels

Source: Adapted from World Bank (2018), Global Carbon Project. Assessed on 10th November 2019.

Figure 1.5 exhibits that the upper-middle-income and high income nations emit 86 per cent of global carbon emissions. The low and lower-middle-income nations contribute only about 14.5 per cent of the total emissions. This graph illustrates a strong indication pertaining to the relative sensitivity of environmental degradation to income structures as opposed to the total population. To assess environmental sustainability, the ecological footprint is investigated as it encompasses a more inclusive variable that measures the total biologically productive land and water that is utilised by mankind to produce all the resources that are consumed via industrial and economic activities. Furthermore, the ecological footprint measurement also entails the capacity of the biosphere to absorb the waste it generates by adopting clean technology expertise and sustainable resource management practices (GFN, 2018). The Ecological Footprint of Consumption (EFC) is the commonly reported value to assess environmental sustainability as the value illustrates the total consumption of a nation based on Earth's 12.2 billion hectares of biologically productive land and water areas that encompasses the utilisation of cropland, forestland, grazing land, fishing grounds, built-up land and carbon footprint. By assessing environmental sustainability utilising the ecological footprint of consumption variable would provide a holistic view of the ecological reserves that are presently available within the ecosystem of this planet.

Based on the findings from GFN (2018), based on current population levels, the resources consumed by each individual should not exceed 1.6 global hectares of biologically productive surface area per individual. As such, for nations to reach the Global Sustainable Development Quadrant (GSDQ) indicated in Figure 1.6, the average ecological footprint per person needs to fall significantly below this threshold to accommodate the rising growth in population, to enable wild species to thrive and to preserve 86% of the world's biodiversity in the future (GFN, 2018). The GSDQ was introduced by (Boutaud, 2002) refers to a nation's ability to satisfy its socio-economic developments from the perspective of an increased life expectancy, improved education systems and increased economic progress whilst preserving the ecological reserves of the planet to achieve sustainable development. As demonstrated in Figure 1.6, only a selected few nations have succeeded in reaching the Global Sustainable Development Quadrant. This clearly demonstrates that initiatives towards attaining sustainable development have to be accelerated amongst nations across the globe.

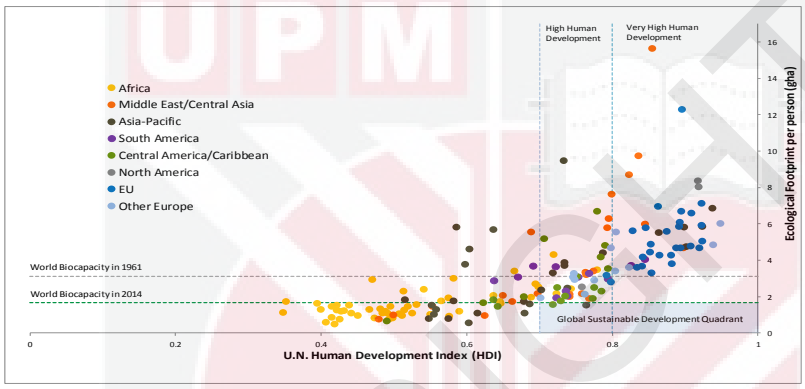

Figure 1.6: Ecological Footprint and Human Development Index by Regions

Source: Adapted from National Footprint Accounts 2018 Edition, Global Footprint Network. Assessed on 20th June 2018.

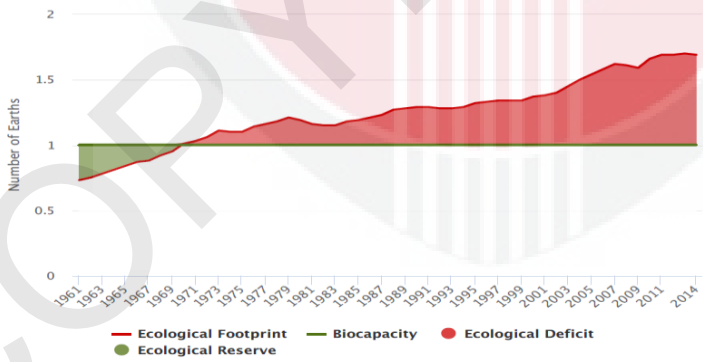

Figure 1.7: Ecological Footprints (Number of Earths) – Global Outlook

Source: National Footprint Accounts 2018 Edition, Global Footprint Network. Assessed on 15th June 2018 at https://www.footprintnetwork.org/licenses/public-data-package-free-2018/

As illustrated in Figure 1.7, it is evident that environmental sustainability is threatened as the ecological reserves have been on deficit since the early 1970s and the ecological overshoot is increasing at unsustainable levels. As the ecological footprint of a

population exceeds the biocapacity that is available to that population, ecological deficit prevails within that nation. If nations import biocapacity through globalisation, particularly through trade, liquidating national ecological endowments or emitting carbon emissions waste into the atmosphere to cater to the population's demands, this predicament illustrates that the nations are experiencing ecological deficits. Conversely, ecological reserves are prevalent if the biocapacity of the nation exceeds the requirement of the population's ecological footprint. Biocapacity refers to the productive land that is available to produce resources for the population's consumption needs, the ability for these lands to regenerate resources to accommodate to rising human demand and the capacity for these lands to absorb carbon emissions waste, based on current environmental management practices (GFN, 2018).

Presently, the world is consuming more than 1.7 of Earth's existing resources, which demonstrates that mankind has consumed 0.7 times more of the available natural resources of Earth's actual capacity to cater to the consumption demands of the human population. With continued usage of non-renewable energy amongst nations to achieve economic development, the 'ecological overshoot' predicament will persist and exceed the capacity of the ecosystem to regenerate its consumed resources and absorption of wastes (GFN, 2018). The ecological overshoot predicament illustrates that humanity's demand for ecological resources has exceeded Earth's ability to regenerate resources and are forced to liquidate stocks of ecological resources to resolve this environmental crisis.

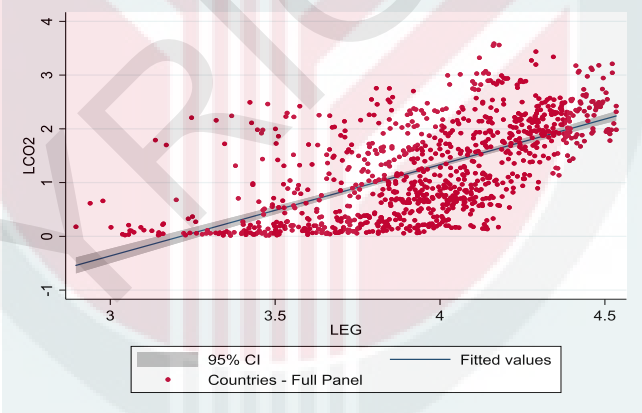

Figure 1.8: The Impact of Economic Globalisation (Overall Index) on Environmental Degradation (Full Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LEG – Log (Economic Globalisation).

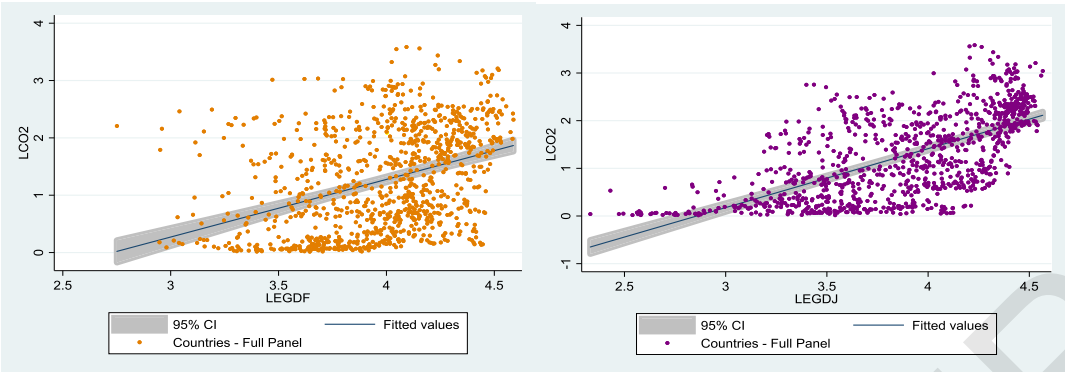

Figure 1.9: The Impact of Economic Globalisation (Segregated Indexes) on Environmental Degradation (Full Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LEGDF – Log (Economic Globalisation De Facto); LEGDJ – Log (Economic Globaliasation De Jure).

As illustrated in Figure 1.8 and Figure 1.9, the differing impacts of economic globalisation between the overall index, de facto index and de jure index on environmental degradation validates the rationale to assess its impact based on its segregated indexes. These trends further affirm with (Figge & Martens, 2014; Martens et al., 2015) that propagated the justification of examining economic globalisation policies from a segregated perspective.

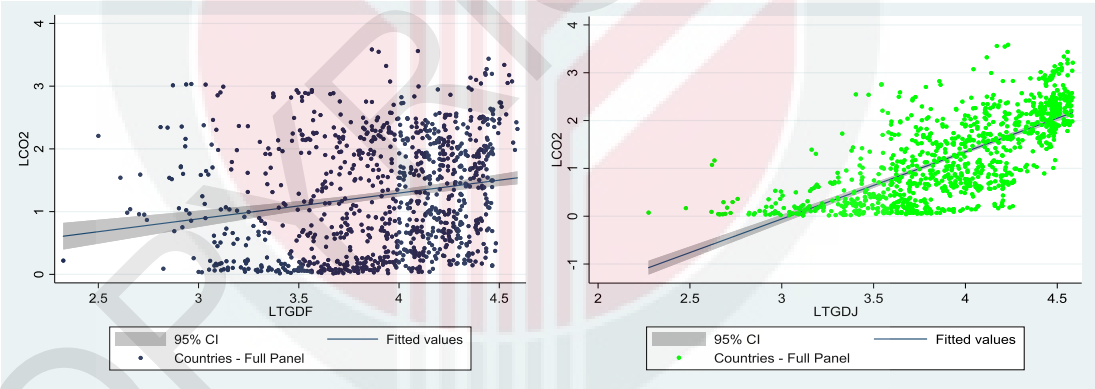

Figure 1.10: The Impact of Trade Globalisation (Segregated Indexes) on Environmental Degradation (Full Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LTGDF – Log (Trade Globalisation De Facto); LTGDJ – Log (Trade Globaliasation De Jure).

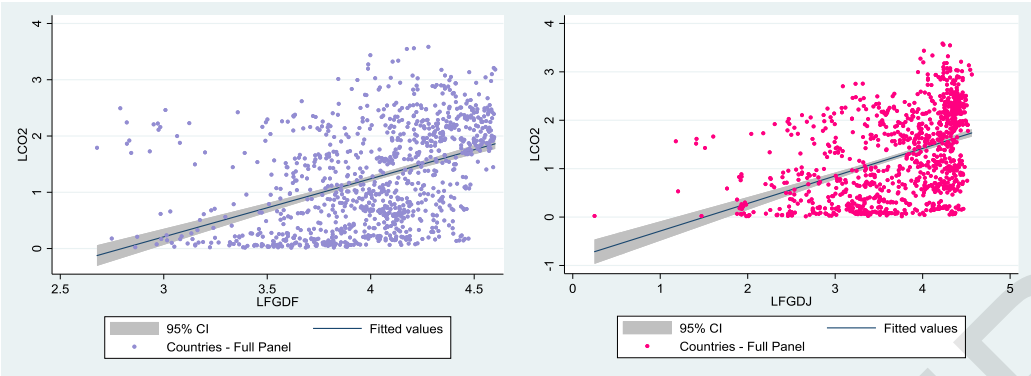

Figure 1.11: The Impact of Financial Globalisation (Segregated Indexes) on Environmental Degradation (Full Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LFGDF – Log (Financial Globalisation De Facto); LFGDJ – Log (Financial Globaliasation De Jure).

As depicted in Figure 1.10 and Figure 1,11, the varying trends of the segregated trade and financial globalisation indexes highlight the need to examine in greater depth on the impact of present globalisation initiatives on environmental degradation.

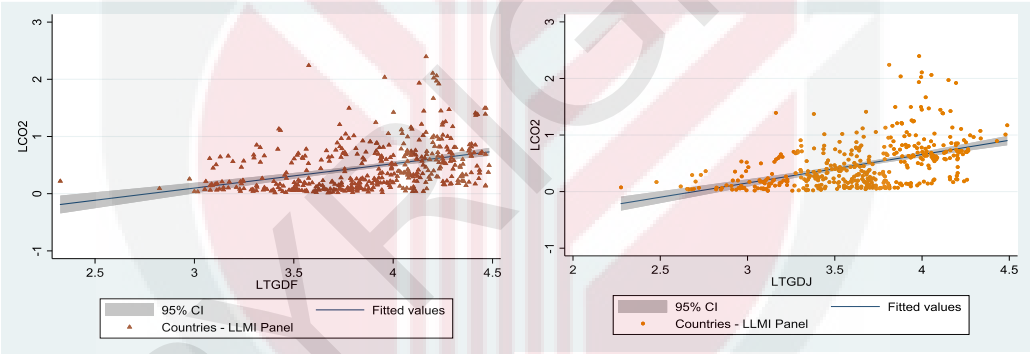

Figure 1.12: The Impact of Trade Globalisation (Segregated Indexes) on Environmental Degradation (LLMI Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LTGDF – Log (Trade Globalisation De Facto); LTGDJ – Log (Trade Globaliasation De Jure).

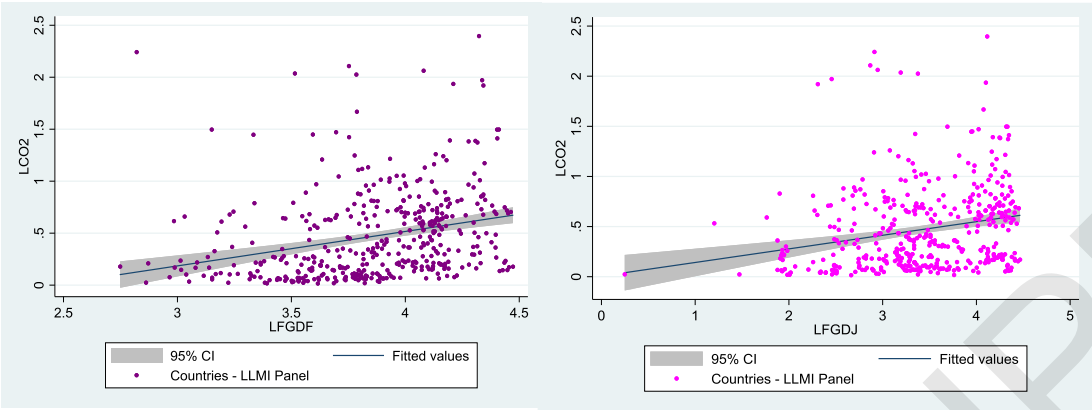

Figure 1.13: The Impact of Financial Globalisation (Segregated Indexes) on Environmental Degradation (LLMI Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LFGDF – Log (Financial Globalisation De Facto); LFGDJ – Log (Financial Globaliasation De Jure).

From Figure 1.12 to Figure 1.15, a clear distinction between the segregated trade and financial globalisation policies is difficult to be determined, although similarities can be drawn from the perspective of the trade and financial globalisation (de jure) indexes. These trends warrant the need to investigate the impact of executing effective economic globalisation policies, for both the UMIHI and LLMI panel to minimise environmental degradation.

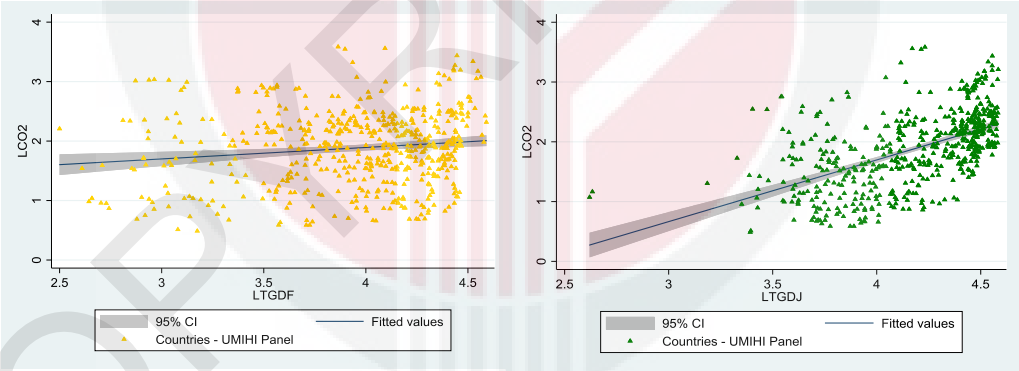

Figure 1.14: The Impact of Trade Globalisation (Segregated Indexes) on Environmental Degradation (UMIHI Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LTGDF – Log (Trade Globalisation De Facto); LTGDJ – Log (Trade Globaliasation De Jure).

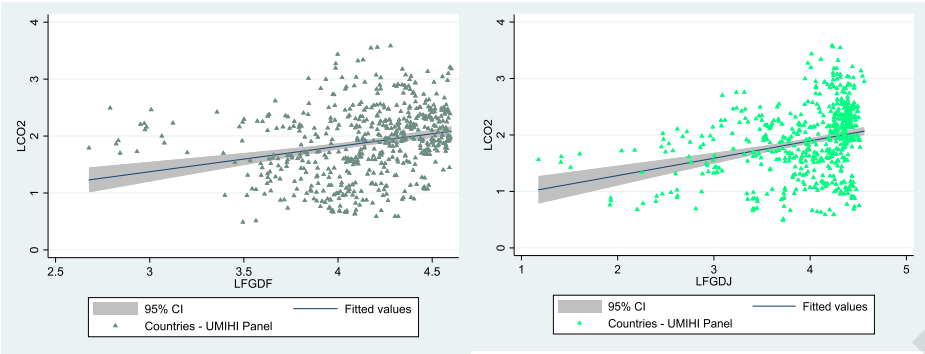

Figure 1.15: The Impact of Financial Globalisation (Segregated Indexes) on Environmental Degradation (UMIHI Panel)

Source: World Bank (2018), World Development Indicators 2018; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LCO2 – Log (Carbon Emissions Per Capita); LFGDF – Log (Financial Globalisation De Facto); LFGDJ – Log (Financial Globaliasation De Jure).

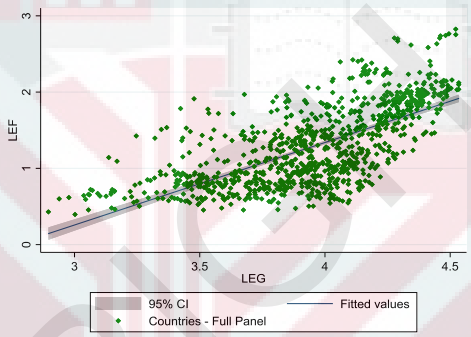

Figure 1.16: The Impact of Economic Globalisation (Overall Index) on Environmental Sustainability

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LEG – Log (Economic Globalisation)

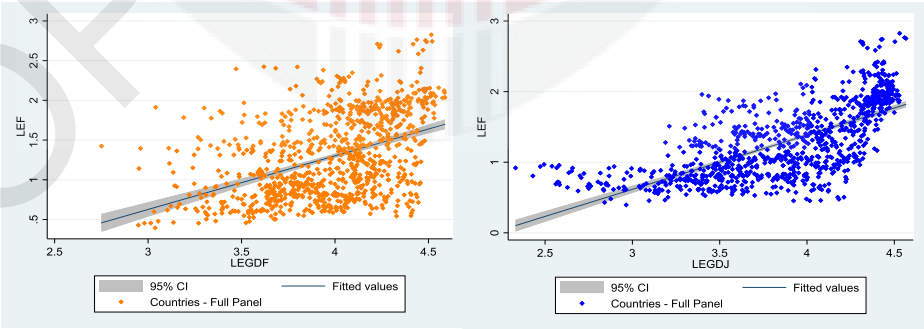

Figure 1.17: The Impact of Economic Globalisation (Segregated Indexes) on Environmental Sustainability (Full Panel)

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LEGDF – Log (Economic Globalisation De Facto); LEGDJ – Log (Economic Globaliasation De Jure).

By investigating the impact of segregated economic globalisation policies on environmental sustainability as depicted in Figure 1.16 and Figure 1.17, the derived findings could shed light for governments and industry players to formulate and execute policies that would promote sustainable development. Furthermore, the issue of declining ecological reserves that is currently pervading across the globe can be minimised to preserve environmental sustainability.

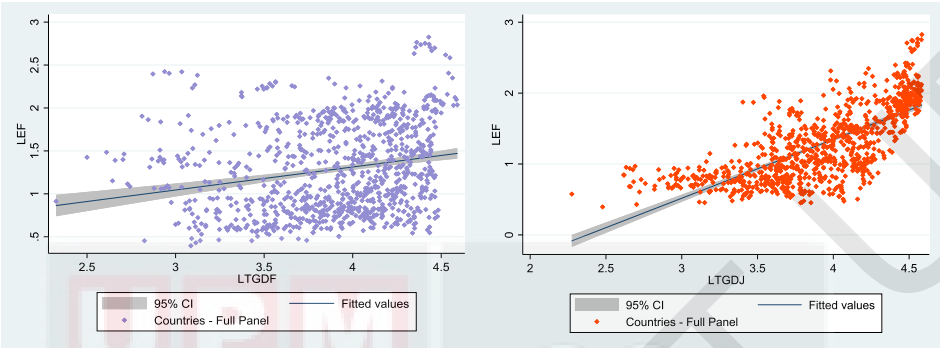

Figure 1.18: The Impact of Trade Globalisation (Segregated Indexes) on Environmental Sustainability (Full Panel)

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LTGDF – Log (Trade Globalisation De Facto);
LTGDJ – Log (Trade Globaliasation De Jure).

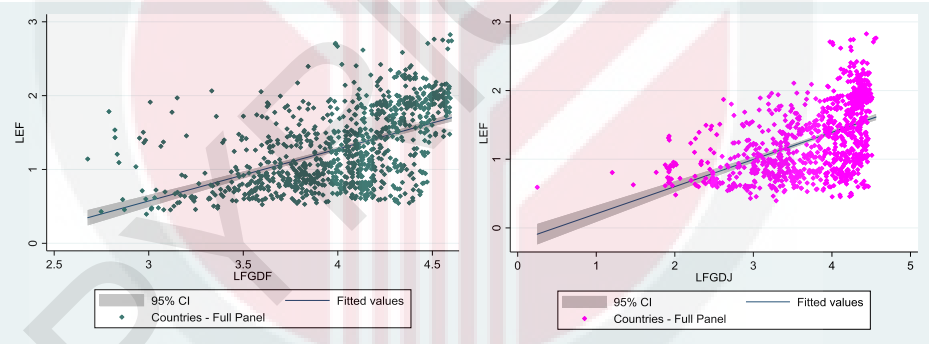

Figure 1.19: The Impact of Financial Globalisation (Segregated Indexes) on Environmental Sustainability (Full Panel)

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LFGDF – Log (Financial Globalisation De Facto);
LFGDJ – Log (Financial Globaliasation De Jure).

As illustrated in Figure 1.18 and Figure 1.19, the varying trends of the segregated trade and financial globalisation indexes highlight the need to examine in greater depth on the impact of present globalisation initiatives on environmental sustainability.

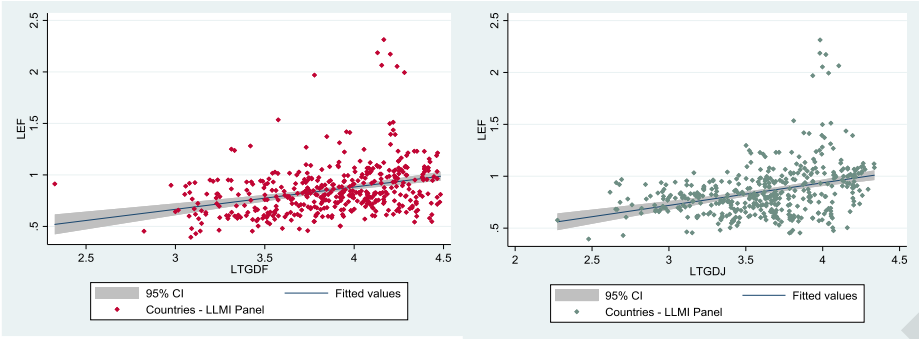

Figure 1.20: The Impact of Trade Globalisation (Segregated Indexes) on Environmental Sustainability (LLMI Panel)

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LTGDF – Log (Trade Globalisation De Facto);
LTGDJ – Log (Trade Globaliasation De Jure).

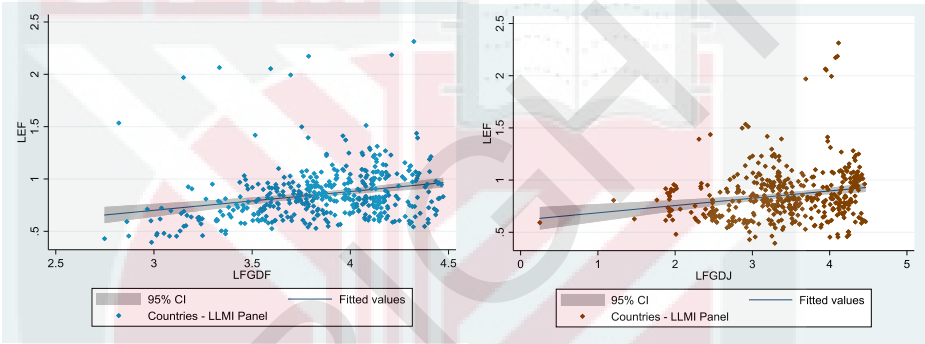

Figure 1.21: The Impact of Financial Globalisation (Segregated Indexes) on Environmental Sustainability (LLMI Panel)

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LFGDF – Log (Financial Globalisation De Facto);
LFGDJ – Log (Financial Globaliasation De Jure).

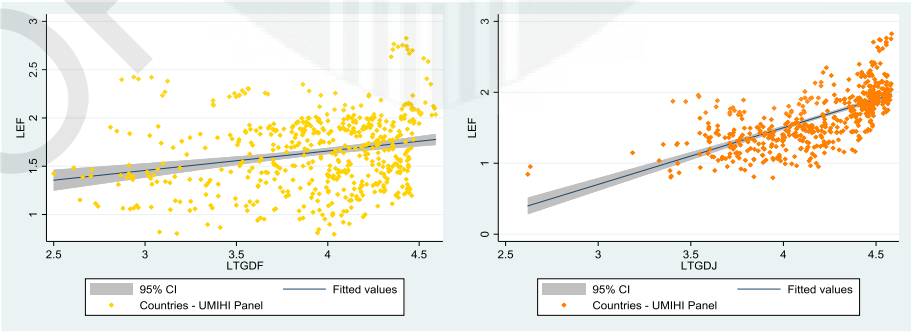

Figure 1.22: The Impact of Trade Globalisation (Segregated Indexes) on Environmental Sustainability (UMIHI Panel)

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LTGDF – Log (Trade Globalisation De Facto);
LTGDJ – Log (Trade Globaliasation De Jure).

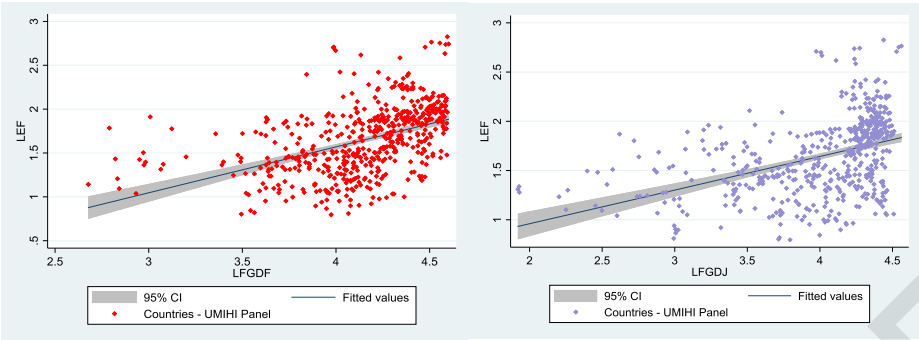

Figure 1.23: The Impact of Financial Globalisation (Segregated Indexes) on Environmental Sustainability (UMIHI Panel)

Source: National Footprint Accounts 2018 Edition, Global Footprint Network; The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LEF – Log (Ecological Footprint); LFGDF – Log (Financial Globalisation De Facto); LFGDJ – Log (Financial Globaliasation De Jure).

As exhibited in Figure 1.20 to Figure 1.23, it is evident that the execution of trade and financial globalisation policies have been implemented in varying degrees across the LLMI and UMIHI panels. These trends necessitate the need to examine the impact of these globalisation policies, for both the UMIHI and LLMI panel to address issues pertaining to environmental sustainability amongst these nations.

1.4 Global Trends on the Economic Globalisation-Energy Consumption Paradigm

In April 2014, the Intergovernmental Panel on Climate Change (IPCC) affirmed that energy efficiency measures could potentially lead to decreases in energy demand, and invariably accelerate the reductions of carbon emissions triggered by energy efficiency measures (Pachauri et al., 2014). Although cost-effective energy efficiency technologies are beneficial to economic welfare and are worth pursuing on grounds of climate change mitigation, the execution of sustainable economic globalisation policies and their implications for the utilisation of energy efficiency as a climate change mitigation strategy remains contested. Electricity generation comprises 16 per cent of the world's total energy consumption, a figure that is anticipated to grow in the near future. As for the iron and steel sector, it is currently one of the largest industrial consumers of energy (Luke et al., 2014). The demand for new energy services and energy-intensive goods occurred in the context of rapid industrialization and growth may have been attributed by prior financial and trade liberalisation policies. Conversely, by executing effective economic globalisation policies, the introduction of more energy-efficient technologies would contribute to significant cost declines, enabling the widespread use of energy services that enhances human welfare.

In 2014, nations across the European Union (EU) established a 2030 Framework that entails the following initiatives; a 40% reduction in greenhouse gas emissions from 1990 levels, to ensure a minimum 27% share of renewable energy is adopted amongst industries and implementing clean energy technologies that lead to a 30%

improvement in energy savings (OECD, 2012). To accomplish these objectives, the European Commission (EC) proposed a reformed EU Emissions Trading Scheme (ETS), by introducing new indicators to assess the competitiveness and security of the energy system. These indicators include price differences with major trading partners, diversification of supply and formulating innovative ideas based on national plans, to develop competitive, secure, and sustainable energy solutions. Furthermore, these strategies aim to ensure stronger investor certainty, enhanced policy coherence and sustainable energy systems that cost-effectively achieve decarbonisation by 2050 (Thollander et al., 2014). As such, the pertinence of adopting economic globalisation policies that reduces demand for non-renewable energy invariably minimises environmental degradation and preserves environmental sustainability. To mitigate the present environmental crisis, comparable initiatives should be deployed across the globe.

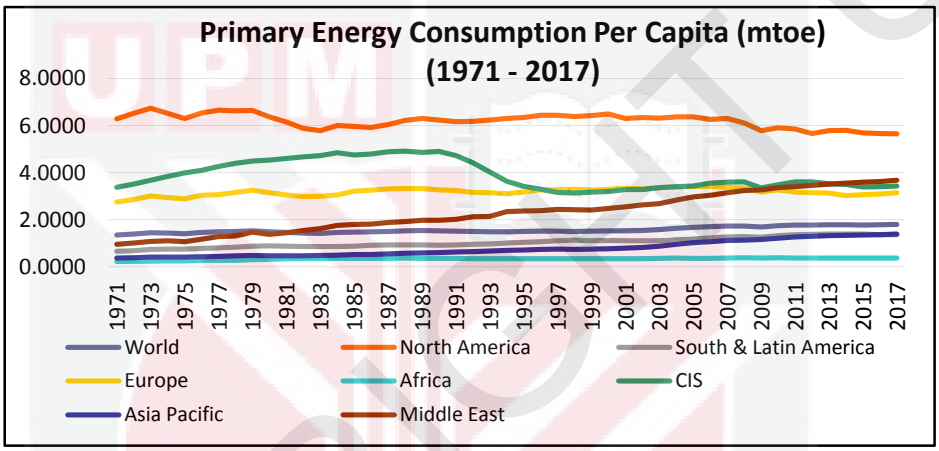

Figure 1.24: Global Outlook – Primary Energy Consumption (1970 – 2017)

Source: BP Energy Outlook – 2018 Edition. Accessed on 23rd September 2018 at https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/energy-outlook-downloads.html

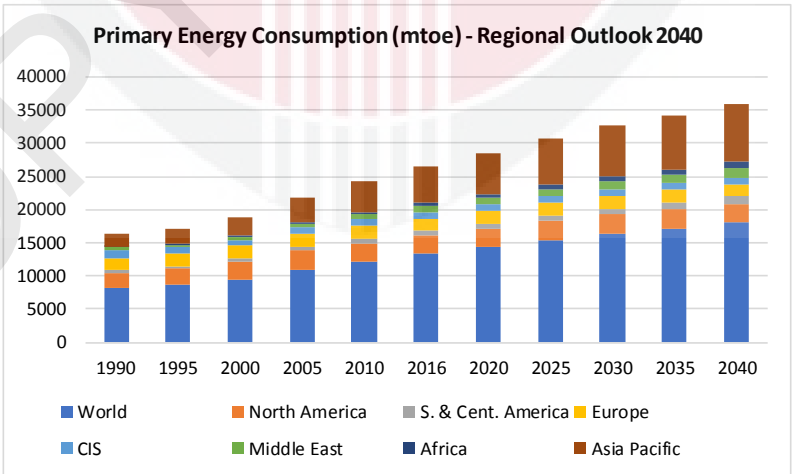

Figure 1.25: Projected Outlook – Primary Energy Consumption (1990 - 2040)

Source: BP Energy Outlook – 2018 Edition. Accessed on 23rd September 2018 at https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/energy-outlook-downloads.html

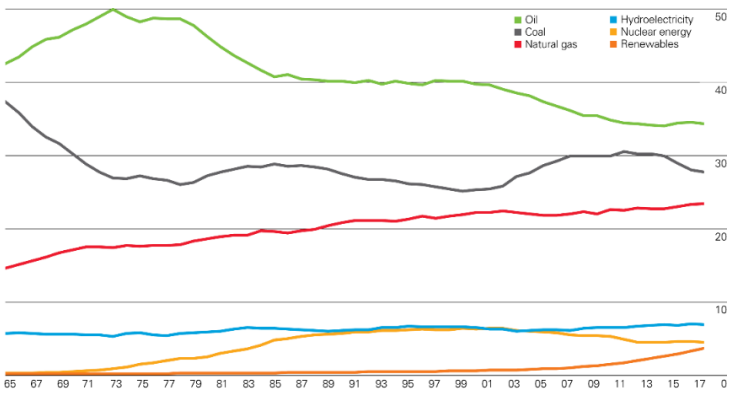

Figure 1.26: Trend on shares global primary energy consumption (Percentage) (1965 - 2017)

Source: BP Energy Outlook – 2018 Edition. Accessed on 23rd September 2018 at https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/energy-outlook-downloads.html

As projected in Figure 1.24 to Figure 1.26, increased prosperity across most regions across the globe would contribute towards increased energy demand. According to the Energy Transition (ET) scenario outlined by the British Petroleum (BP) Energy Outlook 2018, world Gross Domestic Product (GDP) is anticipated to double by 2040, as more than 2.5 billion people would be lifted from poverty.

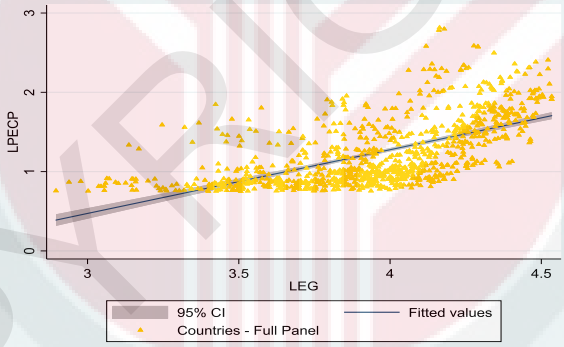

Figure 1.27: The Impact of Economic Globalisation (Overall Index) on Energy Consumption (Full Panel)

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LPECP – Log (Primary Energy Consumption Per Capita); LEG – Log (Economic Globalisation)

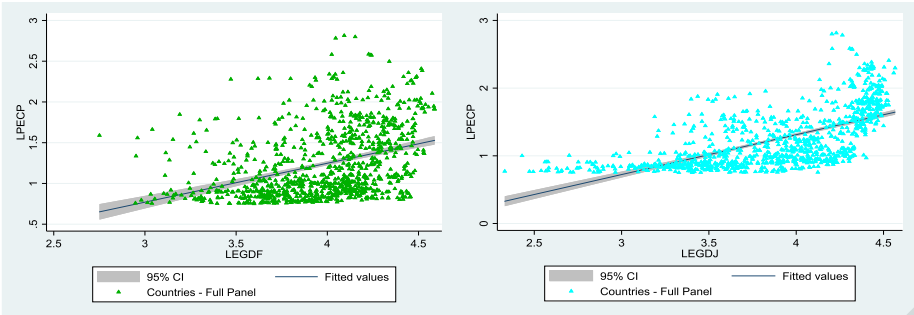

Figure 1.28: The Impact of Economic Globalisation (Segregated Indexes) on Energy Consumption (Full Panel)

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LPECP – Log (Primary Energy Consumption Per Capita); LEGDF – Log (Economic Globalisation De Facto); LEGDJ – Log (Economic Globaliasation De Jure).

By exploring the implications of economic globalisation on energy consumption as exhibited in Figure 1.27 and Figure 1.28, from the perspective of the full panel, the varying impacts between the overall indexes, de facto index and de jure index justifies the necessity to examine the impact of economic globalisation based on segregated indexes. These trends correspond with (Gygli et al., 2018) which illustrates that economic globalisation does not merely encompass trade openness, movement of capital and foreign direct investment, as stipulated by existing literature (Kurniawan & Managi, 2018; Salim et al., 2017a; Shahzad et al., 2017). As economic globalisation is a multifaceted concept, it is pertinent to examine its impact from a segregated basis to account for the varied manifestations attributed by trade and financial globalisation policies.

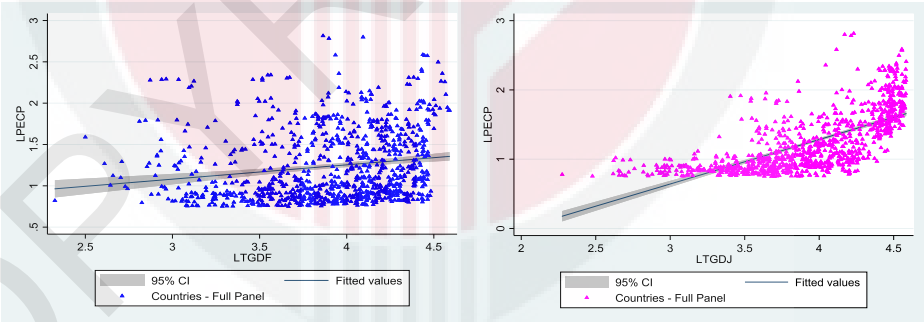

Figure 1.29: The Impact of Trade Globalisation (Segregated Indexes) on Energy Consumption (Full Panel)

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LPECP – Log (Primary Energy Consumption Per Capita); LTGDF – Log (Trade Globalisation De Facto); LTGDJ – Log (Trade Globaliasation De Jure).

The varying trends prevalent in Figure 1.29 and Figure 1.30 demonstrates the rationale for segregating economic globalisation indexes into trade and financial globalisations, to explore its' impact on energy consumption. Furthermore, balancing economic liberalisation and restrictive policies are instrumental towards curtailing rising energy demand attributed to the growth of the global population and prosperity. As such, government leaders and environmental policymakers need to continuously engage in

collaborative actions to advocate energy efficiency initiatives and developing renewable energy sources to address the rising energy demand that threatens the environment.

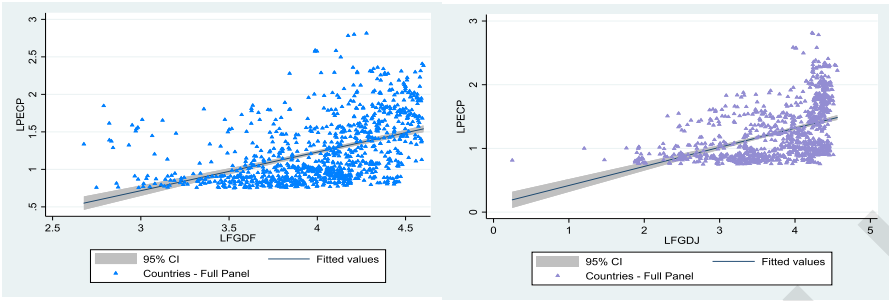

Figure 1.30: The Impact of Financial Globalisation (Segregated Indexes) on Energy Consumption (Full Panel)

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.

Note: LPECP – Log (Primary Energy Consumption Per Capita); LFGDF – Log (Financial Globalisation De Facto); LFGDJ – Log (Financial Globaliasation De Jure).

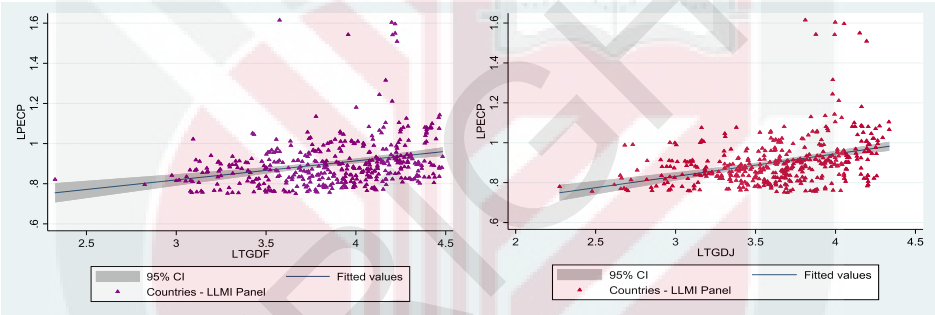

Figure 1.31: The Impact of Trade Globalisation (Segregated Indexes) on Energy Consumption (LLMI Panel)

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.

Note: LPECP – Log (Primary Energy Consumption Per Capita); LTGDF – Log (Trade Globalisation De Facto); LTGDJ – Log (Trade Globaliasation De Jure).

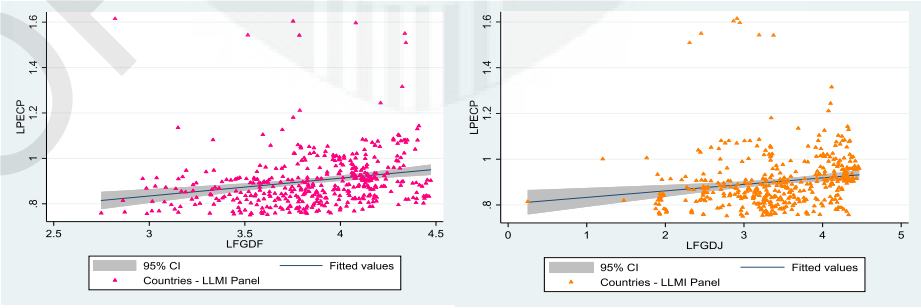

Figure 1.32: The Impact of Financial Globalisation (Segregated Indexes) on Energy Consumption (LLMI Panel)

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.

Note: LPECP – Log (Primary Energy Consumption Per Capita); LFGDF – Log (Financial Globalisation De Facto); LFGDJ – Log (Financial Globaliasation De Jure).

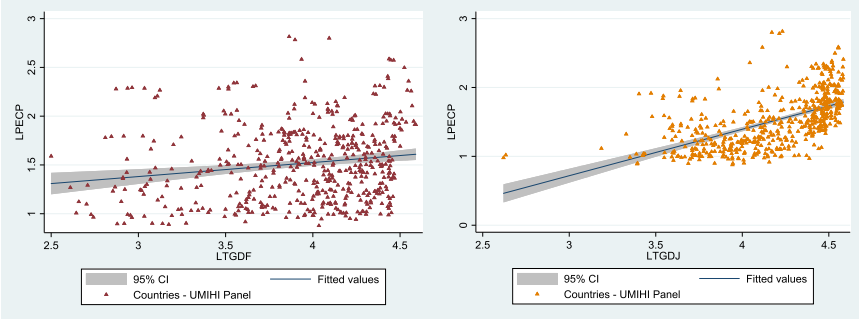

Figure 1.33: The Impact of Trade Globalisation (Segregated Indexes) on Energy Consumption (UMIHI Panel) – A Graphical Representation

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LPECP – Log (Primary Energy Consumption Per Capita); LTGDF – Log (Trade Globalisation De Facto); LTGDJ – Log (Trade Globaliasation De Jure).

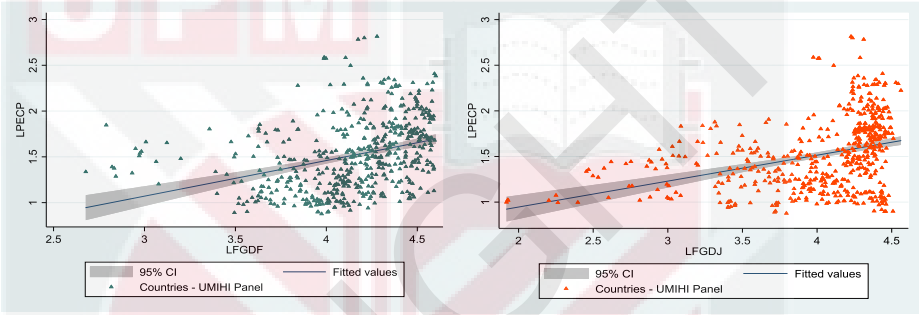

Figure 1.34: The Impact of Financial Globalisation (Segregated Indexes) on Energy Consumption (UMIHI Panel) – A Graphical Representation

Source: Enerdata Database (2018); The KOF Globalisation Index (2018) – Revisited (2018), KOF Working Paper, No. 439.
Note: LPECP – Log (Primary Energy Consumption Per Capita); LFGDF – Log (Financial Globalisation De Facto); LFGDJ – Log (Financial Globalisation De Jure).

As illustrated in Figure 1.31 to Figure 1.34, it is evident that the execution of trade and financial globalisation policies have been implemented in varying degrees across the LLMI and UMIHI panels. These divergent trends necessitate the need to examine the impact of these globalisation policies, for both the UMIHI and LLMI panel to address issues pertaining to energy consumption amongst these nations.

1.5 Problem Statement

The Earth's population is anticipated to increase from 7 billion to over 9 billion, and the world economy is forecasted to attain quadruple growth by 2050 attributed to globalisation (OECD, 2012). These trends would further lead to increased demand for energy and natural resources, as demonstrated the adoption of material resources increased from 27 billion tonnes in 1970 to 89 billion tonnes in 2017 (OECD, 2019a). As such, the implementation of integrated and coherent globalisation policies is necessary to address the present environmental crisis. As 70% of the world is forecasted to be in urbanised by 2050, challenges such as increased environmental

degradation attributed to air pollution and declining ecological reserves which threatens environmental sustainability needs to be addressed by pursuing sustainable energy consumption patterns (OECD, 2012).

As nations across the globe have pursued accelerated growth in industrialisation and economic development over the last four decades, issues pertaining to environmental degradation and environmental sustainability remains a pressing concern amongst policymakers and government leaders. Globalisation would be instrumental in setting the context for developing policies pertaining to sustainable development. The environmental impacts of globalisation are attributed to the scale effects of production and consumption processes, the structural effects arising from shifting of premises on varied economic activities and sectors, the technical effects of adopting energy-efficient technologies and product effects arising from varied energy mixes in production and consumption patterns (OECD, 2019b).

Essentially, as economic integration, trade freedom and financial liberalisation have been one of the driving forces towards attaining economic development, a renewed interest amongst environmental scholars have examined globalisation trends from the perspective of minimising environmental degradation and preserving environmental sustainability. As such, pursuing globalisation policies that focus on remedial efforts such as advocating clean energy practices in pursuit of achieving sustainable development is pertinent towards addressing the current environmental crisis. However, forces of globalisation could negate the realisation of these initiatives. With increased economic activities, pollution could potentially rise attributed to increased resource consumption. Moreover, the distributional impacts of environmental pressures would differ between income levels, attributed to available resource endowments and comparative advantages amongst these nations.

The United Nations Framework Convention on Climate Change (UNFCCC) have indicated the disparaging climate inequity arising between the developed and developing nations (Khan & Chowdhury, 2012). With globalisation, the notion of "winners" and "losers" amongst nations may arise due to the rise of social injustice, the distributional consequences of increased consumption trends and the share of global resources consumed by differing income panels. If sustainable globalisation policies are not executed, the continued degradation of the environment and the erosion of natural environmental capital which threatens environmental sustainability are expected to rise by 2050. Furthermore, the risk of changes to the environment being irreversible could potentially endanger two centuries of mankind's living standards (OECD, 2012).

Based on the data reported by the World Bank (2017), the upper-middle-income and high-income (UMIHI) nations emitted 17.45 metric tons of carbon emissions per capita in 2014. The low and lower-middle-income (LLMI) nations merely emitted 1.77 metric tons of carbon emissions per capita in 2014. Although LLMI nations emit low levels of carbon emissions, environmental degradation is anticipated to increase

poverty in these nations due to its impact on agriculture, malnutrition, flooding and inefficient water resource management practices (Stern, 2018). A recent report by the World Bank (2018) has further stipulated that approximately 143 million people or 2.8 per cent of the population from the Sub-Saharan African, South Asia and Latin American regions, which comprises nations from the LLMI panel could be forced to migrate within their own countries to avoid the impacts of the environmental crisis. As declining ecological reserves would affect nations within the LLMI panel, attributed to their dependency on the ecosystem such as forest, rangelands, and oceans, the livelihood and productivity of these nations would be affected drastically due to climate change (OECD, 2012).

Furthermore, with the rise in global temperature and sea levels, the coastal resources within the LLMI nations would be affected which could potentially aggravate natural disasters and invariably hampers the economic growth for these nations (OECD, 2019b). As globalisation could lead to the displacement of mankind and exacerbate environmental conditions amongst LLMI nations, investigating its impact by segregating the income panels would prove beneficial as demonstrated in this study. By examining the impact of globalisation on the environment and energy consumption from the perspective of both the UMIHI and LLMI panels, a wide range of policy instruments that tailors to the available resource endowments, level of economic development and environmental pressures faced by these income panels can be formulated and executed to address the present climate crisis. Furthermore, as internal climate migration is likely to rise, executing globalisation policies that focus on cohesive climate action by undertaking viable energy efficient initiatives and robust sustainable development actions is pertinent over the next decade. As such, for this study, the global panel is further segregated into the upper-middle-income and high income (UMIHI) panel and the low and lower-middle-income panel (LLMI) to examine the potential impact of globalisation on the environment and energy consumption based on differing production structures.

The impact of globalisation has also led to deforestation attributed to the conversion of forests into agricultural land, specifically in developing economies. For instance, Brazillian soy exports to China increased exponentially from 15,000 tonnes in 1996 to 6 million tonnes in 2003. An increase of 250% over less than a decade, has led to massive deforestation that requires converting the primary forests to farmland that is projected to shrink by 13% if present globalisation trends persist in the next decade. Moreover, human welfare, specifically the rural poor and indigenous communities would be affected due to declining biodiversity. As such, it is pertinent for future globalisation trends to advocate less-environmentally damaging patterns to attain economic development, via international climate agreements that focus on sustainable developmental infrastructures and compensating losses and damages arising from natural disasters, particularly in LLMI panels (Bednar-Friedl et al., 2012).

The increase in world energy consumption and the consequent effects with respect to pollution and gradual depletion of natural resources attributed to globalisation is a detrimental challenge faced by policymakers across the globe (OECD, 2012). Energy

demand in developing nations is expected to rise by 65 per cent by 2040, reflecting the growing prosperity and expanding economies. Despite significant energy-efficient gains, global energy demand is anticipated to increase by 35 per cent with an expanding global population projected to be 9 billion by 2040 (IPCC, 2014). As such, present globalisation policies that are not focused on shifting from raw-materials based manufacturing to knowledge-based service industries would hamper efforts on promoting wider diffusion and adoption of renewable energy and clean technologies.

Issues pertaining to alleviating poverty especially in poorer nations, and generating wealth to finance environmental investments would prove futile with the implementation of ineffective globalisation policies. Furthermore, international climate agreements and multi-lateral collaborative efforts that do not focus on improving energy diversity, reducing the energy intensity of economies, and support energy security initiatives would hamper efforts to transform the energy landscape (OECD, 2019c). As such, it is pertinent to investigate the potential impact of globalisation towards uncoupling economic progress from excessive resource consumption that affects environmental degradation and threatens environmental sustainability in the near future.

1.6 Objectives of the Study

The general objectives of this study are to quantitatively explore the international evidence of globalisation policies, which incorporates trade and financial globalisation indexes from both, the de facto and de jure perspectives on the environment and energy consumption. This study embarks on the following objectives outlined below:

(i) To investigate the impact of globalisation on environmental degradation
(ii) To examine the impact of globalisation on environmental sustainability
(iii) To determine the implications of globalisation on energy consumption.

1.7 Significance of the Study

The study on the globalisation-environment-energy consumption paradigm has substantive research coverage over the years. Prior works of literature have usually adopted foreign direct investment, international trade and trade openness (Fernández-Amador et al., 2016; Kivyiro & Arminen, 2014; Liddle, 2018; Sbia et al., 2014; Shahbaz et al., 2015b; Wang & Ang, 2018) as proxies for globalisation to investigate its impact on the environment and energy consumption. A majority of these studies have demonstrated contradictory results pertaining to the globalisation-environment-energy consumption paradigm. As such, further exploration is required to explore these issues in greater depth to address the present environmental crisis attributed to globalisation. For this study, the findings would highlight new insights pertaining to the impact of globalisation, based on the varied dimensions of trade and financial liberalisation and restrictive perspectives on the environment and energy consumption.

With the present environmental crisis becoming the most ubiquitous and exigent issue of the 21st century, collaborative efforts from governments and policymakers across the globe are pertinent to mitigate the environmental crisis. Rudolph and Figge (2017) have argued that with greater global integration, human environmental demands could propel a country's willingness to encourage foreign direct investment and international trade to reduce or meet these ecological demands. Conversely, based on the Pollution-Haven Hypothesis (PHH), developing and emerging nations may liberalise their trade and investment policies to accelerate economic growth, by imposing less stringent environmental standards (Aşıcı & Acar, 2016). By embarking on this study, policy decisions pertaining to the environmental crisis would necessitate the need for governments, industry players and policymakers to execute sustainable trade and financial globalisation policies to minimise environmental degradation and attain environmental sustainability by converting to sustainable energy consumption patterns.

At present, varied literature has examined the impact of globalisation on the environment by merely adopting carbon emissions per capita as a proxy. However, this study also utilises the ecological footprint consumption per capita (EFC) to measure the impact of globalisation on the environment. To investigate the significance of adopting EFCs from the perspective of globalisation, it is pertinent to comprehend that with increased globalisation, varied products are not particularly consumed at its respective production premises. Thus, it is difficult to examine the repercussions of globalisation by merely focusing on a country-specific footprint of production. Consistent with (Figge et al., 2017), the consumption-based quantification of the EFC will be utilised to measure environmental sustainability.

Borucke et al. (2013) have highlighted the pertinence of adopting EFC to represent the consumption demands of nations across the globe, while concurrently examining the externalities arising from these consumption patterns, specifically on the countries of production. The EFC per capita was adopted from the National Footprint Accounts (GFN, 2018) to ensure its comparability features across all nations. Chen and Han (2015) have further reiterated the need to examine from a panel perspective, as global trade and investment flows are embodied in one-third of global arable land. The relevance of adopting an inclusive environmental variable is necessary as environmental sustainability can be threatened due to soil stock, forestry stock, mining stock, amongst others, and not merely through carbon emissions. These resource stocks could potentially produce varying findings compared to the mere inclusion of carbon footprint (Shao et al., 2018). As such, inconclusive arguments on the impact of globalisation on environmental sustainability demonstrates the need to explore this matter in greater depth towards addressing the present environmental crisis (Uddin et al., 2017a).

Environmental externalities arising from ineffective execution of globalisation policies in production, consumption and distribution processes have led to the growth of pollution-emitting industries, which validates the 'displacement hypothesis' and 'pollution-haven hypothesis' across many nations (Copeland & Taylor, 2004, 2009).

Furthermore, as demonstrated by Figge et al. (2017), implementation of unsustainable globalisation policies has caused increasing pressures on the ecological reserves attributed to human activities. The inability to reconcile humanity's consumption demands with Earth's existing biocapacity has led to ecological overshoot since the 1970s (Jóhannesson et al., 2018). As such, this study would provide new insights on the pertinence of formulating sustainable globalisation policies to ensure mankind's demand on an ecosystem does not exceed the present capacity of the ecosystem to absorb its waste and regenerate adequate resources with increased population. With human demand projected to exceed Earth's existing ecosystems by about 75 per cent by 2020 (GFN, 2018), the findings of this study would provide greater insight to policymakers on the pertinence of executing globalisation policies that address ecological deficits and imposing adequate thresholds on ecological limits. Additionally, the implemented policies should ensure nations across the globe function efficiently and sustainably in a resource-constrained world.

As nations across the globe become highly globalised due to integrated economic, trade and financial ties, economic shocks or business cycle effects attributed to the environmental crisis are likely to affect the growth of these countries in the future. As such, it is imperative for nations to evaluate their globalisation policies, particularly from the perspective of trade and financial liberalisation policies, with respect to energy consumption patterns, to attain sustainable growth. With the proposed framework of the Sustainable Development Goals (SDGs) executed by the United Nations Development Programme (UNDP), it is necessary for all countries to tackle the root causes of the environmental crisis attributed to energy consumption policies by pursuing a sustainable development path to achieve economic growth. As such, the findings from this study would assist government leaders, policymakers and industry players to formulate and implement policies (Dreher et al., 2008a; Figge & Martens, 2014) that advocate the adoption on renewable energy and promote the deployment of clean and energy-efficient technologies to reduce energy intensities on a global scale, which invariably minimise its ominous effects on the environment.

Numerous global initiatives have been advocated by the United Nations Framework Convention on Climate Change (UNFCC) such as Emissions Trading, Joint Implementation, and the Clean Development Mechanism (CDM) to combat the ominous effects on the environment. However, implementing effective and binding global agreements have failed due to the lack of global coordination efforts to decarbonise and ensure global temperature would maintain below the 2° target (Picketts, 2018). Although varied initiatives are currently being adopted by several nations, particularly upon the signing of the Paris Accord to attain sustainable consumption patterns, fossil fuel energy still accounts for 80.04% of global consumption (World Development Indicators, 2015). As such, by investigating the impact of globalisation based on varied dimensions of trade and financial globalisation on environmental degradation, environmental sustainability and energy consumption, this study hopes to shed light and suggest effective recommendations to policymakers, the business communities and governments to attain sustainable economic development for the future.

1.8 Scope of the Study

The first objective of this study is to investigate the impact of globalisation on environmental degradation (utilising carbon emissions per capita as a proxy), based on a panel of 143 countries (full sample) spanning over a period from 1994 – 2014. The full panel is segregated into two samples based on the World Bank income classification groups. The low income and lower-middle income (LLMI) panel comprise 63 countries and the upper-middle-income, and high income (UMIHI) panel consists of 80 countries. The list of countries for all three panels is stipulated in Appendix 1. The segregated income panels may reveal similarities or differences between the countries within these panels pertaining to environmental degradation. For the second and third research objective, the study examines the impact of globalisation on environmental sustainability and energy consumption based on a panel of 137 countries (full sample) spanning over a period from 1994 – 2014. Both studies will also segregate between two income levels, i.e. the low income and lower-middle income (LLMI) sample comprising 62 countries and the upper-middle-income, and high income (UMIHI) sample which consists of 75 countries. The list of countries for all three panels is stipulated in Appendix 2. The segregated income groups based on the World Bank income classification is necessary as environmental issues and energy consumption trends vary between countries based on their income levels (Aşıcı & Acar, 2016).

Although the sample size is relatively limited for the segregated income groups for all three research objectives, the balanced panel would enable adequate assessment on the role of economic globalisation to address potential endogeneity problems inherent in environmental economics and energy economics literature. Furthermore, the alternative (unbalanced panel) could potentially lead towards biased results, effectively straying the analysis from its central premise (Wooldridge, 2015). Numerous econometric methodologies have been utilised to examine the impact of economic globalisation on the environment and energy consumption over the last two decades.

For our study, the two-step system GMM framework was adopted for all three research objectives, as the proxies to examine environmental degradation, environmental sustainability and energy consumption is anticipated to have endogeneity problems (Kahouli, 2018). The quantification of the impact of economic globalisation on the environment and energy consumption remains a thorny issue amongst environmental economics scholars. As such, this necessitates the pertinence of effective control over simultaneity and misspecification bias that may potentially arise across all the three research objectives for the full panel, LLMI panel and the UMIHI panel of this study.

1.9 Organisation of the Study

This research study is organized as follows. Chapter 2 reviews the theoretical and empirical studies pertaining to the impact of globalisation on environmental degradation, environmental sustainability and energy consumption trends. The detailed information on the theoretical framework, analysis of framework, empirical model specification, and estimation techniques and data description are illustrated in Chapter 3. Chapter 4 encompasses the analysis of the empirical findings and the discussion of the results derived from this study. In the final chapter, the summary of findings, policy implications and limitations of the study are elaborated in Chapter 5. The implications of the research outcome and the pertinence for implementing sustainable globalisation policies to combat the present environmental crisis are discussed. This chapter also includes suggestions for future research in this area of study.

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BIODATA OF STUDENT

Yasmin Yashodha obtained her Bachelor of Arts (BA) Business Administration (Business Finance) from the University of East London. She also holds a Post Graduate Certificate in Academic Practice (PGCAP) and a Masters (MSc) in Money, Banking and Finance, both from Lancaster University.

Yasmin commenced her career as a tax associate for about a year at Arthur Andersen, Johor Bahru Branch in 2001, and was responsible for preparing the tax computations for individuals and companies, performing due diligence reviews and occasionally assisting with the preparation of operational budgets for clients. After a one-year stint, she was a senior tax consultant at Pricewaterhouse Coopers engaging with tax advisory and consulting services. The areas covered included withholding provisions, transfer pricing and other specialised projects focusing on capital allowance studies.

After two years, she was attached to the Strategy and Development Division at the Securities Commission of Malaysia. Throughout her three years, her portfolio of responsibilities included the development of the investment banking guidelines, formulating policies to stimulate the unit trust industry, as well as undertaking research in corporate finance and primary markets to enhance the value proposition and strengthen the competitive positioning of the Malaysian capital market. Furthermore, her other scope of responsibilities included engaging in multilateral negotiations and bilateral agreements pertaining to the liberalisation of the capital market in trade agreements such as Malaysia – United States Free Trade Agreement and the Malaysia – Australia Free Trade Agreement.

After 10 years of working with the industry, Yasmin decided to explore the education sector and commenced her role as a lecturer at Taylors University in 2010 until August 2014. During this period, she was responsible for the development of several new Finance modules and the development of the Finance and Economics programme for the business school. Presently, Yasmin is a lecturer and the Chair for the Internship Committee at Sunway University Business School.

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