

# *A Review of Trade, Finance, Migration Openness and Environmental Quality under Globalisation*

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**Abstract:** During the process of world integration, the relationship between openness and the environment has gradually become a nonnegligible issue. This paper provides a theoretical and empirical overview of the nexus between openness and the quality of the environment under the background of globalisation from three major economic-social perspectives: Trade, finance, and migration. The empirical researches find that the trade openness-environment nexus, financial openness-environment nexus and migration-environment nexus are ambiguous without consensus, the relationship could be negative, positive and insignificant, and the direction of linkages could be one way or two-way. In addition, this paper also summarises research limitations according to the existing literature. Future studies should address the research insufficiency mentioned in the article. Furthermore, the indirect effect of the COVID-19 pandemic on the environmental quality could be a new sight for academics to explore based on trade openness, financial openness and migration.

## 1. Introduction

Globalisation became one of the central topics of academic literature at the end of the twentieth century. The term defines a set of social processes that culminate in a more integrated world. Until today, the world economy is still in the process of integration comprising an increasing bulk of regional trade, investment, bilateral and multilateral agreements and treaties. There is an upward trend regarding world economy and international trade and investment volumes. According to data taken from the World Bank, trade increased over a 30-year period, from 37% in 1990 to 52% in 2020. Evidently, international trade accounts for over half of all global economic activity. Increasing trade signifies a positive trend in production. However, numerous productions cause a large consumption of natural resources and energy as well as the generation and discharge of waste. Ultimately, the globalised, free and open economy foregrounds a predicament wherein two vigorous trends potentially collide. The first is the worldwide-accepted, market-oriented economic reform process and the other is the problem of environmental protection. Therefore, the relationship between globalisation and the environment has gradually become a nonnegligible issue.

Based on the United Nations Environment Program (UNEP)'s Global Environment Outlook 4 (GEO-4): Environment for Development, the Programme documents the warming of the earth's surface, the deaths of over two million people who die annually due to air pollution and the

expansion of the ozone hole. Ironically, these negative impacts result from human beings' activities within an increasingly globalised and interconnected process [1]. On the contrary, optimists believe that the advancement of global cooperation and integration facilitates economic development and raises per capita incomes. Affirmatively, the generation of funds for environmental management is valuable regarding investment and the purchase of green technology [2]. Owing to international trade in goods and technologies, developing countries can directly introduce and use cleaner and more efficient production processes and environmentally friendly design equipment from developed countries. Tahir et al. [3] foreground the multitude of benefits associated with efficient technologies which can foster the efficiency of production, increase the productivity of labour and capital, and reduce emissions. Given that globalisation facilitates the circulation of information in this regard, polluting industries may face pollution abatement costs, culminating in the enforcement of regulations that promote a cleaner environment [4]. Hence, while promoting economic and social progression, the process of globalisation causes environmental degradation that cannot be dismissed but provides a new perspective for environmental improvement.

In addition to the term globalisation, the related debates employ various concepts to signify the extent of world economic integration. For example, the notions of liberalisation and openness are extensively utilised. Notably, the concepts of economic globalisation and openness are interchangeable. Furthermore, Gräbner et al. [5] deem that authors favour the use of openness as the most common jargon to capture the phenomena of increasing international integration within trade and finance, compared with globalisation. Additionally, the increasing openness of economies enables easier and increased migration. As a result, population migration is blamed as the reason for climate change or vice versa. In order to ascertain the connection between the two, researchers have begun to focus on the interaction between migration and environmental quality, despite the relatively new nature of population migration. Trade openness, financial openness and migration are three significant indicators of successful global integration. Therefore, it is imperative to ascertain the connection between them and the quality of the environment in order to facilitate humanity's endeavours to achieve sustainable development goals. With this in mind, this article aims to review and analyse existing studies based on trade openness-environment, financial openness-environment, and migration-environment nexuses in detail respectively.

Following a brief introduction, the rest of the paper is structured as follows. Chapter 2 reviews and summarises the relevant development of theoretical doctrines and empirical studies between trade openness and environmental condition. The third chapter reviews the association between financial openness and the quality of the environment based on the empirical studies. Chapter 4 investigates the nexus between migration and the environment. Finally, the last section presents the paper's conclusion and prospects.

## **2. Trade Openness and Environmental Quality**

Jayadevappa and Chhatre [6] highlight that since the late 1970s, trade analysis has considered environmental issues. Therefore, research into trade openness is relatively comprehensive, subsequent to over 50 years of development. This section reviews the link between trade openness and environmental quality according to the theoretical area and the empirical area respectively.

### **2.1. Theoretical Framework**

Firstly, in relation to the correlation between trade and the environment, utilisation of an extended traditional trade theory is a logical move. Conventional trade theory comprises environmental elements to understand the mechanisms that describe the interaction between environmental quality and trade openness. Beginning with this theoretical standpoint, the

comparative advantage presented by Ricardo [7] indicates that the production and exportation of a country's relatively low-cost goods benefits all parties from producing the same goods at various costs across countries. Hence, pertaining to the comparative advantage theory, trade openness induces structural changes within a country's economy wherein goods or services are allowed to be specialised within country who has a comparative advantage [8]. According to Ricardian comparative advantage, this effect on production factors was pullulated into the Heckscher-Ohlin (H-O) model, which is part of the factor-endowment theory. Specifically, the H-O theorem is a static framework. The factor-endowment theory asserts that the countries will obtain a comparative advantage within industries comprising abundant factors. When considering pollution in relation to the H-O theory, a nation with less stringent environmental standards would be a significant factor in polluting capacity. Gallagher [9] suggests that during the trade process between two contrasting countries, a developed nation comprising more strict regulations could culminate in the expansion of pollution-intensive economic activities within a developing nation with weaker stipulations. However, trade is a dynamic process in the real world, and technological change is a concern for numerous studies. Heerink [10] highlights that the technological gap among countries may be a significant point of comparative advantage. Moreover, Van Beers and Van Den Bergh [11] compile a comprehensive overview of theory in the analysis of trade and the environment ranging from a classical perspective to a modern perspective. This review significantly contributes to the theoretical underpinnings of the field.

### **2.1.1. Decomposition Effects Framework**

In addition, an effective framework outlined by Krueger and Grossman [12] which was then developed by Antweiler et al. [13] is now widely employed across a large body of empirical literature. The framework could be separated into three channels to interpret the influence of trade on the environment: scale effects, technique effects and composition effects.

Firstly, the scale effect occurs in instances where openness leads to an economic activity expansion. For instance, a continual increase in the scale of production and consumption of goods and services stimulated by trade openness inherently entails environmental costs, thus worsening environmental quality.

Secondly, the technique effect refers to changes in production technologies and resource extraction. Implicitly, it demonstrates that the technical impact is benign to the environment. Antweiler et al. [13] substantiate the notion that openness has the capacity to enhance the environment through the technique effect. Besides, there are several conclusive elements that contribute to understanding the existence of the technique effect: trade openness boosts economic growth which then increases income and the demand for a cleaner environment for society. Consequently, this stimulates more environmentally friendly technological innovation. Moreover, openness may encourage corporations to employ cleaner production techniques whilst expanding opportunities to acquire environmental knowledge and technologies.

Thirdly, the composition effect alludes to the impact of trade on the structure of output across countries. Trade openness alters the diversity of economic activity. Optimistic environmental outcomes can be expected if the changes facilitate industries in lowering pollution or exploiting fewer natural resources. Moreover, Copeland and Taylor [14] state that developing countries with weaker environmental regulations specialise in dirty products, while affluent counterparts with stricter environmental criterion specialise in cleaner products. As a result, there has been a shift wherein polluting industries have moved from developed to developing countries. This effect is consistent with the H-O theorem, which implies that the industrial structure of an economy changes as each country becomes increasingly focused on the industries in which it has a comparative advantage. Ultimately, the determinants of an economy's comparative advantage accurately

represent the impact of the composition effects on the environment [15].

### **2.1.2. Pollution Haven Hypothesis and Capital-Labour Hypothesis**

A further, imperative consideration is a renowned notion known as the pollution haven hypothesis (PHH). The PHH believes that variances in environmental regulations between developed and developing economies (i.e., 'North' and 'South') significantly impact the production costs of polluting enterprises. To avoid adherence to strict environmental standards in their own countries, polluting industries in developed countries (with high environmental regulations) consider developing countries (low environmental regulation) for site selection. Alternatively, developed countries expand the import of pollution-intensive products to replace the domestic production of polluting products. Consequently, the outcome may include a scenario wherein the North may continue to specialise in clean production and the South will continue to generate pollution-intensive output. Accordingly, the strength of environmental regulations (environmental endowment) is an intrinsic element in understanding how pollution production and trade patterns change over time in the PHH.

Conversely, Tobey [16] and Krueger and Grossman [12] expressed strong doubts regarding the PHH's validity by means of empirical analysis as early as the 1990s. They ascertained that the initial trade flow was in fact determined by factor endowments, not by variances in pollution control costs (environmental endowments). The factor-endowment theory (Capital-Labour Hypothesis, CLH) claims that capital-intensive firms will invest in capital-abundant countries (developed countries). In contrast, labour-intensive firms tend to invest in labour-abundant countries (developing countries). However, capital-intensive sectors are typically pollution-intensive, whereas labour-intensive sectors tend to be cleaning sectors. Thus, the CLH implies that capital-abundant developed countries (North) will specialise in capital-intensive products (pollution), whereas the converse occurs within labour-abundant developing countries (South). Evidently, the impact direction of the PHH and CLH hypotheses are in opposition with one another.

### **2.1.3. Trade Openness and the Environmental Kuznets Curve**

Finally, the continued increasing level of openness is a critical element in integrating countries globally and contributes to economic growth which consequently impacts the quality of the environment. From this, the degree of openness indirectly correlates to environmental quality, due to its role in enhancing the economic growth process which then has environmental consequences. Therefore, consideration of the Environmental Kuznets Curve (EKC) theory proposed by Grossman and Krueger [17], originally derived from the Kuznets curve is imperative. This hypothesis outlines the relationship between economic growth and environmental degradation. It states that countries prioritise production over environmental issues during the first stage of economic development. Consequently, due to surges in economic growth (i.e., income per capita), environmental quality will continue to deteriorate until it reaches a certain income level (the turning point). Subsequently, further economic growth with increased income per capita will contribute to improving the environmental situation. The practical significance of this hypothesis is that although temporary phenomena such as environmental degradation and resource shortages may occur in the initial phases of economic development, these problems can eventually be resolved as a result of developing the domestic economy. In the long term, the fundamental means of improving a country's environment centres upon its wealth.

Given that trade openness culminates in economic development, from the perspective of the scale effect, during the first stage of development, the profits of increasing output are huge and therefore dominate the environmental quality demand caused by a higher income. Development of

the economy, to a certain extent, prompts the implementation of high-value-added technological projects and development of the service industry. This shift heightens environmental awareness, enables the execution of environmentally friendly practices, and helps reduce environmental degradation. Consequently, trade openness may have an income effect on environmental degradation [18].

In considering the composition effect from an alternative perspective, economies develop through physical capital accumulation and expansion of physical capital-intensive industries in their initial stages, which are generally dirty. Nevertheless, economies develop through human capital and knowledge accumulation, during later stages, resulting in cleaner industries. The process yields an EKC. Within the empirical area, a vast proportion of literature not only serves to explore the connection between trade openness and environmental quality but more recently, attempts to verify the existence of EKC.

## 2.2. Empirical Studies

This section reviews the empirical literature on the nexus between trade openness and the environment. It investigates empirical literature from the perspective of cross-countries and individual countries in sub-sections 2.2.1 and 2.2.2, respectively.

### 2.2.1. Multinational Empirical Evidence

There are several empirical literature that determine the environmental benefits of trade openness. Specifically, in early research, Antweiler et al. [13] explore the influence of freer trade in 43 countries between 1971 and 1996 on sulphur dioxide ( $\text{SO}_2$ ) concentrations in terms of the scale effects, the technical effects, and the composition effects. Evidently, the net impact of trade on the environment is positive according to the theoretical framework. However, authors identified that the drawback of their work may lie in the lack of endogeneity prompting several scholars to endeavour to solve this problem [13]. Hence, focus on the recent studies, Ahmed et al. [19] in 2016 explore the concept of trade endogeneity and utilise Pedroni's panel cointegration method to estimate the newly industrialised economies from 1970 to 2013 and conclude that trade openness decreases  $\text{CO}_2$  emissions in the long term. Furthermore, Salam and Xu [20] determine a difference in the relationship with  $\text{CO}_2$  emissions and trade openness between different countries. Using a sample of China and 88 Belt and Road Initiative (BRI) countries, they applied the two-step generalised method of moments (GMM) model during a period ranging from 2001 to 2018. Moreover, the evidence suggests that trade openness between BRI countries and China significantly detracts  $\text{CO}_2$  emissions while the impact on  $\text{CO}_2$  emissions among BRI countries is insignificant.

Conversely, a bulk of research analysts state that trade has a negative influence on environmental quality. Le et al. [21] refer to the particulate matter ( $\text{PM}_{10}$ ) emissions as the elemental environmental indicator to ascertain the connection between trade openness and the environmental quality in 98 countries, encompassing the period from 1999 to 2013. Scholars reveal a detrimental relationship between trade openness and the environment. Furthermore, according to countries with varying income levels, results indicate that in high-income nations, trade openness has a non-malignant environmental impact, whilst resulting in a malignant effect in middle-income and low-income nations using the GMM. Similarly, parallel outcomes were obtained in Wang and Zhang's [22] study of 182 countries, from 1990 to 2015. Their focus utilised  $\text{CO}_2$  emissions as the indicator and aligned the empirical results as consistent with PHH. Besides, the empirical literature of Le et al. [21] asserting the view in support of the popular concept of PHH. Analogously, Van Tran [23] not only confirms the detrimental impact of trade on the environment, and but verifies the validity of EKC in 66 developing countries over an extensive period, from 1971-2017. This study adopts the

same econometric approach as Le et al. [21]. Moreover, Aller et al. [24] revisited the indirect effects of trade on the environment in an observation of 177 countries between 1996 and 2010. The outcomes suggest that trade has a positive indirect impact on the environment within low-income countries, while a detrimental effect is evident within high-income countries, which explicitly contrasts with the conclusions of Le et al. [21] and Wang and Zhang [22].

Additionally, a 2017 study investigates the nexus between CO<sub>2</sub> emissions and trade openness in 105 countries from 1980 to 2014 [25]. The econometric analysis discovers that CO<sub>2</sub> emissions increase as a result of trade openness, following vector error correction model (VECM) causality and panel cointegration tests. In addition, the existence of EKC within this study has been verified, which implies that trade openness has an income effect on environmental degradation. Al-Mulali and Ozturk [26] deliberate the impact of trade openness on the environmental degradation in 14 Middle East and North African countries, over the period from 1996-2012. Consequently, their study ascertains similar consequences that trade openness impairs environmental quality by applying a fully modified ordinary least square approach (OLS). However, empirical studies from Sharma [27] indicate that there is no statistical relation between trade openness and environmental degradation by means of investigating the determinants of CO<sub>2</sub> emissions in 69 nations, spanning from 1985-2005 using a dynamic panel method. Evidently, there is an insignificant effect of trade openness in an international panel although the impact is negative.

### 2.2.2. Individual Country Empirical Studies

Focus on literature from individual economies. The study of Hakimi and Handi [28] purports that trade liberalisation is harmful to the environment due to elevated CO<sub>2</sub> emissions in Tunisia and Morocco, encompassing the period from 1991 to 2013 by employing VECM and cointegration tests. Moreover, an indirect consequence of trade openness for environmental quality exists through promoting the economies. Similarly, Lau et al. [29] determined a parallel result in the empirical study of Malaysia covering the period from 1970 to 2008. Primarily, scholars adopt the autoregressive distributed lag (ARDL) method in examining the trade openness-environment nexus in both the short and long term, respectively wherein they refer to CO<sub>2</sub> emissions as an environmental indicator. Here, the inverted U-shaped curve exists. Likewise, Naranpanawa [30] adopted the ARDL approach and ascertained that trade openness promotes emissions in the short term, but there was no evidence of a long-term nexus in Sri Lanka, during the ten years from 1960 to 2006. However, Cetin et al. [31] determine consistent outcomes in the case of Turkey, using the same method, where they reveal the existence of a long-term correlation between CO<sub>2</sub> emissions and international trade.

Besides, the outcomes of Farhani and Ozturk [32] indicate that trade openness impedes emissions in Tunisia, which is also clarified in a study of Nigeria by Ali et al. [33]. However, Dada et al. [34] indicate that trade openness contributes to a negative impact on environmental quality in Nigeria by employing ARDL techniques, which opposes the study of Ali et al. [33]. Similarly, Shahbaz et al. [35] positively associate trade openness and the quality of the environment within South Africa between 1965 and 2008, by reducing the growth of energy pollutants by using the ARDL bounds testing method. Besides, with regards to the case of the United States' (U.S.) manufacturing plants, between 1991 and 1998, Cherniwchan [35] evaluates the influence of the North American Free Trade Agreement (NAFTA) on the PM<sub>10</sub> and SO<sub>2</sub> emissions, where NAFTA represents trade liberalisation. Hence, the outcomes imply that trade liberalisation improves the quality of the environment by modifying the emissions of PM<sub>10</sub> and SO<sub>2</sub> that result from existing industries.

### 2.2.3. Discussion of the Empirical Literature

In short, whether the impact of trade openness has a beneficial, detrimental, or insignificant impact on the quality of the environment depends on distinctions in sample sizes, chosen econometric method, environmental quality indicators, theoretical and econometric methodologies, and trade openness variables. Inevitably, trade openness impacts environmental quality in various directions, and the interaction between trade openness and environmental quality not only presents a unidirectional nexus but a bidirectional relationship and feedback effect in the short- and long-term. To a certain extent, different factors can influence outcomes, which is one of the reasons for the absence of a consensus thus far. Consequently, various conclusions, founded on numerous studies, suggest that a one-size-fits-all assumption for each economy is not guaranteed. What's more, the nature of the country's characteristics is a significant element in determining positive or negative influence direction between trade openness and environmental quality. In addition, an increasing number of scholars continually endeavour to illustrate the nexus between trade openness and environmental quality following the EKC hypothesis of income effect during recent years. Despite the ambiguous nature of the empirical results, the trend is a positive indicator. Notably, evidence relating to PHH is also limited.

However, a minimal number of studies consider the direct impact of trade. For instance, successful trade depends on transport (i.e., shipping, aviation, and trucking). Therefore, the openness of trade implies a simultaneous rise in transport demand, which naturally impairs environmental quality unless technology used in the transportation of goods and services evolves further. Transportation represents a direct effect, creating a new research direction for the attention of scholars such as focusing on transportation and transportation emissions within further studies. Such empirical research may facilitate the improvement of manufacturing technologies within the transportation manufacturing industry. Simultaneously, this may serve as a reminder for relevant departments to adopt effective policies to supervise manufacturing industries' production and consequently control transportation carriers' pollution emissions during the transportation of goods. Evidently, a large proportion of literature concentrates on the 'North-South' (developed country to developing country) trade. However, the surge in 'South-South' trade is a new trend for academic study, a trend that challenges traditional theories of North-South globalisation, which examine whether the North's stricter standards could lead to polluted heavens.

## 3. Financial Openness and Environmental Quality

Chapter 3 reviews financial openness. Clark et al. [37] classify the concept of financial openness firstly from a broader perspective and then from a narrower standpoint: financial openness broadly means the extent to which a country is dependent on and/or impacted by international financial flows. However, financial openness narrowly refers to a country's policies. More detailed, greater openness results in fewer taxes and fewer governmentally imposed capital limitations. According to data from the Group of 7 (G7) which comprises the United States, the United Kingdom, Germany, Japan, Italy, Canada and France, the average financial globalisation index increased to 80.20 in 2016. This figure, when compared to the equivalent score in 1980, has increased by 28.19 [38].

### 3.1. Empirical Studies

Over recent years, studies related to the financial openness-environment relationship have emerged, most literature employs a financial openness index as a measure. Specifically, the most widely employed index is the Chinn and Ito index (KAOPEN). Nevertheless, the existing literature exploring the connection between openness and environmental degradation, wherein it refers to

financial development and foreign direct investment (FDI) as the proxy financial indicator, is more saturated than the number of studies that focus on financial openness. Meanwhile, in terms of quantity, evidence relating to financial openness/development and environmental quality is relatively insufficient compared with literature concerning the trade-environment nexus. Hence, we will review and discuss the empirical research focusing on the impact of financial openness/development on the environment.

The literature on the relationship between financial openness and environmental quality could be decomposed primarily into two categories. The first states that due to the fact that increased financial openness develops the activities of R&D whilst enhancing investment in environmentally friendly technologies to provide high energy efficiency, it also advantages the environment [39,40]. On the contrary, another standpoint asserts that financial openness has a detrimental impact on the environment. In view of a macroeconomic perspective, financial openness prompts the supply of loans and reduces loan costs, which encourages firms and households' consumption and investment behaviours. Consequently, both levels of demand and production increase which culminate in increased consumption of natural resources. Finally, this may cause the release of pollutants thus damaging the environment [41]. Converse to section 2, this section firstly refers to the research that determines a negative impact on environmental quality, outlined in sub-section 3.1.1. and subsequently, with retrospect, the research which reveals a positive impact.

### **3.1.1. Financial Openness/Development Reduces Environmental Degradation**

In relation to the focus on the benign interpretation of the relationship between financial openness/development and environmental quality, Abbasi and Riaz [42] allude to CO<sub>2</sub> emissions as the environmental indicator and collect data from 1970 to 2010 in Pakistan. Specifically, they employ the ARDL model in the form of an Unrestricted Error Correction Model (UECM). The empirical evidence denotes that financial development augments investment in green technologies, elevates consumption and production biased toward the utilisation of renewable energy, and therefore reduces environmental damage (i.e., decreased CO<sub>2</sub> emissions) in Pakistan. Meanwhile, scholars, Ozturk and Acaravci [43] reach similar conclusions which argue that financial development was beneficial in terms of its contributions to decreasing emissions in the long term in Turkey from 1960 to 2007. In the cases of China and Malaysia, analogical outcomes are also drawn by scholars in the long term [44,45].

In addition, Jalil and Feridun [46] and Shahbaz et al. [44] purport that China's financial development impedes CO<sub>2</sub> emissions wherein they employ the ARDL model and ARDL bounds testing approach, respectively. According to the cross-countries literature, Saidi and Mbarek [47] and Salahuddin et al. [48] verify the standpoint and obtain the equivalent conclusions as Abbasi and Riaz [42] through their examination of 19 emerging countries from 1990 to 2013 alongside Gulf Cooperation Council (GCC) countries from 1980 to 2012 respectively by means of a range of econometric methods. Ahmad et al. [38] determine the negative impact of financial development on the ecological footprint (EF) as they apply the datasets of G7 countries encompassing the time period: 1980 to 2016. Evidently, the presence of EKC is substantiated within the study. Similarly, based on financial openness, Aydin and Turan [40] also verify the existence of EKC in the empirical evaluation of Brazil, Russia, India, China and South Africa (BRICS) countries for the period 1996-2016 by alluding to the same environmental indicator in examining the correlation between financial openness and environmental quality. On the contrary, Ulucak et al. [49] classify the inverted U-shaped curve as invalid as financial globalisation decelerates environmental deterioration by using the same environmental indicator with different samples. Furthermore, You et al. [50] examine the relationship between environmental quality and financial openness employing data from 68 countries from 1985-2005 wherein they apply a panel quantile model as the



empirical technique. Consequently, research determines that financial openness fosters the expansion of credit supply, which urges enterprises and individuals to invest in and purchase more effective technologies that could facilitate reduced energy consumption, thus lessening environmental damage. Nevertheless, there is no significant impact of financial openness on pollution econometrically. As a result of analysing the commonwealth of independent states over the period from 1992 to 2015, Rasoulnezhad and Saboori [51] pinpoint evidence in relation to a bidirectional long-term and a unidirectional short-term connection between Chinn and Ito's index and CO<sub>2</sub> emissions.

### **3.1.2. Financial Openness/Development Enhances Environmental Degradation**

Within this sub-section, the perspective shifts to explore the detrimental correlation between financial openness and the environment. Islam et al. [52], in their study of Malaysia from 1971 to 2009, consider this connection by employing the ARDL model. Evidently, the empirical results conclude that financial development initially facilitates capital supply and subsequently lessens the price of credit, which in turn, stimulates investment. Therefore, increased investment fosters expansion in production and energy consumption. As a result, there is a significant surge in CO<sub>2</sub> emissions. In conforming to the same methodology, Abbasi and Riaz [42] conducted their research. Specifically, their study considers Pakistan over a forty-year period from 1971 to 2011 (full sample) and from 1988 to 2011 (sub-sample) and they revealed that financial development had a positive impact on environmental quality in adherence with the work of Islam et al. [52]. Meanwhile, similar outcomes were obtained by Shahbaz et al. [53], who investigated the nexus in Indonesia from 1975 to 2011, on a quarterly basis. What's more, several scholars researching the same topic but from the perspective of multinational data, also arrived at parallel conclusions. Moreover, recent research evaluates the sample of South Asian economies from 1990 to 2014, and the empirical results indicate that financial development accelerates environmental impairment [3]. Besides, Koengkan et al. [41] in their analysis of MERCOSUR countries from 1980 to 2014 had to modify their methodology. They made this decision after one year wherein Koengkan et al. [54] utilised the ARDL model in the form of a UECM to explore 21 Latin American and Caribbean (LAC) countries, spanning the time period of 1980 to 2014 and employed the Chinn and Ito index as a representative of financial openness. The two studies empirically argue that financial openness increases CO<sub>2</sub> emissions in the short and long term.

Furthermore, according to the various empirical techniques and individual country evidence, Koçak and Şarkgüneşi [55] and Ren et al. [56] utilise the DOLS model and GMM model as the econometric approach respectively and determine a positive relationship between foreign direct investment (FDI) (a proxy indicator of financial openness) and the environment (i.e., increased CO<sub>2</sub> emissions) by means of examining the case of Turkey from 1974-2013 and China from 2000-2010 respectively. A minimal number of related literature refer to EF as an indicator as opposed to CO<sub>2</sub> emissions and find that financial openness increases EF, thus deteriorating environmental quality. However, later studies begin to employ EF as a proxy indicator of environmental quality. Additionally, the empirical results reveal that financial openness aggravates environmental degradation in Pakistan as a consequence of increased EF [57].

### **3.1.3. Insufficiency of Studies**

Evidently, the empirical findings in relation to financial openness are loaded with controversy and ambiguity, similar to the trade openness-environment nexus. The diverse nature of the structure and development processes of financial systems in various economies is one of the reasons attributed to the failure of empirical tests to reach a consensus. Additionally, the degree to which

developed and developing countries are financially open may explain why it impacts the quality of the environment. Furthermore, recent relevant literature reveals that some scholars have introduced the ECK into their empirical analysis, wherein they aim to prove the validity of the inverted U-shaped curve. Numerous studies indicate that financial openness, as a result of reducing capital controls, can promote economic growth by means of better and more efficient allocation of resources, portfolio and risk diversification in adherence to appropriate frameworks and regulators [58]. Therefore, financial openness may impact the quality of the environment indirectly due to boosting economic growth. From this standpoint, the EKC hypothesis outlined in chapter 2 could also be regarded as an appropriate methodology. Secondly, in correspondence with the literature review, a relatively small number of studies adopt financial openness as a representative variable in exploring the relationship between openness and environmental quality. Despite the popularity of the Chinn and Ito index, most empirical studies assume financial development and foreign direct investment as the primary variables. Notably, within future empirical research, authors could pay increased attention to financial openness and experiment with different variables to represent financial openness or create another measurement.

#### **4. Migration and Environmental Quality**

Owing to the improvement of the degree of openness both across countries and within countries, the proportion of internal and international migration continues to follow an upward trend. Statistically, the International Organisation of Migration (IOM) declared that, in 2020, an estimated 281 million people were living in a different country to where they were born, which is more than triple that of 1970. Therefore, population floating is a crucial factor in the process of globalisation.

##### **4.1. The Impact of the Environment on Migration**

This section pays attention to the impact of environmental quality on migration, and this influence could be referred to conceptually as environmental migration. Notably, there is not a unified, international standard definition of environmental migration, thus hindering the development of this field. In 2007, an overarching definition of environmental migration proposed by the IOM denoted that people are subject to sudden or gradual environmental changes caused by various factors, which adversely influence societal conditions of living. Consequently, individuals may be forced or may choose to leave their place of habitual residence. Migration can be on a temporary or permanent basis wherein the destination can be domestic or overseas.

According to the nature of environmental issues, environmental migration is separated into two categories. The first form of migration involves sudden natural disasters. Here, people leave their original residence or are forced to relocate to other areas. However, the second type of migration involves gradual environmental pollution or environmental change. In this case, people have the time to make an informed decision regarding migration. Based on the classification, Hunter and Nawrotzki [59] purport that the first sort of obligatory evacuation, due to natural disasters, is forced migration, whereas another form of population mobility represents voluntary migration. It is difficult to incorporate the first form of migration into a standard framework of economic analysis, whereas it is easier to estimate the overall scale of such environmental displacement. For instance, Reuveny [60] states that, in the Great Plains of the United States, dust storms, as a result of strong winds and drought, reduce agricultural output and quality of life, causing 2.5 million people to leave the region in the 1930s. Undoubtedly, this phenomenon, as a result of unforeseen environmental factors, contributes to a series of social and economic problems, and these problems have a profound impact on human society. The second type of migration differs due to the fact that the migration decision depends on personal preferences, wherein the environment is one of the factors

impacting their decision. Accordingly, Reuveny [60] categorises environmental adaptation into three groups: the first comprises individuals who accept the damage caused by climate change and remain where they live without any reflection. The second consists of people who stay in their original residence while reducing possible damage from climate change by means of various approaches. Thirdly, people opt to leave their current residence, a decision that is informed by the extent of environmental degradation and the ability of residents to relocate. Residents in developed countries, that are impacted by environmental degradation, may minimise losses through technological inventions or institutional design. Conversely, disaster-stricken residents of less developed countries are more susceptible to the same losses due to inexperience and lack of sufficient wealth, thus prompting them to remain in their original location. As a result, residents in less developed countries are more vulnerable to environmental disasters than in those developed countries. Renaud et al. [61] comprehensively discusses the definition of environmental migration and clarifies the significance of environmental conditions and change within migration decisions to facilitate policy informing and programmatic response.

## 4.2. The Environmental Impact of Migration

Up until now, this chapter predominantly reviews environmental factors that influence migration. Subsequently, this section considers the capacity for migration to attain environmental results.

Research indicates that destination impacts are related to immigration and that immigration prompts environmental outcomes due to the relatively large association with population growth in the destination. Hunter and Nawrotzki [59] stated that numerous research has explored the harmful effects of immigration on tropical forests in the Amazon, Central and West Africa, and Southeast Asia. Nevertheless, the vast proportion of this work prioritises deforestation along the Amazonian border. Settlement is associated with deforestation for unclear property rights and land tenure systems that encourage deforestation [59]. Notably, most empirical studies focus on the U.S. and the earliest study was conducted by Cramer [62]. Here, data is used from 56 California counties, encompassing the period from 1980 to 1990, and reveals a positive correlation between total population and emissions of certain pollutants. However, it is difficult to attribute an association between impact and immigration. Besides, a study of 200 urban counties in the year 2000 determined no clear link between air pollution and immigration concentrations in the U.S. [63]. Subsequently, Squalli [64] employed U.S. state-level data and CO, SO<sub>2</sub>, PM<sub>10</sub>, NO<sub>2</sub> emissions as an environmental indicator to examine the correlation between immigration and the environment. There is no evidence to suggest that immigrants reduce environmental emissions. However, the results indicate a negative relationship.

Furthermore, the research draws a conclusion that aligns with prior studies wherein there is no evidence of an interaction between immigration and seven analysed air pollution (carbon monoxide (CO), NO<sub>2</sub>, ground-level ozone (O<sub>3</sub>), SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, Air pollution Index (API)), when referring to data for 183 Metropolitan Statistical Areas [65]. Pertaining to recent literature, Ma and Hofmann [66] utilised the Environmental Quality Index (EQI) and employed spatial panel models for U.S. county-level datasets, from 2007 to 2014, to ascertain the association between immigration and air quality. The empirical outcomes substantiate a linkage between the native population and poorer air quality and between the foreign-born population and improved air quality. Additionally, this research documents the interactions between air quality and migrants' original nation, entry year, and cohort. Similarly, in the same year, Ma and Hofmann [67] chose to use the Air Quality Index (AQI) during the same time horizon. They associated superior air quality with total population and immigration population. Notably, the statement that the population is linked to better air quality contradicts the generally accepted standpoint that population growth is related to environmental

degradation. Fortunately, Squalli [68] evaluates the relationship between immigration and air emissions using data from 1997 to 2014. The empirical evidence reveals a negative and bidirectional relationship between the proportion of immigration and CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O emissions. Ultimately, the outcomes of empirical analysis imply that immigration may induce environmental advantages while environmental quality may be a significant element or facilitator impacting immigration flows.

### 4.3. Insufficiency on Migration-Environment Topic

Undoubtedly, the integration of environmental issues with migration is lengthy and complex. The following aspects may offer inspiration for future research in this field.

The first aspect considers the debate between internal and international migration in response to climate change. Hunter and Nawrotzki [59] propose that many scholars purport that internal and short-distance migration is the primary choice for climate-related migration as opposed to international and long-distance migration. For instance, Jonsson [69] determines, in a meta-analysis of 16 case studies from the African continent, that individuals impacted by environmental change were less likely to migrate to the global north or even across borders into neighbouring countries. Rather, most observed movements occurred within countries and tended to be relatively short distances. Meanwhile, Massey et al. [70] relate environmental deterioration to the local population floating rather than to mobility from the international population. This phenomenon may be attributed to the fact that households in fragile rural areas lack financial, human, and social capital. Hence, urbanisation may be regarded as a result of internal migration. Yin et al. [71] associate urbanisation with the process of clearing vegetation and widespread environmental degradation, by observing satellite images from 1979 to 2009. Furthermore, the Population Reference Bureau (PRB) estimates that 75% of the world population will live in urban areas in 2050, especially in developing countries, and the population in rural areas will decrease [72].

In fact, there is still a large proportion of international migration that occurs in response to environmental change. We outlines the causes of international migration: (1) Variances in economic, political, and social conditions between North and South countries; (2) the rise of the international migration industry in the context of globalisation, and openness as a connecting force interrelating people, industry, and institutions. Moreover, Shen and Gemenne [73] argue that considering the importance of climate change as a driver of migration, more Tuvaluan migrants will move to New Zealand through various migration schemes (e.g., the Pacific Access Category Scheme). Therefore, the second aspect refers to the selection of sample regions. When considering this thesis, it is evident that most of the existing literature use data from the United States as its research object. However, owing to the continuous expansion of openness and the emergence of immigration policies aimed at fostering talents within the country and internationally, the number of immigrants in the United States and some other countries and regions has gradually increased. Consequently, scholars may explore the impact of immigration on the destination/original area or country and the environmental quality. Besides, the number of recent literature, focusing on this area, is relatively minimal, the majority of which is relatively outdated, especially the studies about the exploration of the impact of immigration on the original areas' environment. From a methodological perspective, there are various methodologies employed in the migration environment. Recent studies apply spatial models wherein they analyse internal relationships because of the social network [66,67,74]. Moreover, Hunter and Nawrotzki [59] regards subjectivity as a methodological problem. For instance, the variances between farmers who live in different areas feelings about drought. Consequently, objective rainfall measurement has a different implication for each. Therefore, precise consideration of the local environmental background is an essential measurement challenge

one that is possibly expressed within the procedure of migration decision-making.

## 5. Conclusion and Prospects

This paper provides an overview of the nexus between openness and the quality of the environment in accordance with globalisation from three major economic-social perspectives: trade, finance, and migration. These perspectives are distinguished into several sub-sections to explain their connection with environmental issues, both theoretically and empirically. Pertaining to empirical evidence in these three aspects, there is no fully unified consensus. Based on different samples, time intervals, methodology, and environmental indicators, their connection may be positive, negative, unidirectional, or bidirectional in the short and long term and can even be econometrically insignificant. A limited number of studies are focusing on the direct effect of trade openness. Besides, environmental impacts of ‘South-South’ provides a new insight for academics which could form a new prospective research direction. Furthermore, financial system’s development level and structure are varied among countries while there is no unanimous opinion for the financial openness-environment nexus, and only a small quantity of studies adopt financial openness as a representative variable. With this in mind, further research could experiment with different financial openness indicators and choose different economies with varying financial development levels. By means of horizontal and vertical comparisons, it is beneficial to improve green finance policies in economies with different financial system processes. Chapter 4 detailed that the update rate of the literature in this field is relatively slow, as most recent literature studies centre upon the influence of the United States and the destination of population migration, leaving only a minimal amount of literature to focus on other regional or cross-country samples. Notably, only a scarce amount of literature combines all three aspects to examine the overall effect on environmental quality. Therefore, future researchers may consider the combination of trade openness, financial openness, and migration. Meanwhile, the selection of methodologies and instruments for testing the openness-environmental quality nexus could require improvement and innovation.

Additionally, the COVID-19 pandemic may offer fresh insight for scholars as a result of the privatisation of public goods within increasingly globalised and liberalised markets in collectivising risks such as environmental disasters, pandemics, and economic crises. At the epidemic’s peak, most countries opted for the lockdown to ensure that measures could decelerate the virus's rapid spread. As a result, trade, finance, and population floating were impacted by COVID-19. Ultimately, a foreseeable recovery in environmental quality, over this period due to a reduced human economic activity, is likely. However, due to the implementation of successful vaccination programmes and epidemic prevention measures, various epidemic restrictions in most countries have gradually been lifted, and normal activities have resumed. Inevitably, this period can be regarded as a pause and that human activity will rebound, thus nullifying the benefits associated with the pandemic. Furthermore, environmental quality is likely to be worse than before the pandemic given that economies are eager to restore economic development. Therefore, scholars may investigate trade openness, financial openness, population migration, and environmental indicators before, during, and after the pandemic with reference to different samples (cross-regions and individual regions) to identify evidence for the updating and conduction of sustainable development policies. In addition, if similar situations arise in the future, research the concentrates on this time interval may serve as a reference.

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