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Navigating Sustainability and Open Trade: A Deep Dive into Indonesia's Case

by

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This study confronts the global urgency of sustainability challenges by evaluating the relationship between international trade and sustainable development, with a specific focus on Indonesia. As a nation deeply entangled with environmental issues and heavily dependent on natural resources, Indonesia's sustainability path under the influence of international trade is a subject of crucial importance. From 1981 to 2019, this thesis investigates the relationship between trade openness and sustainable development, employing genuine savings as an indicator of sustainable development. The results highlight a noteworthy negative relationship between trade openness and genuine savings in both the short and long run. This relationship compels a reevaluation of the traditionally perceived benefits of trade, underlining potential environmental drawbacks associated with resource-intense exports.

Keywords : Indonesia, International Trade, Sustainable Development, Genuine Savings, Time Series Regression

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1 Introduction

The past decades have seen some of the most pressing sustainability challenges that the world has ever faced. These challenges have ranged from climate change and biodiversity loss to water scarcity, land degradation, and energy security. In tackling these issues, the 17 Sustainable Development Goals (SDGs) were introduced by the United Nations in 2015 as a means of promoting worldwide sustainable development across environmental, economic, and social spheres. This initiative has gained immense significance, with 193 nations pledging to work towards these ambitious goals, which comprise 169 targets. The SDGs have become a crucial framework for ensuring a sustainable future for all. Among various policies, trade policy continues to be a key area of focus when establishing connections with sustainable development, whether through direct or indirect means. The United Nations 2030 Agenda for Sustainable Development specifically mentions that international trade can act as an engine for inclusive economic growth, poverty reduction, and sustainable development. WTO (2018) also promotes trade as a key actor in achieving sustainable development, particularly in environmental protection, because it facilitates the transfer of green technology.

Along with this objective, countries have undertaken efforts in pursuing cooperation and policy alignment for promoting trade to achieve sustainable development. Indonesia, located in Southeast Asia, has placed sustainable development at the forefront of its policy action, as evidenced by the establishment of its inaugural low-carbon national development plan for 2020-2024 (Bappenas, 2023). With its rich cultural heritage, vast natural resources, and unique geographical position, Indonesia holds a distinct position within the Asian region. Its extensive coastline and marine resources support thriving fishing industries, while its lush tropical rainforests house unparalleled biodiversity (OECD, 2019). Furthermore, Indonesia possesses valuable reserves of minerals and energy resources, making it a significant player in the global extractive industry. Given its strategic location and substantial natural resources, Indonesia's sustainability challenges and its approach to international trade have far-reaching implications beyond its borders (Bappenas, 2023).

However, for years, Indonesia has been struggling with sustainability issues, as the country is among the world’s largest greenhouse gas emitters (OECD, 2019). Indonesia is confronting a diverse array of environmental issues, such as deforestation, air, and water pollution, and unsustainable fishing practices which impose serious threats to its biodiversity. Sustainability issues in Indonesia are important for the global context due to the country's vast natural resources and unique biodiversity. Indonesia is home to the world's third-largest tropical forest, which serves as a critical carbon sink and is vital for mitigating climate change. In this context,

international trade plays a significant role in the context of sustainability issues in Indonesia, as it can either support or undermine sustainable development efforts in the country.

For decades, international trade has been one of the major sources of Indonesia's economic growth (Verico and Pangestu, 2020). Over the last 50 years, Indonesia has experienced a growing level of global integration, as evidenced by the increase in its trade-to-GDP ratio from 24 percent in 1960 to 50 percent in the 2010s. The benefits of trade are undeniable: it has brought in export revenue, opened access to new markets and technologies, attracted foreign investment, diversified the economy, and created job opportunities (Verico and Pangestu, 2020). While trade can bring many economic benefits, its impact on the environment and social welfare is complex. While it could address resource scarcity, promote efficient global resource consumption, and improve social welfare, international trade can also have negative impacts on the environment and social well-being, including carbon leakage, biodiversity loss, deforestation, and exacerbating socio-economic inequalities (Xu et al., 2020).

Investigating the impact of international trade on sustainable development in Indonesia is crucial, as it has a high dependency on natural resources, where commodity exports significantly help to boost the economy (Basri, Rahardja, and Fitrania 2016). This potentially could lead to natural capital depletion and raises a concern about whether Indonesia has been on a sustainable path or not over the past decades (Kurniawan & Managi, 2018). The concept of sustainable development encompasses various dimensions, but its essence lies in the preservation of natural capital, as emphasized by the principle of weak sustainability. According to this principle, maintaining overall capital stocks is crucial for development to be deemed sustainable. In this context, the utilization of genuine savings as a measure for sustainable development is meaningful. Genuine savings provide insights into whether a nation's changes in total capital stocks, encompassing natural, human, and manufactured capital, contribute positively or negatively to its overall welfare (Hamilton, 2000). Hence, exploring the relationship between trade openness and genuine savings in Indonesia holds significant importance. This analysis can offer valuable insights into how international trade can either support or hinder sustainable development. Furthermore, it can guide us in formulating strategies to foster sustainable development through international trade.

1.1 Aim and Scope

The aim of this study is to analyze the relationship between trade openness and sustainable development in Indonesia for the period of 1981 - 2019. To tackle this aim, the following research questions are chosen. The first question is: ***What is the relationship between international trade and sustainable development in Indonesia?*** To answer this research question, time series data regression analysis will be performed to investigate the short-run and long-run relationship between the trade openness and sustainable development. Sustainable development will be proxied by genuine savings, as a measure for weak sustainability. Upon

establishing the relationship between international trade and sustainable development in Indonesia, it becomes evident that our understanding is incomplete without delving deeper into the underlying factors and dynamics that shape the relationship. The findings from our regression analysis provide us with patterns and correlations, but they don't fully explain the "why" and the "how" of the results we observe. This leads us to the second research question: ***What are the dynamics of the relationship between international trade and sustainable development in Indonesia?*** To answer this question, the results will be supported by empirical research based on literature reviews regarding the possible mechanisms and factors affecting the relationship. By exploring the second question, it allows us to make sense of our initial findings and contribute a more nuanced understanding of the relationship between international trade and sustainable development in Indonesia.

1.2 Thesis Outline

Chapter 2 presents a literature review. It first explores the definition of sustainable development and explores the concept of genuine savings as a measure for weak sustainability. It is then followed by a discussion of previous studies on international trade and sustainable development, shedding light on existing knowledge gaps and research findings. Moving on to Chapter 3, a theoretical approach is presented. This section offers an exploration of the theories and frameworks that underpin the relationship between international trade and genuine savings. Chapter 4 focuses on the data and methodology employed in this thesis. In the data section, the thesis discusses the definitions of the data utilized, along with the summary statistics that characterize the selected datasets. Additionally, any limitations associated with the data are addressed. The methodology section explains the step-by-step process of model selection, including the criteria used to choose the most appropriate model for the research objectives. Furthermore, the specific variables selected for analysis will be further discussed, highlighting their relevance and importance in examining the relationship between trade openness and genuine savings. Chapter 5 presents the findings of this thesis, presenting the results and empirical discussion on the relationship between trade openness and genuine savings. Finally, in Chapter 6, the thesis concludes by summarizing the key findings, reiterating their significance, and reflecting on the broader implications of the research.

2 Literature Review

The next section explores existing literature on the complex relationship between international trade and sustainable development. The objective of this review is to shed light on various perspectives and empirical findings, providing a solid foundation for addressing the research questions at hand. The section commences with an exploration of the definition and discourse surrounding sustainable development, followed by an examination of genuine savings as a robust measure for evaluating weak sustainability and its prior research applications. Subsequently, in order to understand the relationship between trade openness and genuine savings, the discussion delves into previous findings that investigate the relationship between trade openness, sustainable development, and genuine savings.

2.1 Previous Discussions on Sustainable Development

The most used concept of sustainable development was proposed by the Brundtland Commission. In its report, Our Common Future, in 1987 to establish a connection between economic development and environmental stability. This report introduced the frequently referenced definition of sustainable development, which is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations General Assembly, 1987, p. 43). Although not emphasized extensively, the description highlights the significance of intergenerational equity. Preserving resources for future generations is a crucial aspect that differentiates sustainable development policy from conventional environmental policy, which strives to incorporate the externalities of environmental degradation (Emas, 2015). Sustainable development aims to achieve the long-term stability of both the economy and environment, which can only be attained by integrating and recognizing economic, environmental, and social considerations in the decision-making process.

Following the publication of The Brundtland Commission Report, many definitions concerning sustainable development arised. The economic perspective has a more concise interpretation of sustainable development, which is defined as non-decreasing welfare per capita, ensuring that future generations are not worse off than the present (Alisjahbana & Yusuf, 2004). To measure welfare, the concept of a "capital basis for sustainable development" is introduced, as a direct

measure of welfare is challenging (Alisjahbana & Yusuf, 2004). The capital stock of an economy reflects its ability to produce output and promote the welfare of its citizens. The productive capacity of an economy contributes to the improvement of its people's well-being. If an economy can sustain its productive capacity, then it can also maintain the well-being of its people. The concept of the "constant capital rule" is the capital basis for sustainable development. This rule states that non-declining welfare per capita is ensured by a non-declining capital stock (Alisjahbana & Yusuf, 2004). If the capital stock remains constant, then well-being per capita will also remain constant. Thus, to determine whether an economy is following a sustainable development path, it is essential to examine the trend of its capital stock over time (Alisjahbana & Yusuf, 2004).

There are two contrasting viewpoints regarding the capital basis for sustainable development, known as weak sustainability and strong sustainability (Barua and Khataniar, 2016). Both perspectives provide contrasting approaches to measuring and achieving sustainability, focusing on the capital stock of an economy and how it should be managed to ensure the well-being of current and future generations. The concept of strong sustainability posits that certain levels of natural capital must be preserved for the welfare of future generations. This perspective emphasizes that the loss of natural capital cannot be entirely compensated by an increase in human-made capital (Daly, 1990; Gowdy, 2000). Advocates for strong sustainability, mainly ecologists and environmentalists, argue for the essential role of nature in maintaining the balance of life-supporting systems, the value of biodiversity, and the irreplaceability of certain environmental assets (Stoddart, 2011).

Despite the critical considerations raised by the strong sustainability perspective, this study chooses to focus on the concept of weak sustainability. Rooted in the ideas of neoclassical economists Robert Solow and John Hartwick, Weak sustainability is an extension of neoclassical welfare economics (Barua and Khataniar, 2016). The principle of weak sustainability suggests that as long as the overall amount of capital remains constant or grows, sustainability is ensured, regardless of whether the natural capital is diminishing or not (Stern, 1997). For instance, if a decline in natural capital can be offset by an increase in human-made capital, sustainability is still maintained.

Weak sustainability presents a more flexible framework for managing capital, reflecting the economic perspective of sustainable development (Alisjahbana & Yusuf, 2004). It aligns with the economic definition of sustainable development as non-decreasing welfare per capita, ensuring that future generations are not worse off than the present (Alisjahbana & Yusuf, 2004). By maintaining or enhancing the total capital stock - the measure of an economy's productive capacity - an economy can sustain the well-being of its people over time. The constant capital rule, which is central to the weak sustainability approach, therefore provides a practical measure to determine if an economy is on a sustainable development path. Attaining weak sustainability also serves as a prerequisite for achieving strong sustainability, making it a necessary condition. This implies that progressing towards weak sustainability is an initial step towards achieving the more challenging goal of strong sustainability (De Soysa et al., 2012).

In the case of Indonesia, with its heavy reliance on natural resources and significant contributions to economic development from commodity exports, the weak sustainability perspective offers a pragmatic approach to balancing economic growth and environmental protection (Anggareni et al., 2017). By focusing on maintaining or increasing the total capital stock, it allows for strategic resource management that ensures the long-term welfare of its citizens. This approach of measuring sustainable development using genuine savings, an indicator closely aligned with the weak sustainability principle, will be the main focus of this study. Furthermore, in this thesis, the terms "weak sustainability" and "sustainable development" will be used interchangeably.

2.1.1 Previous Discussions on Genuine Savings

From the two discussions above, we move to the indicator used for the weak sustainability. In the realm of sustainable development, it is crucial to have a robust measurement tool that takes into account not just the economic aspects, but also the environmental concerns. Enter Genuine Savings, also known as adjusted net savings. Developed by Pearce and Atkinson (1993), and Hamilton and Clemens (1999), this indicator aligns with the principles of weak sustainability, allowing us to understand the true rate of savings within an economy. It measures the rate of savings or investment within an economy, factoring the depreciation of fixed capital, investments in human capital, depletion of natural resources, and damages resulting from pollution. It builds on the Hartwick rule which posits that “welfare can be sustained indefinitely if gross saving just equals the sum of depreciation of produced assets, depletion of natural resources, and pollution damages” (Hamilton, 2000). The concept of genuine savings was developed as an alternative to traditional measures of economic development, such as Gross Domestic Product (GDP), which do not account for the depletion of natural resources or environmental degradation. The World Bank provides estimates of Genuine Savings and wealth for a large number of countries and regions across the world, using a methodology developed by Hamilton and Clemens (1999).

However, the methodology used to calculate Genuine Savings does not fully encompass natural capital depletion, pollution damage, and human capital formation (Hess, 2010). There have been critiques of its calculation of natural resource depletion, as it can not measure all the natural resource depletion. For example, measures such as water depletion, depletion of fishing stocks, and soil erosion and degradation are not accounted for, and only pollution damage from carbon dioxide and particulate emissions is included (Hess, 2010). Additionally, the current expenditures on education, healthcare, and nutrition are traditionally classified as consumption in national income accounting, even though they contribute to human capital formation and should be considered investments. Although adjusted net savings do include public expenditures on education, a more comprehensive measure of human capital formation would involve private expenditures on education and other expenditures that improve the stock of human capital (Hess, 2010). Due to data limitations, adjusted net saving rates cannot be measured comprehensively. Nonetheless, it is a useful indicator of sustainable development.

Genuine savings provides a more comprehensive measure of a country's economic well-being and its ability to sustain economic growth over the long term. Studies also have been investigating whether Genuine Savings can accurately predict future well-being, and their findings have been highly encouraging (Ferreira et al., 2008; McLaughlin et al., 2012). When the indicator of genuine savings is positive, it implies that a country is increasing its overall stock of capital, including natural capital. Conversely, when the indicator is negative, it suggests that the country is depleting its capital stock. If a country experiences persistently negative genuine savings, it indicates that its development is not sustainable.

Research on genuine savings provides insightful findings regarding the sustainability of economies with various resource endowments. One recurring pattern in this research is the evident unsustainability of countries rich in exhaustible resources but generally economically disadvantaged. Dupuy (2012) highlights this phenomenon, noting that natural resource-rich economies often exhibit lower adjusted net saving rates than their counterparts with similar gross national saving rates. Hess (2010) reports that these countries may even present negative adjusted net saving rates. This alarming trend suggests that the path of development in these nations may not be sustainable. Adding to the debate, Ferreira et al. (2008) postulated that adjusted net savings serve as a useful measure for developing countries but might fall short for developed economies. They reason that this inadequacy stems from the differing nature of economic growth between the two groups. Developing countries rely more on produced and natural capital, which are stocks that adjusted net savings can estimate relatively accurately. On the other hand, developed countries depend on human capital to a greater extent, which is typically estimated only as a residual in most adjusted net savings studies (Ferreira et al., 2008).

Exploring the factors that impact genuine savings has been the focal point in numerous studies. Natural resource intensity in export is noted as one of the factors that can affect genuine savings, as higher intensity in natural resource export would lead to a decrease in the genuine savings rate because of natural resource depletion (Hess, 2010). Dietz et al. (2007) conducted a study using panel data from 115 countries over an 18-year period and identified natural resource abundance, measured by the proportion of fuel and mineral products in total exports, as a significant negative factor in the genuine savings rate. Similarly, Hess (2010) examined cross-section regressions of developing countries during the period of 2001-2006 and found that the percentage of natural resources in exports negatively affected the genuine savings rate. A case study conducted by Pardi and Salleh (2015) focusing on Malaysia also revealed that mineral exports had a negative impact on the country's adjusted net savings.

In addition to examining the natural resource intensity in exports, Hess (2010) identified other factors that exert a positive influence on genuine savings. Notably, the human development index and the proportion of the population in the prime working-age range were found to have a significant positive impact. Similarly, Dietz et al. (2007) reported that economic growth, foreign direct investment (FDI), and democracy also contribute positively to genuine savings. These findings were further supported by Din et al. (2021), who observed a substantial and statistically significant positive relationship between economic growth (measured by GDP per capita) and adjusted net savings. Koirala and Pradhan (2020) investigated a group of 12 Asian

countries using panel data from 1990 to 2014 and confirmed the positive impact of GDP per capita on sustainable development, as represented by adjusted net savings. Likewise, in their study on sustainable development in Kenya from 1991 to 2014, Kaimaru and Kosimbei (2017) revealed a positive association between real GDP per capita and adjusted net savings in the long run. The underlying assumption is that the growth of per capita income is expected to have an influence on sustainable development, since economic theory and empirical studies consistently support the idea that income plays a crucial role in determining saving patterns (Koirala and Pradhan, 2020). As income rises, both saving levels and sustainable development tend to increase. The influence of foreign direct investment (FDI) on genuine savings was also explored by Huo et al. (2022), who specifically focused on Pakistan. Their study highlighted that inflows of FDI make a positive contribution to adjusted net savings. The underlying rationale for this finding is rooted in the positive spillover effects of FDI on machinery advancement and employment growth. Furthermore, FDI facilitates the transfer of technologies, particularly through new capital inputs, thereby enabling countries to allocate resources to various research and development (R&D) activities, ultimately fostering sustainability (Huo et al., 2022).

De Soysa et al. (2012) also mentioned that democracy could influence genuine savings rates positively because governments that operate under a democratic system tend to consume fewer natural resources and invest more in human capital. Many argue that democracy has a positive influence on environmental protection, as it empowers individuals and provides channels through which civil society can influence government decisions (Frankel, 2003). In democratic systems, there is often enhanced international cooperation on environmental issues. The presence of green movements, non-governmental organizations, and activist groups within democratic societies is often cited as evidence of this trend. Additionally, democracy has an impact on the gross savings rate through political factors that shape tax policies and address concerns related to corruption and rent-seeking behavior, which in turn can influence genuine savings (De Soysa et al., 2012). There is a contention that democracies are generally less susceptible to corruption, as argued by Sandholtz and Koetzle (2000). Conversely, corruption has been posited as a potential explanation for the wasteful depletion of wealth in resource-rich states, as highlighted by Dietz, Neumayer, and de Soysa (2007).

Other factors that have important implications on genuine savings are demographic factors, such as population density and size as they can cause environmental stress, which negatively affects the genuine savings rate (De Soysa et al., 2012). Brander (2007) identifies population growth as the primary driver of excessive natural resource utilization, resulting in environmental degradation. Gregne (2009) in his study in examining adjusted net savings and welfare change in developing and developed countries, from 1971 – 2000 also highlighted that there exists negative relationship between population pressure and adjusted net savings.

2.2 Previous Discussions on International Trade and Sustainable Development

The potential impact of international trade on sustainability is a topic of debate, and its effects are uncertain (Belloumi and Alshehry, 2020). In terms of economic development, the initial works in trade theory by Smith (1776) and Ricardo (1817) emphasized the positive impact of international trade on development, and this has been supported by numerous empirical studies (Bernhofen and Brown, 2005). The benefits derived from trade are based on the concept of specialization according to comparative advantage (Haberler, 1930). Numerous studies have also shown that policies promoting international trade can result in a better standard of living and economic growth (de Soysa & Neumayer, 2005). Frankle & Romer (1999) found that trade raises income, and that trade has the ability to boost income by encouraging the accumulation of both physical and human capital, as well as increasing output for a given level of capital. Noguer & Siscart (2005) confirmed this finding, which shows that trade openness led to an increase in income levels.

According to studies by Lee (1995), Kraay (1999), and Coe and Helpman (1995), trade has been shown to provide both static benefits, such as efficient allocation of resources, as well as dynamic advantages such as opening up new markets for domestically produced goods, promoting competition, increasing investment flows, accelerating productivity growth, facilitating learning by doing, and encouraging the acquisition of new knowledge and ideas. Brack (1995) also mentioned that trade can lead to the efficient allocation of resources which help in minimizing waste, ultimately promoting sustainability. Openness to trade can also help to eliminate market distortions and promote good economic policies, which enhance sustainability (de Soysa & Neumayer, 2005). The adoption of environmentally friendly production technologies may be more likely in open markets due to the market-driven price signals. Trading systems that are open and unrestricted facilitate the spread of innovative and improved technologies at a quicker pace compared to systems that are more restricted. This is because eco-friendly production is likely to be more profitable since people value the environment more. Therefore, market-driven prices will encourage the adoption of such production technologies more rapidly (de Soysa & Neumayer, 2005). Adopting the theory of Hecksher Ohlin, Copeland & Taylor (1994, 2004) categorized the effect of trade on environmental services into three effects: scale, technique, and composition. The scale effect suggests that as an economy expands, emissions increase due to quantitative growth, implying a negative environmental impact. Conversely, the technique effect posits that trade-induced economic growth elevates income and living standards, thereby increasing demand for environmental quality. This prompts governments and industries to introduce environmentally friendly legislation and technologies, creating a positive environmental impact. Lastly, the composition effect is tied to trade-induced specialization. Countries with comparative advantages in pollution-intensive 'dirty' goods tend to pollute more, while those excelling in 'clean' goods pollute less. Given that most economies produce a mix of clean and dirty goods,

the net effect on pollution from this compositional shift remains ambiguous. In their analysis of US-Mexico trade, Copeland and Taylor (2004) employ comparative statistics to ascertain whether the composition and technique effects outweigh the scale effect. Their findings suggest that trade overall contributes positively to the environment, as heightened global competition motivates companies to cut pollution in order to decrease costs associated with regulatory compliance (Antweiler et al., 2001; Copeland and Taylor, 2004).

On the other hand, some studies argue that international trade has negative environmental and social impacts, leading to "global pillage" and environmental degradation, while increasing trade can trap poorer countries in dependence on primary exports and lead to a rise in world pollution (Brecher and Costello, 1994; Ropke, 1994; Copeland and Taylor, 1994; Bellmann et al., 2011; Dar and Asif, 2020). Ropke (1994) argues that the push for more trade and specialization could actually hinder efficiency, especially for poorer countries that rely heavily on exporting primary commodities. They believe that by increasing trade, these countries could become trapped in a situation where they are only able to provide resources to a global market that has an insatiable appetite for them, ultimately limiting their economic growth. Kolstad & Wiig (2009) also highlighted the institutional role in influencing the impact of international trade on sustainability. The power dynamics arising from the institutional framework can lead to potential profits and income increases being seized by the governing class (Kolstad & Wiig, 2009). If the sectors that profit from trade liberalization are controlled by a select few, the economic benefits of trade could likely be usurped (Acemoglu and Robinson, 2012; Van der Ploeg, 2011). For sustainability, it's crucial that these gains are cycled back into the economy.

In Indonesia, numerous studies have also been conducted in investigating the relationship between international trade and sustainable development. International trade has been shown to have a positive relationship with economic growth (Islam, 1998, Syahrani et al., 2022). However, its impact on the environment has been mixed. Shahbaz et al. (2013) conducted a study in Indonesia from 1975 to 2011 using the autoregressive distributed lag (ARDL) model, and found that in the long run, trade openness plays a beneficial role in improving environmental quality by reducing CO2 emissions. Purnama et al. (2020) and Adebayo (2021) also discovered that in Indonesia, trade openness reduces environmental degradation which is proxied by CO2 emissions. On the other hand, Anwar and Elfaki (2021) found that trade openness in the long run has a positive relationship with environmental degradation which is represented by CO2 emissions, during the period of 1965 – 2018.

2.2.1 Previous Discussions on Trade Openness and Genuine Savings

Vincent et al. (1997) stated that the optimal path of use or depletion of a given resource is affected by international trade, hence showing the connection between international trade and genuine savings. Studies investigating the impact of trade openness on genuine savings have been limited. De Soysa and Neumayer (2005) empirically assessed the relationship between economic openness and genuine savings. They investigate how the degree of trade openness and foreign direct investment (FDI) impact the level of economic freedom and the rate of

genuine savings (GS) at the national level, for 135 countries, from 1980 to 1999, using panel data regression. The study shows that greater trade openness, dependence on foreign direct investment (FDI), and economic freedom lead to an increase in national genuine savings (GS), contradicting the claims of dependency and world system theorists who argue that a capitalist world system harms future generations' well-being. This study does not support such claims of the negative effects of globalization. In fact, countries that are more integrated into world markets and allow more economic freedom have better protection for their future well-being than isolated countries that heavily restrict economic activity (de Soysa and Neumayer, 2005). In addition to economic openness, De Soysa and Neumayer (2005) also discovered that natural resource intensity in exports had a significant negative impact on genuine savings, in addition to economic openness. The study uses measures of metals, ores, and fuel exports as a percentage of merchandise exports as a proxy for the natural resource intensity in exports. They found that countries that have higher natural resource intensity in exports has a negative impact on genuine savings because resource depletion is higher in these countries.

On the other hand, with the case of India, Sheikh et al. (2020) found that trade openness significantly reduced genuine savings, which contradicts the basic principle of trade theory claiming that free trade leads to the most efficient use of global resources, including the environment and natural capital. These findings support environmentalists and social commentators who argue that trade openness and economic activity carry higher welfare costs.

2.3 Research Gap

Despite the wealth of research on the relationship between trade openness and various aspects of sustainability, a gap exists in the literature concerning the link between trade openness and genuine savings in the Indonesian context. Therefore, comprehending the relationship between trade openness and genuine savings could provide a more comprehensive understanding of Indonesia's sustainability path in the context of international trade. Investigating this specific relationship could not only fill a gap in current academic understanding, but also offer valuable contributions to the wider field of study. First, it would offer new empirical evidence on the impacts of trade openness on weak sustainability, specifically through the lens of genuine savings. Depending on the findings, the evidence provided on this study could potentially challenge existing theoretical models and empirical findings related to trade and sustainability or provide further validation for them. Second, it would enhance our understanding of Indonesia's sustainability trajectory in the face of increasing global integration. Given Indonesia's unique context as a rapidly developing, resource-rich economy with a large and diverse population, such insights could be particularly valuable. Furthermore, the findings could also have practical implications. By providing more detailed insight into the ways in which trade openness impacts genuine savings and thus weak sustainability, the study could inform more sustainable and equitable policy-making in Indonesia.

3 Theoretical Approach

There is no single unified theory that comprehensively addresses the relationship between international trade and sustainable development. Dupuy and Agarwala (2014) highlight this lack of a unified theory, suggesting that different theoretical frameworks may be required to explore the various aspects of this relationship. However, the Heckscher-Ohlin (H-O) model of international trade is one such framework that can be used to study the links between international trade and sustainable development (Dupuy, 2015). In this chapter, we will take a closer look at the Heckscher-Ohlin model, breaking down its key ideas. Subsequently, we will examine its association with the concept of weak sustainability, delineating how the model provides insights into this realm of sustainable development.

3.1 Heckscher-Ohlin Model

The Heckscher-Ohlin (H-O) theory (Ohlin, 1933), also known as the Heckscher-Ohlin model or factor proportions theory, is an economic theory that explains the basis of international trade. This model emphasizes that differences in factor endowment play a significant role in determining the specialization of countries and the occurrence of international trade. Developed by two Swedish economists, Eli Heckscher, and Bertil Ohlin, in the early 20th century, the theory posits that countries will specialize in the production and export of goods that use their abundant factors of production more intensively and import goods that use resources which are relatively scarce in their country (Ohlin, 1933). The theory includes several simplifying assumptions: technology is constant across all countries, production functions demonstrate constant returns to scale, factors of production can move freely within countries and their domestic industries but cannot move between countries, all economic agents are influenced by market prices, and countries possess varying factor endowments (Forstner, 1985). The different factor endowments mean that they possess varying amounts of land, labor, and capital. Some countries may have abundant labor resources, while others may have vast amounts of land or capital. The theory also states that goods differ in factor intensity (Forstner, 1985). Different goods require different proportions of factors of production for their manufacturing process. For example, some goods are labor-intensive, while others are capital-intensive.

The Heckscher-Ohlin model suggests that countries will specialize in producing and exporting goods that utilize their abundant factors of production while importing goods that require factors that are scarce in their country (Ohlin, 1933). This specialization leads to comparative advantages and enables countries to trade with one another, maximizing their overall welfare

(Subasat, 2003). For example, a country with a large labor force and limited capital resources would have a comparative advantage in producing labor-intensive goods, such as textiles. Conversely, a country with abundant capital and a smaller labor force would have a comparative advantage in producing capital-intensive goods, such as machinery.

As a corollary of the Heckscher-Ohlin (H-O) theorem, three other propositions are connected to its core insights, providing further depth and nuance to our understanding of international trade dynamics (Dupuy and Agarwala, 2014). The factor price equalization suggests that as countries engage in free trade, the prices of production factors (such as wages and return on capital) will tend to equalize across countries, assuming that the countries in question share the same technology (Ohlin, 1933). The Stolper-Samuelson theorem establishes a relationship between the prices of output and the prices of inputs (Stolper and Samuelson, 1941). More specifically, an increase in the relative price of a good will lead to an increase in the real return to the factor used intensively in its production, and conversely, a decrease in the real return to the other factor. The Rybczynski theorem addresses the impact of changes in factor endowments on output, holding goods' prices constant (Rybczynski, 1955). Specifically, an increase in a country's endowment of a factor, holding everything else constant, will lead to an increase in output of the goods that use that factor intensively, and a decrease in the output of the other good. For example, a growth in the labor force, ceteris paribus, would lead to an increase in the production and exportation of labor-intensive goods.

The Heckscher-Ohlin theory has been instrumental in providing a theoretical framework for understanding international trade dynamics. However, it's important to note that this theory has its fair share of criticism and limitations. The theory relies on several assumptions which are often not reflective of real-world conditions (Krugman, Obstfeld, & Melitz, 2015). The H-O theory assumes that a good that is capital-intensive in one country is also capital-intensive in another. However, factor intensity can reverse between countries, which limits the theory's applicability (Leontief, 1953). Nevertheless, this theory remains a foundational concept in the study of international economics.

3.2 Connecting H-O Theory and Weak Sustainability

The Heckscher-Ohlin theory, with its emphasis on international trade and specialization based on countries' factor endowments, can be connected to sustainable development in several ways. The connection between the H-O model and weak sustainability is apparent, as both involve capital stocks functioning as factor endowments at their core (Dupuy, 2012). To connect the Heckscher-Ohlin theory with weak sustainability, we can consider the role of factor endowments and trade patterns that can influence the balance and distribution of different types of capital within its economy. In this context, genuine savings can be seen as an indicator of

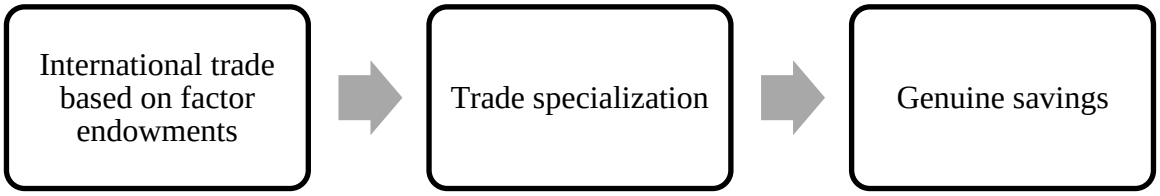
how well a country is managing its factor endowments for sustainable economic growth and intergenerational equity (Dupuy, 2012).

In the context of the H-O theory, trade will lead to specialization in producing and exporting goods that utilize their abundant factors of production, for example, natural resources goods, labor intensive, and capital-intensive goods. This can affect weak sustainability in several ways. For example, countries that are rich in natural resources may be inclined, according to their comparative advantage, to exploit and trade these resources which could lead to an accelerated depletion of these resources (Dupuy, 2012). Another important aspect when the HO (Heckscher-Ohlin) theorem is extended to include environmental considerations is that "environmental resources" encompass not only finite resources like forests, fisheries, and exhaustible stocks but also elements such as air, water, and assimilative capacity (Dupuy and Agarwala, 2014). The term "assimilative capacity" can be understood as a way to refer to regulatory stringency, where countries with stricter pollution controls effectively possess fewer environmental resources (Baldwin, 2008). Then in this case countries that possess comparative advantages in the production of "dirty" goods tend to generate higher levels of pollution, while those with advantages in the production of "clean" goods tend to have lower pollution levels (Copeland and Taylor, 2004).

The Stolper-Samuelson theorem highlights the significance of competition not only between countries but also factors in a globalized world (Dupuy and Agarwala, 2014). Trade openness might increase the returns to abundant factors (e.g., natural resources or unskilled labor), but decrease the returns to scarce factors (e.g., capital or skilled labor). Leamer (1995) employs this theorem to elucidate the downward wage pressures experienced by developed countries during the 1990s. This could have important implications for social sustainability. However, from a weak sustainability perspective, the potential negative consequences, such as exploitation and degradation of these resources can be alleviated, if not counterbalanced, by the positive effects, such as income growth and enhanced efficiency resulting from the improved allocation of productive capacities (Dupuy and Agarwala, 2014). It can be balanced by an increase in other forms of capital in order to maintain intergenerational equity. For instance, revenues obtained from resource extraction could be invested in education or infrastructure, thereby increasing human or manufactured capital.

In essence, Figure 1 provides a graphical representation of a theoretical framework that links the Heckscher-Ohlin (H-O) theory and the concept of weak sustainability, as measured by genuine savings. Put simply, international trade based on factor endowments can result in specialization in the production and export of goods that utilize a country's abundant factors of production. This specialization can have various impacts on genuine savings, depending on its influence on the components of genuine savings. For instance, in the case of a country specializing in natural resource goods, it is more likely to contribute to the depletion of natural capital, thereby reducing genuine savings. However, if the revenues generated from this specialization can be invested in physical or human capital, it can lead to positive genuine savings as well.

Figure 1. Theoretical Framework



Drawing from the theoretical framework, it allows us to begin investigating results for the research questions. The theories cast light on how trade openness could relate to sustainability outcomes in Indonesia. With Indonesia's rich endowment of natural resources and labor, the principles from these theories help us anticipate trends in trade that could shape the sustainability trajectory of the nation, especially from the perspective of weak sustainability and genuine savings. Simultaneously, our theoretical framework helps in identifying the factors that could play an important role in defining the relationship between trade openness and sustainable development. This speaks directly to our second research question that focuses on the dynamics that influence this relationship.

4 Data and Methodology

This chapter provides an overview of the data utilized and the methodological approach employed to examine the complex relationship between trade openness and genuine savings in Indonesia spanning from 1981 to 2019. The first section focuses on explaining the data sources, describing the data used, presenting descriptive statistics, and discussing any limitations. Following that, the second section elaborates on the selected methodological approach in detail.

4.1 Data

The annual data set used for this thesis covers the period 1981 to 2019. The reason why this period is chosen is because during this time, Indonesia had experienced a significant increase in its international trade, with exports and imports growing at a rapid pace. The government implemented a series of economic reforms, including the reduction of trade barriers, that helped to promote international trade and attract foreign investment (Puspitawati, 2021). The data used for this thesis comprises of the following variables listed in Table 1: genuine savings or adjusted net savings (GS), trade openness (TO), foreign direct investment (FDI), natural resource intensity in exports (NAT), population density (DEN), and economic growth (GROWTH). GS measures genuine savings rate, as an indicator of weak sustainability. We include trade openness (TO) as an independent variable in our model to emphasis the role of international trade, which is in line with the H-O model. TO indicates the degree of trade openness which is calculated by the proportion of Indonesia's imports and exports to its GDP. As a country that is rich in natural resources, following the H-O theory, it is predicted that Indonesia would specialize in exporting natural resources goods. Therefore, the variable of natural resource intensity in exports will be used, which represents the natural resource exports as a percentage of total exports. Other variables, namely FDI, population density and economic growth are also included, following its influences based on literature review, which will be explained more thoroughly in the methodology section. FDI represents the investment share of real GDP. Population density is calculated by dividing the total population by land area and square kilometers. Economic growth is annual gross domestic product per capita growth. All of the data, except natural resource intensity, are collected from World Development Indicators from World Bank (2023). Natural resource intensity in export data is calculated and collected from UN COMTRADE (2023). The term "natural resource" refers to product categories listed as SITC1 0 (Food and live animals), 1 (Beverages and Tobacco), 2 (Crude materials, inedible, except fuels), 3 (Mineral fuels, lubricants, and related materials - including coal and oil), 4

(Animal and vegetable oils and fats - including palm oil), and 68 (Non-ferrous metals). All variables are transformed into natural logarithms for statistical reasons.

Table 1. Variables description

Symbols	Variables	Data Source
GS	Genuine Savings or Adjusted Net Savings	World Bank
TO	Trade Openness	World Bank
FDI	Foreign Direct Investments	World Bank
NAT	Natural Resource Intensity in Exports	UN COMTRADE
DEN	Population Density	World Bank
GROWTH	Growth of GDP per capita	World Bank

Table 2 presents a summary of descriptive statistics for the variables included in the analysis. It includes the number of observations, mean, median, minimum, maximum, and standard deviation of the time series data for each variable. On a closer examination, for genuine savings on average the value is 9.73 which suggests that Indonesia on average has a positive saving rate. For trade openness, the average and median values suggest that Indonesia is relatively open to trade. Natural resource intensity in exports has an average of 59.4, indicating that for Indonesia, natural resources constitute a significant portion of exports. The data shows that Indonesia has a modest level of foreign direct investment, but the negative minimum (-2.757) indicates that the country experienced a net outflow of investment. For economic growth, the mean rate is 4.017, but the negative minimum suggests that Indonesia experienced economic contraction. Meanwhile, for population density, the average and median values are quite close (111.073 and 111.681 respectively), suggesting a symmetric distribution. The range from 79.134 to 140.641 points to a moderate degree of variation in population density among these entities.

Table 2. Descriptive statistics

Variable	No. Obs	Mean	Median	Min	Max	Std. Dev
Genuine Savings	39	9.735	11.421	-3.872	21.191	8.220
Trade Openness	39	52.880	51.877	37.421	96.186	8.220
Foreign Direct Investments	39	1.042	1.192	-2.757	2.916	1.271
Natural Resource Intensity in Exports	39	59.359	54.736	39.785	98.025	15.903
Population Density	39	111.073	111.681	79.134	140.641	18.466
Economic Growth	39	4.017	5.501	-14.127	6.520	3.349

Given the dataset and the variables chosen for this study, there are several limitations to be considered. First, it should be noted that the measurement of genuine savings might not fully represent all the natural capital depletion. The World Bank (2006) advises caution in interpreting the calculated savings measures due to the exclusion of various assets, including diamonds, fisheries, soil erosion, and the value of ecosystem services. The measure used as a

proxy for human capital also underestimates its true value since it solely relies on education expenditure, failing to account for all investments made in human capital. Additionally, the measure does not capture the contribution of on-the-job training or private education expenditure.

4.2 Methodology

4.2.1 Model Specification

To investigate the relationship between trade openness and genuine savings, multivariate time series regressions will be used. The model is specified in equation 1 as below:

$$lnGS_t = \beta_0 + \beta_1 lnTO + \beta_2 lnFDI + \beta_3 lnNAT + \beta_4 lnDEN + \beta_5 lnGROWTH + \mu_t$$

Here the dependent variable is genuine savings (*GS*), and the independent variables are trade openness (*TO*), foreign direct investment (*FDI*), the natural intensity of exports (*NAT*), population density (*DEN*), and economic growth (*GROWTH*). The time period is represented by *t*, and the error term is represented by μ. In line with the Heckscher-Ohlin model's emphasis on the role of international trade, we include trade openness (TO) as an independent variable in our model. In addition to trade openness, the model includes other independent variables that may affect genuine savings or obscure the relationship between trade openness and genuine savings, as noted in the literature review. Foreign direct investment (FDI) is included because trade openness may increase the flow of FDI, which can facilitate sustainable development by enabling investment in research and development (R&D) projects and technology transfer (Ahmed et al., 2020). Moreover, the intensity of natural resource exports is included as it has been found to have a negative impact on genuine savings, since increased reliance on natural resources leads to higher resource depletion (de Soysa and Neumayer, 2005). Demographic factors also affect trade dependency, savings rates, and environmental pressures (Alesina and Spolaore, 1997). Therefore, the model incorporates population density, as it plays a crucial role in influencing the aforementioned factors. Economic growth is included because it is believed that higher levels of growth or income have higher saving rates and possibly better environmental standards (de Soysa and Neumayer, 2005). Furthermore, according to de Soysa et al. (2012), democracy can significantly impact genuine savings, as democratic governments tend to prioritize investment in human capital and consume fewer natural resources, resulting in higher savings rates. Thus, a dummy variable is incorporated to examine the relationship between democracy and genuine savings, with the year 2000 serving as the starting point for the democracy period.

4.2.2 Model Selection

Before conducting the regression, several tests are conducted to help determine the right model for the data. The first step is to conduct a stationary test, which is to test whether the variables are stationary or not. Stationarity is a key concept that refers to the statistical properties of a time series that do not change over time. A stationary time series is one where the mean, variance, and covariance are constant over time (Enders, 2014). Conversely, a time series is considered non-stationary if its mean, variance, and auto-covariance are time-dependent. When there is a presence of non-stationarity, using methods designed for analyzing stationary time series can lead to spurious results (Gujarati, 2011). Non-stationary variables can be transformed into stationary ones through several methods, such as taking the first difference, incorporating variables into regression models, or using filtering techniques to eliminate trends and seasonality. However, it is important to note that data transformation has the potential to eliminate the long-run information and associations among the variables (Salles et al., 2019). Therefore, when a spurious relationship exists due to non-stationarity, Cointegration methods can be utilized to investigate if variables have a long-term association. When cointegration is present, it is possible to determine both the short-term dynamics of the relationship as well as long-term coefficients (Salles et al., 2019). To test the stationarity, two unit root tests, which are the Augmented Dickey-Fuller test (ADF) and the Phillips-Peron test (PP) are conducted. The results are shown in Table 2.

Table 3. Results of Unit Root Tests

Variables	ADF Test		PP Test		Order of Integration
	Level	First Difference	Level	First Difference	
GS	-2.178	-6.785***	-2.273	-6.948***	I(1)
TO	-2.485	-8.530***	-2.254	-8.991***	I(1)
FDI	-4.30***	-5.753***	-3.51***	-5.832***	I(0) or I(1)
NAT	-1.529	-3.914***	-2.236	-3.574***	I(1)
DEN	-7.85***	-2.781*	-5.66***	-2.341*	I(0) or I(1)
GROWTH	-4.59***	-7.989***	-4.64***	-9.397***	I(0) or I(1)

Note: *, **, *** Level of significance at 1%, 5%, and 10%, respectively.

The results show that none of the variables exhibit second-order integration, instead, they are either stationary at their levels or their first differences, suggesting that they are integrated at the order of zero or one. When dealing with mixed time series data, where some variables are stationary (integrated of order 0, or I(0)) and others are non-stationary (integrated of order 1, or I(1)), autoregressive distributed lag (ARDL) approach to cointegration is a suitable choice (Jalil and Rao, 2019).

4.2.3 Autoregressive Distributed Lag (ARDL) model

The autoregressive distributed lag (ARDL) model is a type of model that utilizes ordinary least squares (OLS) and can be used to analyze time series data that are non-stationary or have mixed

orders of integration (Pesaran and Shin, 1999). The ARDL cointegration method offers several advantages over other cointegration techniques such as those by Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990). While Johansen cointegration techniques require a large sample size for validity, the ARDL method is more statistically valid in smaller samples. The ARDL procedure allows for variables to have different optimal lags, which is not possible with traditional cointegration methods. The ARDL technique generally produces unbiased estimates of the long-run model and valid t-statistics even if some regressors are endogenous (Salles et al., 2019). Moreover, the model's long-term and short-term parameters are estimated simultaneously.

The ARDL model is specified in equation 2 as below:

$$\begin{aligned} \Delta lnGS_t = {} & \varepsilon_0 + \sum_{k=1}^{n1} \varepsilon_{1k}\ \Delta lnGS_{t-k} + \sum_{k=0}^{n2} \varepsilon_{2k}\ \Delta lnTO_{t-k} + \sum_{k=0}^{n3} \varepsilon_{3k}\ \Delta lnFDI_{t-k} \\ & + \sum_{k=0}^{n4} \varepsilon_{4k}\ \Delta lnNAT_{t-k} + \sum_{k=0}^{n5} \varepsilon_{5k}\ \Delta lnDEN_{t-k} + \sum_{k=0}^{n6} \varepsilon_{6k}\ \Delta lnGROWTH_{t-k} \\ & + \gamma_1 lnGS_{t-1} + \gamma_2 lnTO_{t-1} + \gamma_3 lnFDI_{t-1} + \gamma_4 lnNAT_{t-1} + \gamma_5 lnDEN_{t-1} \\ & + \gamma_6 lnGROWTH_{t-1} + \mu_t \end{aligned}$$

The expression with summation ($\sum$) signs represents the short-term dynamics of the variables, and the expression with gamma (γ) represents the long-run relationship between the variables. Furthermore, ε_0 depicts constant, Δ symbolizes the first difference, and μ_t is the Gaussian white noise term. The complete results for both short- and long-term dynamics are obtained using the ARDL bounds testing approach, which consists of several steps. First, the model is estimated using the OLS method, and an appropriate lag selection criterion, such as the Akaike Information Criterion (AIC) or Schwarz Information Criterion (SIC), is applied. Subsequently, an F-test is conducted to investigate the presence of a long-term relationship among the variables. The test statistic is then compared to the critical values provided by Pesaran et al. (2001). If the test statistic exceeds the upper bound, the null hypothesis is rejected, indicating a long-run relationship (cointegration) among the variables. Conversely, if the test statistic falls below the lower bound, the null hypothesis is not rejected, suggesting the absence of cointegration.

Upon establishing the existence of a long-run relationship among the variables, the next step involves estimating a general error correction model (ECM). The ECM for equation 2 is specified below:

$$\Delta lnGS_t = \varepsilon_0 + \sum_{k=1}^{n1} \varepsilon_{1k}\ \Delta lnGS_{t-k} + \sum_{k=0}^{n2} \varepsilon_{2k}\ \Delta lnTO_{t-k} + \sum_{k=0}^{n3} \varepsilon_{3k}\ \Delta lnFDI_{t-k} + \sum_{k=0}^{n4} \varepsilon_{4k}\ \Delta lnNAT_{t-k} + \sum_{k=0}^{n5} \varepsilon_{5k}\ \Delta lnDEN_{t-k} + \sum_{k=0}^{n6} \varepsilon_{6k}\ \Delta lnGROWTH_{t-k} + \delta ECT_{t-1} + \mu_t$$

The δ represents the rate at which variables need to adapt to their long-run levels following a short-term disturbance. Moreover, $ECTt-1$ refers to the residuals obtained from the estimated long-run relationship model represented by Equation 2.

In order to ensure that the regression model meets the necessary assumptions and that the results can be validly interpreted, several diagnostic tests were performed. To check whether serial correlation exists, the thesis conducted the Breusch-Godfrey test (Godfrey, 1978). In order to ensure that the residuals exhibit homoscedasticity, which implies constant variance, the Breusch-Pagan-Godfrey test (Breusch & Pagan, 1979; Godfrey, 1978) was employed in this study. The Breusch-Pagan-Godfrey test helps to assess whether there is a systematic relationship between the variance of the residuals and the independent variables, thus verifying the homoscedasticity assumption. To evaluate the normality of the residuals, the Jarque-Bera test (Jarque & Bera, 1987) was employed in this thesis. Normality of the residuals is an essential assumption in statistical analysis, as it ensures that the errors of the regression model follow a normal distribution. The Jarque-Bera test assesses the skewness and kurtosis of the residuals and compares them to the expected values under the assumption of normality. If the p-value of the test is greater than a predetermined significance level, it suggests that the residuals are normally distributed. Lastly, to ensure that the chosen model specification correctly reflects the underlying relationship between the variables, the Ramsey RESET (Regression Equation Specification Error Test) was conducted whether the model is correctly specified (Ramsey, 1969).

5 Empirical Analysis

This chapter provides the results from the ARDL regression model, providing the short-term and long-term relationship between genuine savings and dependent variables. Furthermore, the findings will also be discussed further, with a focus on the dynamics that could explain the existing relationships, with a special focus on international trade and sustainable development.

5.1 Results

5.1.1 ARDL Bounds Test for Co-integration

Table 3 shows that the test statistic in both models surpasses the critical value bound for I (1) at all levels of significance. Thus, we would reject the null hypothesis of no cointegration at the 10%, 5%, and 1 % significance levels. This confirms the existence of a long-term relationship between genuine savings and the other independent variables. Once the equilibrium relationship between the variables is confirmed, the study estimates the long-term and short-term impacts of independent variables, particularly trade openness, on sustainability.

Table 4. Bounds Test Result

	Test Statistic	Significance	I(0)	I(1)
F-statistic	9.35	10%	2.26	3.35
K	5	5%	2.62	3.79
		1%	3.41	4.68

5.1.2 Short-run and Long-run Estimates

In Table 4, the upper panel displays the long-term results, while the lower panel presents the short-term results. The models displayed two specifications: Model 1 and Model 2, which include a Democracy variable. The results from the two models provide insight into the relationship between genuine savings, trade openness, foreign direct investment, natural resource intensity in exports, economic growth, and population density.

From the results, in the short run, trade openness coefficients are negative in both models, suggesting that changes in trade openness have a negative relationship with the changes in the dependent variable in the short run. This implies that as a country opens its economy more to international trade, the rate of genuine savings may decrease in the short term. The coefficients of foreign direct investment (FDI) are negative in both models, yet they are not statistically significant. On the other hand, the coefficients of economic growth are positive and insignificant in both models. Natural resource intensity in export terms is negative and significant in both models, suggesting that changes in natural resource intensity in exports have a negative relationship with the changes in genuine savings in the short run. This may be reflective of resource depletion and environmental degradation that occurs as a result of exporting natural resources.

In the long run, the coefficient of trade openness is negative and significant in Model 1, implying that a 1% increase in trade openness is associated with a decrease in the dependent variable by 4.074%. However, in Model 2, the coefficient is still negative but not significant, suggesting that the political context may interact with trade openness to influence its effect on genuine savings. A similar trend is seen with FDI. The coefficient of foreign direct investment is negative and significant in Model 1, suggesting that a 1% increase in FDI is associated with a decrease in genuine savings of 1.023% in the long run, all else equal. But the coefficient becomes insignificant when democracy is included in Model 2. This could imply that the effect of FDI on genuine savings could be influenced by the country's political system, possibly through the policies or regulations that govern FDI. Natural resource intensity in export terms is negative and significant in Model 1 which suggests that as a country's exports become more heavily weighted towards natural resources, genuine savings decrease. This could be due to the depletion of these resources and the associated environmental costs, which reduces genuine savings, a measure that explicitly accounts for environmental degradation and resource depletion. However, once democracy is introduced into the model (Model 2), the relationship between natural resource intensity in exports to genuine savings becomes insignificant, even though the coefficient is negative. This indicates that the political structure of a country, as captured by the democracy variable, may interact with natural resource intensity in exports to affect its impact on genuine savings. The coefficient of economic growth is not significant in both models, suggesting that economic growth does not have a statistically significant relationship on the dependent variable in the long run. The coefficient of population density is negative and significant in Model 1 but becomes insignificant in Model 2.

Table 5. ARDL Regressions Results

	Model 1				**Model 2 with Democracy**			
	Coefficient	Std. err.	t	P>|t|	Coefficient	Std. err.	t	P>|t|
Long Run Coefficients								
lnTO	-4.074***	1.136	-3.59	0.002	-2.450	1.560	-1.570	0.134
lnFDI	-1.023**	0.389	-2.63	0.016	-0.432	0.549	-0.790	0.441
lnNAT	-0.142***	0.803	-4.22	0.001	-1.040	1.221	-0.850	0.406
lnGROWTH	-0.097	0.134	-0.73	0.476	-0.135	0.121	-1.110	0.280
lnDEN	-4.592**	1.693	-2.41	0.031	-3.335	-4.035	-0.560	0.585
Democracy					-1.776	1.297	-1.370	0.188
Constant	-0.748***	0.246	-3.04	0.004	-0.803***	0.244	-3.21	0.006
Short Run Coefficients								
ΔlnTO	-1.791*	1.036	-0.22	0.083	-1.837**	0.756	-0.780	0.045
ΔlnTOt-1	-1.641**	0.695	-2.36	0.034	-1.658**	0.678	-2.450	0.031
ΔlnFDI	-0.483	1.557	-0.31	0.761	-0.662	1.524	-0.430	0.672
ΔlnFDIt-1	-1.762	1.126	-1.57	0.142	-1.066	1.223	-0.870	0.401
ΔlnNAT	-1.791*	0.887	0.110	0.091	-4.301*	2.615	-0.280	0.079
ΔlnNATt-1	-3.496**	1.557	0.22	0.043	-2.978*	1.571	-0.190	0.082
ΔlnGROWTH	0.465	0.496	0.94	0.366	0.184	0.530	0.350	0.735
ΔlnGROWTHt-1	0.410	0.303	1.36	0.198	0.418	0.295	1.420	0.182
ΔlnGROWTHt-2	0.193	0.248	-0.78	0.449	0.055	0.309	0.180	0.861
Constant	2.576	1.058	2.44	0.030	-5.119	2.603	-0.200	0.847
ECTt-1	-0.530***	0.105	-5.04	0.000	-0.906***	0.195	-8.264	0.005
Diagnostic Tests								
Serial correlation		0.377				0.325		
Heteroskedasticity		0.943				0.865		
Normality		0.348				0.324		
Functional form		0.643				0.623		

Looking at the democracy variable, its coefficient in Model 2 is negative but insignificant. This indicates that while the political system may interact with other variables to influence genuine savings, its direct relationship to genuine savings is not statistically significant. The diagnostic tests at the bottom of the regression results provide additional information on the validity and reliability of the model. These tests aim to check the assumptions of the econometric model and to reveal any specification errors. Based on the results, it shows that both models do not suffer from autocorrelation and heteroskedasticity. The results also show that the errors appear to be normally distributed, and correctly specified.

5.2 Discussion

In the following discussion, we will delve into the analysis of the results derived from our Autoregressive Distributed Lag (ARDL) model. This model was employed to explore the long-term and short-term relationships between our variables of interest - trade openness, foreign direct investment, natural resource intensity in export, economic growth, population density, and democracy - and the dependent variable, genuine savings. The findings from this study illuminate a variety of associations that are of importance to the formulation of policy and the establishment of strategies for economic development in Indonesia. In the long-run and short-run coefficients, the negative relationship between trade openness and adjusted net savings challenges traditional assumptions about the benefits of international trade in Indonesia. Following the Heckscher-Ohlin (H-O) theory, international trade driven by specialization leads to comparative advantages and enables countries to trade with one another, maximizing their overall welfare (Leamer, 1995). In the case of Indonesia, it is found that international trade in Indonesia greatly contributed to its economic growth (Islam, 1998). Furthermore, the economic gains from Indonesia's advantage in exporting naturally sourced and primary product are significant (Purwono et al., 2022). However, looking more on the sustainability side, the results show that international trade might undermine sustainability.

The coefficients of trade openness for both models are negative and statistically significant in the short run, but not statistically significant in the long run when a dummy for democracy is included. However, the direction of the coefficient is still negative. Turning into the second research question, this section will also explore the dynamics of the relationship, through investigating the possible mechanisms and factors affecting the relationship between trade openness and genuine savings. The pattern of trade and specialization offers intriguing insights into the relationship under examination. Drawing from the concept of Revealed Comparative Advantage (RCA), it is found that Indonesia predominantly exports goods from sectors specializing in the utilization of natural resources and unskilled labor (Hasanah, 2020). This specialization has a distinct implication for the country's natural resource capital, as it tends to accelerate resource depletion. This is supported by our findings of a negative association between natural resource intensity in export variables and genuine savings. Like the case of trade openness, the coefficients of these relationships in our model exhibit a similar pattern: they are statistically significant and negative in the short run, indicating a short-term impact of natural resource intensity in export on genuine savings. However, when we introduce a democracy dummy into the model to account for political transitions, these coefficients lose their statistical significance in the long run. Despite this, it's noteworthy that the coefficients retain their negative direction, suggesting an enduring albeit the subtle impact of trade patterns and specialization on genuine savings over time.

Looking at the historical context, in the early 1980s, Indonesia's significant resource assets are its abundant natural resources and labor force, suggesting that the country has a comparative advantage in natural resources and labor-intensive activities (Soesastro and Basri, 2005). In the

1980s, Indonesia underwent economic reforms, resulting in the robust expansion of non-oil and gas exports, manufactured goods, and some commodities (Hill, 1996). Indonesia witnessed a shift in its economic landscape, with a decreased reliance on oil and an increased emphasis on other natural resource products. Notably, liquefied natural gas, copper, gold, and timber gained significant importance during this period (Tadjoeddin, 2007). During the 1990s, oil, and gas accounted for approximately 30% of Indonesia's total exports, while minerals and related products contributed 19%, and forest products comprised 10% of the country's export composition (Simangunsong, 2004). It is also noteworthy that while these natural resources revenue played a vital role for economic development, the non-natural resource-based sector, particularly labor-intensive industries focused on exports, has emerged as the primary contributor to economic growth (Resosudarmo, 2005, p.8). During the period from 1982 to 1996, the industrial policy of Indonesia focused on fostering the growth of labor-intensive, export-oriented, and non-oil and gas manufacturing sectors. This period witnessed further liberalization of the economy, although certain protective measures were maintained at the micro level, particularly in heavy and hi-tech industries (Puspitawati, 2021). The period witnessed a rapid growth and development of labor-intensive, export-oriented, and non-oil and gas manufacturing industries (Puspitawati, 2021). However, this expansion in exports on commodity and manufactured goods has come with problems of environmental degradation. The utilization of natural resources in Indonesia has not been without its share of difficulties. As a result, there has been a notable rise in instances of environmental degradation over the years (Resosudarmo, 2005, p.3). Exports in manufacturing also associated with environmental degradation pressures, as the industries are mostly high polluting industries (Resosudarmo, 2005, p.6). This has led to increasing criticism directed towards the government for its failure to effectively manage the rate of resource exploitation while also protecting the interests and well-being of future generations (Resosudarmo, 2005, p.4).

Moving on to the 2000s and 2010s, regardless of the effort to be the key player in the global value chain and the fact that higher value-added sectors such as chemical, machinery, and processed wood grow stronger, the top five export products still heavily depend on natural resource-intensive and unskilled labor-intensive commodities (Hasanah, 2020). The top five exports of Indonesia consist of coal, palm oil, textile, base metal product, and natural gas. While mineral fuels, machinery, electrical equipment, steel, and plastic became the top five Indonesian imports. Due to this, Anggraeni (2017) pointed out that mineral extraction, forest resource depletion, and environmental degradation in Indonesia have been increasing and are potentially exceeding sustainable yield levels. Hence, this condition may jeopardize Indonesia’s future sustainable development. However, following the weak sustainability perspective, it is predicted that international trade could be associated to higher genuine savings when these potential negative consequences, such as exploitation and degradation of these resources can be alleviated, if not counterbalanced, by an increase in other forms of capital in order to maintain intergenerational equity. The results could indicate that Indonesia has not sufficiently reinvested the resource rents from trade in other forms of human and produced capital.

Mikesell (1997) pointed out that Indonesia had not invested adequately in productive industries that could offset the reduction in resource-based export earnings when the export price of

natural resource commodities decreased in 1982 and caused a major decline in the gross investment of Indonesia. This significant reduction in the gross investment therefore could have a negative association with genuine savings. Henstridge et al. (2013) also found that total wealth which is proxied by adjusted net savings from 2002 was in decline. In 2002, the global commodity boom increased export earnings in Indonesia. A portion of the substantial depletion of natural resources has been converted into physical capital, notably through an increase in construction activities (Henstridge et al., 2013). This primarily includes the expansion of real estate in Jakarta, characterized by the construction of shopping malls and residential apartments. Apart from investment in real estate, a significant portion of windfall revenues generated during the commodity price boom has been allocated towards subsidies (Henstridge et al., 2013). Specifically, energy subsidies, including fuel and electricity, have accounted for an average of 16.4% of annual expenditures since 2005. In 2011, spending on fuel subsidies nearly equaled the total resource revenues. Moreover, fuel subsidies have increased as a proportion of government revenues, rising from 9.6% in 2002 to 12.5% in 2011. These subsidies primarily benefit wealthier segments of the population, with the richest 20% receiving approximately two-thirds of the direct benefits, while the bottom 10% receiving only 1% in 2009. Similar patterns are observed for electricity subsidies (World Bank, 2007; Enrique et al., 2010). Therefore, this could show why negative relationships exist between trade openness, natural resource intensity in export, and genuine savings.

Looking at the foreign direct investment variable, the results show that in the long run and short run the coefficients are negative, however, it is only significant in the long run for Model 1, even though the coefficient is still negative. In the late 1980s, Indonesia underwent a significant transformation by embracing foreign direct investment (FDI), signifying a notable departure from the restrictive policies that prevailed in the preceding decade (Puspitawati, 2021). This shift in approach was primarily motivated by the considerable decrease in oil prices experienced in the early 1980s. Faced with mounting economic challenges, the Indonesian government proactively implemented a comprehensive set of structural adjustments in the mid-1980s. However, the inflow of FDI was also marked by significant environmental degradation, primarily due to the exploitation of natural resources (Resosudarmo, 2005, p.5). During Soeharto's leadership, Indonesia witnessed a significant increase in the extraction of its natural resources. Recognizing the immense developmental potential embedded in the country's abundant reserves of forests, oil, gas, and minerals, Soeharto enacted laws in the early years of his presidency that yielded remarkable results, evident in the rapid expansion of multinational companies engaged in natural resource extraction within Indonesia in just a few years. These further caused intensive exploitation of Indonesia’s natural resources, leading to significant environmental consequences (Barbier et al., 1994; Casson and Obidzinski, 2002). The studies further argue that the intensive exploitation of Indonesia's natural resources, especially its forests, led to increase deforestation and biodiversity loss. The laws enacted during the Soeharto era made it easier for foreign companies to carry out large-scale logging activities, leading to significant environmental pressures. In addition to the exploitation of natural resources, a considerable portion of the FDI flowing into Indonesia following the structural adjustment reforms was directed towards highly polluting industries such as paper, chemical, and metal

products (Resosudarmo, 2005, p.7). After the Soeharto era, foreign investments still had a significant influence on the primary sector. De Crombrugghe et al., (2020) noted that during 2009 – 2019, there was an increasing share of FDI, driven by Indonesia's rich endowment of natural resources. Foreign investors are also often gravitated toward sectors characterized by higher levels of CO2 emissions, signifying more polluting activities (De Crombrugghe et al., 2020). Therefore, this offers insights into the observed negative correlation between FDI and adjusted net savings, as the environmental consequences of FDI become apparent through the depletion of Indonesia's natural capital.

The coefficients of economic growth are insignificant, showing that the relationship between economic growth and genuine savings is ambiguous in Indonesia. However, the population density coefficient shows a negative and significant relationship in the long run, which might indicate the environmental stress caused by the increasing population, as noted by Alesina and Spolare (1997). Countries with a high population density are associated with increased pollution and unsustainability. Additionally, the greater energy and resource consumption by a high population is incongruent with the principles of sustainability (Taghvaee et al., 2023). It also should be noted that the rising in population density in Indonesia mainly concentrated in Java Island, as most of Indonesia's population is concentrated in the island (Ilham, 2021). However, it can still affect Indonesia as the high population density in Java can drive an increase in demand for natural resources from other parts of Indonesia (Ilham, 2021). This demand, coupled with the economic activities on the island, could lead to resource depletion and environmental degradation in these resource-rich regions (Ilham, 2021).

Lastly, when taking into account the relationship between democracy and genuine savings, its coefficient is insignificant. However, the magnitude of the coefficient is still negative. Several explanations can potentially explain the result. The reason why democracy does not have any significant relationship could be explained by the fact that policy outcomes in Indonesia, both before and after the democratization are majority unchanged, as the policies adopted by both regimes were not very different (Phyo, 2012). Looking at resource management, the downfall of President Soeharto marked a significant turning point in Indonesia, leading to the transition from an authoritarian society to a more democratic one. Simultaneously, there was a shift from a highly centralized system of government to a more decentralized one (Phyo, 2012).

These transformations held the promise of better natural resource management and the pursuit of a sustainable and equitable long-term development path (Phyo, 2012). However, thus far, the extensive changes that have unfolded in Indonesia have resulted in an atmosphere of political instability, inconsistent laws and regulations, weak law enforcement, a fragile governmental system, and insecure land tenure. (Phyo, 2012). Consequently, the management of natural resources in the country has not deteriorated, but it has also not shown signs of improvement (Phyo, 2012).. Political instability can be also negatively associated with genuine savings, as noted by Aghaeli and Taghvaee (2022). The presence of political stability creates a conducive environment for an increase in adjusted savings, as a secure and stable political setting is essential for conducting business and economic activities, as savings tend to grow within a safe political framework (Aghaeli and Taghvaee, 2022).

6 Conclusions

This study aimed to investigate and analyze the relationship between trade openness and sustainable development in Indonesia for the period of 1981 – 2019. Two main questions were addressed. The first question is focused on what the relationship between international trade and sustainable development in Indonesia is. The second question aims to seek explanations based on the result from the first question, where it aims to explain the dynamics of the relationship between international trade and sustainable development in Indonesia. Our results revealed that there is a significant negative relationship between international trade and sustainable development, as measured by genuine savings, in both the short and long term. The observed relationship between trade openness and sustainable development challenges traditional assumptions about the benefits of trade and suggests that more attention needs to be given to the sustainability aspects.

These outcomes can be linked to Indonesia's trade patterns and specializations. Indonesia is known for its heavy export of goods from sectors reliant on natural resources and unskilled labor, which likely accelerates resource depletion. Similarly, natural resource intensity in export variables has a negative relationship with genuine savings. Examining the historical context, Indonesia, rich in natural resources and labor force, experienced economic reforms in the 1980s. The shift led to the rapid expansion of non-oil and gas exports, such as manufactured goods and some commodities, and reduced reliance on oil. This evolution of the economic landscape was accompanied by environmental degradation issues due to intense resource utilization. Despite the problems, labor-intensive industries focused on exports emerged as significant contributors to economic growth. These developments continued into the 2000s and 2010s, with the top five export products still being resource and unskilled labor-intensive commodities. The weak sustainability perspective suggests that trade could enhance genuine savings if the negative consequences of resource exploitation and environmental degradation can be counterbalanced by an increase in other forms of capital. However, this balance seems not to have been achieved in Indonesia, as the country hasn't reinvested its resource rents from trade sufficiently into productive sectors.

This issue became especially apparent during the global commodity boom in 2002, where the increase in export earnings did not translate into an increase in total wealth, as reflected by declining adjusted net savings. Instead of adequately reinvesting in productive sectors, a significant portion of windfall revenues was directed towards subsidies, particularly energy subsidies. These subsidies, mainly benefiting the wealthier population segments, have likely further negatively affected genuine savings. Overall, trade openness and natural resource intensity in export negatively influence genuine savings in Indonesia. The historical context and economic practices contribute to this trend, highlighting the need for sustainable resource management and equitable reinvestment strategies.

The study faced several limitations. Given that the study focuses on Indonesia, thus the findings might not be directly applicable to other countries with different socio-economic structures or natural resource endowments. Indonesia also has diverse regional characteristics, which could possibly result in differences in resource utilization. Natural resources are not evenly distributed across Indonesia, with different regions rich in different types of resources. Further studies therefore could include a regional-level analysis which would help understand how international trade based on regional resource endowments affect genuine savings in each region.

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