BUILDING A HEALTHIER AND SMARTER ECONOMY THROUGH TAXATION: EXAMINING THE RELATIONSHIP BETWEEN TAX MIX AND HEALTH AND EDUCATION OUTCOMES IN THE ASIA-PACIFIC REGION WITH MODERATING EFFECTS OF POPULATION, GDP PER CAPITA, AND DEBT-TO-GDP RATIO

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Executive Summary

This study aims to examine the effects of tax mix on the Sustainable Development Goals 3 and 4, while also considering the moderating effects of macroeconomic factors including population, GDP per capita, and debt to GDP ratio. This study examines whether certain tax structures can impact the enrichment of human capital. The study also aims to determine how different tax mixes and dominant tax structures affect the degree of achievement of various SDG outcomes, specifically health (SDG 3) and education (SDG 4) , using the proxies applied in the study. Part of this study focuses on the Asia-Pacific region, which underwent the inclusion criteria established by the researchers. To validate the data collected by the researchers, specific tests are selected to be conducted, such as the Principal Component Analysis, Breusch-Pagan Test, Variance Inflation Factor, Wooldridge Test, Panel Data Cross Dependence Test, and Unit Root Test. Aside from validating the data, various model selection tests are to be conducted to determine the optimal model for the panel data regression analysis. These models are the Breusch-Pagan LM Test, Hausman Test, Chow Test, Fixed Effects Models, and Random Effects Model.

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Disclosure of AI Usage

No AI was used.

Chapter 1: The Research Problem

1.1. Background of the Study

There are different approaches to how various international organizations measure countries' efforts in achieving the Sustainable Development Goals (SDGs). These organizations are the World Bank, Asian Development Bank, and the Organisation for Economic Co-operation and Development (Xetor and Mensah, 2025). However, despite the differences in approach, they aim for only one goal — *to achieve these Sustainable Development Goals (SDGs)*. When reaching these goals, a sense of mutual reinforcement between the government and private sector emerges, driving the achievement of these objectives.

However, despite the desire to achieve these goals, disparities in the economic situations of the countries in the Asia and Pacific region are still evident. One of the reasons for these disparities is the unequal opportunities countries have, which are vital in achieving the SDGs (United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP], n.d). As seen in the study by Yang and Greaney (2016), there are inequalities in terms of GDP per capita within the economies in Asia, which included China, Japan and South Korea, as well as the Pacific which focuses on the United States of America. It highlighted that these inequalities slow down economic growth. Nevertheless, it is vital to reduce these inequalities if there is a desire to see inclusive growth (Azam, 2019).

Taxation is central to building strong societies through raising revenues that are essential for the provision of goods and services (Organisation for Economic Co-operation and Development [OECD], n.db). Beyond revenue generation, a sound tax system, along with well-targeted fiscal policies, is crucial in achieving the SDGs because taxes were found to be a

driver in promoting healthier living, better education, and a more sustainable environment (Xu, 2022). For the purpose of achieving the SDGs, public financing is essential for funding investments and policies that address the issues raised by the SDGs and potentially reach the goals by 2030. However, Xu (2022) observed that countries often source their funds from public borrowing, which can be unreliable and risky, mainly if not settled promptly. Thus, there must be an efficient and fair tax system in place.

One of the concepts of taxation focuses on the composition of tax revenue through the tax mix or the combination of different taxes such as income tax (i.e., personal or corporate income tax), consumption tax (i.e., value-added tax, sales tax, excise tax), or such taxes imposed by national and local laws (Tanzi and Zee, 2001). In creating an optimal tax mix based on the progressivity of income taxes and regressivity of consumption taxes, the efficiency and equity of such must be taken into consideration, tax structures vary and primarily depends on the economic development of a country (Addison et al., 2018; Peter and Kerr, 2001). Developed countries have a higher share of personal income tax in their tax mix than indirect tax, but if developing countries implement the same tax mix, it would negatively affect their economic growth (Thaci and Gerxhaliu, 2018). This suggests that tax policies should vary by country, provided that tax revenues contribute to social and economic outcomes (OECD, n.da).

Many developing countries in the Asia-Pacific region encounter challenges in tax mobilization because indirect taxes, rather than direct taxes, heavily dominate their revenue mix. Around 48.8% of the total tax revenues in the region in 2022 were composed of indirect taxes (OECD, 2024a). It is roughly around half of the total tax revenue. The dominance of indirect tax, especially in the developing economies in the Asia-Pacific region is evidenced by the findings of the United Nations Economic and Social Commission for Asia and the Pacific (2017). The

results have shown that direct taxes account for 36% of the total tax revenue in the developing countries, in contrast to the developed countries under the categorization of the Organisation for Economic Co-operation and Development (OECD). The predominant status of indirect taxes in the developing countries could be attributed to the ease of consumption taxes implemented. However, this might cause disparity and a larger gap in equity as it may impose a huge burden on lower income earners that is greater than what progressive income taxes do.

Undoubtedly, the significant role of taxation in the economy, particularly as a mechanism for public funding, has been extensively studied by numerous researchers worldwide. However, the distributional impact of the tax mix on the performance levels of social outcomes, particularly in health (SDG 3) and education (SDG 4), remains underexplored in empirical research. While some studies have shown the behavioral impact of the tax mix through income distribution, there is comparatively little research that specifically examines the linkage between the composition of taxes with the human development outcomes. A study by the World Bank Group (2017) emphasized that direct taxes are more equalizing, while indirect taxes increase inequality because the tax burden is shared and may disproportionately affect lower-income individuals. Despite the availability of these studies, they seldom examine how the tax composition affects education and health development outcomes. This leaves a gap in understanding how tax design matters for social development.

Only a few studies have examined the relationship between tax and social outcomes, particularly in educational outcomes. A study by Reeves et al. (2015) found that progressive tax system impacts the achievement of international health goals. Therefore, it was recommended that policymakers must create tax systems that are leaning to progressive reforms rather than indirect tax policies. This study was supported by McCoy et al. (2017), which states that

progressive tax system lessens health inequalities through equitable income distribution. However, studies that primarily emphasize the linkage of tax mix to education outcomes are limited, especially in the context of the Asia-Pacific region. Thus, this study undertakes an in-depth analysis of the linkage between tax mix and health (SDG 3) and education (SDG 4) outcomes, making it more timely and relevant.

The selected macroeconomic variables such as GDP per capita, debt-to-GDP ratio, and population are variables that affect the capacity of the government to raise taxes and the effectiveness of translating these revenues into education and health outcomes. This study considers the aforementioned macroeconomic variables as moderating factors between the relationship of tax mix and education and health outcomes.

Given the connection between taxation as a contributing factor to economic growth and sustainable development, this study aims to provide empirical evidence that could inform equitable tax policy designs and sustainable development strategies in aligning with health (SDG 3) and education (SDG 4), while considering macroeconomic conditions of population, GDP per capita, and debt-to-GDP ratio. This study will examine the tax mix of countries in the Asia-Pacific region and its impact on their progress in achieving health (SDG 3) and education (SDG 4) outcomes, as measured by quantifiable indicators. Additionally, population, GDP per capita, and debt-to-GDP ratio will be examined to see if such macroeconomic factors strengthen the relationship between tax structures and health (SDG 3) and education (SDG 4) outcomes.

1.2. Statement of the Problem

Taxation plays a key role in development financing and contributing to long-term financial sustainability, however, countries still face challenges in generating sufficient tax

revenues despite having sound tax policies (World Bank Group, n.db). These challenges prevent tax policies from acting upon their full potential and could hinder countries in achieving the SDGs. With this, the study aims to answer the research question: *How does the composition of tax structures affect health (SDG 3) and education (SDG 4) outcomes among Asia-Pacific economies, considering the moderating effects of population, GDP per capita, and debt-to-GDP ratio?*

To further break down the approach as to how the relationship between tax structures and health (SDG 3) and education (SDG 4) outcomes would be examined, along with the influence of the macroeconomic factors, the researchers formulated specific research questions to be addressed in this study:

1. How is tax structure significantly related to health (SDG 3) and education (SDG 4) outcomes in the Asia and the Pacific economies?
2. How do countries with different predominant tax compositions vary in health (SDG 3) and education (SDG 4) outcomes?
3. How does population affect the relationship between tax structure composition and health (SDG 3) and education (SDG 4) outcomes?
4. How does the GDP per capita affect the relationship between tax structure composition and health (SDG 3) and education (SDG 4) outcomes?
5. How does the debt-to-GDP ratio affect the relationship between tax structure composition and health (SDG 3) and education (SDG 4) outcomes?

1.3. Objectives of the Study

The main objective of the study is to examine the relationship between the composition of tax structures and health (SDG 3) and education (SDG 4) outcomes among Asia-Pacific

economies considering the moderating effects of selected macroeconomic factors — population, GDP per capita, and debt-to-GDP ratio. This study aims to examine the relationship between the tax structure and health and education outcomes in the Asia and the Pacific region. The goal is to provide empirical evidence on whether certain tax structures are associated with human development outcomes. This study identifies benchmarked proxies within the Asia and the Pacific region, selected through several studies and existing literature critically reviewed upon. Moreover, this study looks at a wide range of variables that include the following: proficiency in reading and mathematics (4.1.1)**,** completion rates (4.1.2), participation rates by sex (4.5.1), and literacy rates (4.6.1) and trained educators (4.c.1) for education (SDG 4), and maternal mortality ratio (3.1.1), proportion of births attended by skilled health personnel (3.1.2), mortality rates (3.2.1), neonatal mortality rates (3.2.2) and coverage of essential health services (3.8.1), for health (SDG 3). Through elucidating on these variables, this research aims to offer a deeper understanding to policymakers, tax practitioners, and country leaders on creating a more equitable tax policy design conforming to the achievement of the sustainable development goals and improved inclusiveness of the outcomes. This study is expected to contribute in enriching clearer grasps between these imperative factors affecting the policies and strategies to sustainable development.

The following are the specific research objectives of this paper**:**

1. To determine if there is a significant relationship between the tax structure and health (SDG 3) and education (SDG 4) outcomes in the Asia and the Pacific economies.
2. To analyze whether countries with different predominant tax compositions vary in health (SDG 3) and education (SDG 4) outcomes.
    a. **Health (SDG 3)**

i. To analyze if countries with ***predominant income tax share*** in total tax revenue has a significant relationship with health (SDG 3) outcomes.

ii. To analyze if countries with ***predominant consumption tax share*** in total tax revenue has a significant relationship with health (SDG 3) outcomes.

iii. Countries with a ***balanced mix of income tax*** and ***consumption tax*** have a significant relationship with health (SDG 3) outcomes.

b. Education (SDG 4)

i. To analyze if countries with ***predominant income tax share*** in total tax revenue has a significant relationship with education (SDG 4) outcomes.

ii. To analyze countries with ***predominant consumption tax share*** in total tax revenue has a significant relationship with education (SDG 4) outcomes.

iii. To analyze countries with a ***balanced mix of income tax*** and ***consumption tax*** have a significant relationship with education (SDG 4) outcomes.

3. To assess the moderating effects of **population** on the relationship between tax structure composition and health (SDG 3) and education (SDG 4) outcomes.
4. To assess the moderating effects of **GDP per capita** on the relationship between tax structure composition and health (SDG 3) and education (SDG 4) outcomes.
5. To assess the moderating effects of **debt-to-GDP ratio** on the relationship between tax structure composition and health (SDG 3) and education (SDG 4) outcomes.

1.4. Frameworks of the Study

1.4.1. Theoretical Framework

The following theories establish the foundational review of the study. These explain the connection elucidating how taxation influences the attainment of health (SDG 3) and education

(SDG 4) outcomes, and understanding the effect of the selected macroeconomic variables: population, GDP per capita, and debt-to-GDP ratio.

Theory of Public Finance. The approach of Musgrave on the theory of public finance determined three (3) functions— allocation, distribution, and stabilization— that governments must take on when creating and implementing their fiscal policies, taking into consideration not just the structure on how public goods must be provided, but also the disparities of income and wealth between countries, as well as the impact on economic stability. In relation to taxation, its purpose of promoting social welfare was also introduced in this theory, emphasizing that the concept of taxation is not purely financial, but it must be for societal well-being (R. Musgrave and P. Musgrave, 1989). As for the SDGs, the disparities of the implementation and achievement of such goals are evident, especially among the low-income and middle-income countries, and in order to achieve these goals in 2030, there must be interventions to be placed on the indicators and allow interlinkages and interdependence in sectoral areas, societal actors, and among countries (Stafford-Smith et al., 2017; The Lancet, 2018). This theory connects the general idea of how taxation, through effective distribution of public funds, can contribute to achieving the sustainable development goals.

The Optimal Tax Theory. The theory postulates that the tax structure should minimize welfare loss by balancing equity and efficiency. Taxation is an effective mechanism to create social benefits for as long as it ensures equity (Mirrlees, 1971; Atkinson & Stiglitz, 1976). The theory supports the equity-efficiency trade-off behavior by a progressive tax system because this structure ensures equity. On the other hand, despite the fact that the progressive tax system could improve equity, it may somehow discourage productivity compared to indirect taxes. A progressive income tax system assists equity and human capital accumulation (Jacobs, 2012),

while indirect taxes are more efficient in revenue mobilization (Wang, n.d). Nonetheless, this framework supports the study's examination as to which mix or tax composition better sustains health (SDG 3) and education (SDG 4) outcomes.

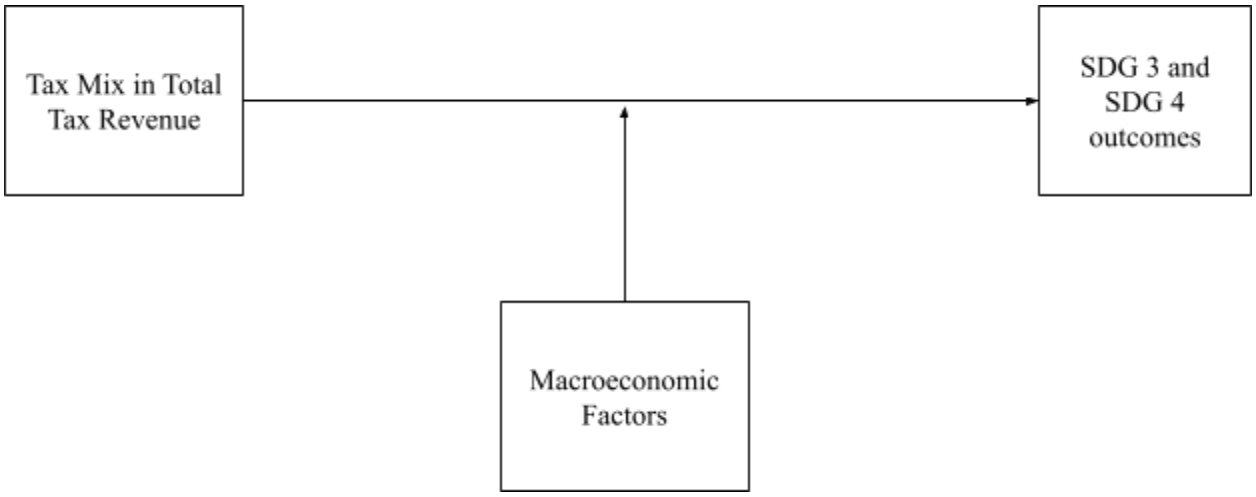
The Human Capital Theory. The term "human capital" was first introduced by Theodore Schultz (1961) and was later developed formally by Gary Becker (1964) which serves as the foundational lens linking fiscal policies to development outcomes. This theory claims that investments in human capital enhance productivity-improving skills. Later on, studies have enhanced the scope of the theory and not just solely focused on human resources and labor-wise aspects. The studies showed that human capital is a major determinant of economic growth. The framework, then, captured the essence of investing in education, training, and health as they are valuable factors that yield economic returns. Individuals who are better educated and healthier could contribute more effectively to the society, could become more productive and more innovative resulting in a fostered economic development. As cited in Leoni (2023), the vital role of education in economic growth was expounded by featuring that education elucidates social imbalance and breaks the vicious cycle of poverty. It was argued that the poor remain trapped in the vicious cycle because of the failure to receive economic benefits that would improve conditions of life. In terms of health, it was found out that health factors are major drivers of economic developments. Somayeh et al. (2013), on the other hand, showed that health factors affected the economy more than other social variables did. Therefore, the spending on education and health should be viewed as an investment rather than a cost. Progressive tax reforms were promoted since it is believed to equitably redistribute wealth and accumulate higher taxes that would increase funds for public services (Pressman 2008). Thus, this framework provides a strong rationale behind examining how tax structures influence health and education outcomes.

Keynesian Model. One of the theories in the Keynesian Model is the *"Principle of Effective Demand"* which states that a nation's economic output is determined by employment, measured by demand. The model even discussed a relationship wherein, as the number of hired employees increases, they are more likely to consume goods and services. A factor included in the model is the role of the government in formulating fiscal policies. One example that was mentioned in the study by McDonald (2008) is the monetary policy the government can use to stimulate the market. This can be achieved through adjusting the effective tax rates, thereby encouraging consumers to purchase more products and increase the demand. Furthermore, the "Interest Rate Theory" is included in this model. It states that a person would hold onto its money when it is expecting that interest rates will increase. In contrast, when interest rates decrease, people are encouraged to borrow money, business owners are encouraged to invest more business opportunities which in turn helps increase the demand and the employment levels. Nonetheless, the model supports the study in terms of the macroeconomic factors. This model shows that population, goods and debt are in the equation that drives the consumers to purchase and spend their money. The secondary effect the model depicts is that the tax structure drives consumer making decisions. The government is also part of the theory, but it will not be dealt with in as much detail in this study.

1.4.2. Conceptual Framework

Figure 1

Conceptual Framework of the Study



The researchers utilized secondary data sources to gather the necessary data to achieve the study's objectives. The researchers obtained the independent variable from the datasets and reports provided by the OECD, particularly reports on the Asia-Pacific region. On the other hand, the dependent variables were obtained from the Sustainable Development Goals Index, a comprehensive database containing information on all countries' sustainable development goals, performances, and metrics. Lastly, the moderating variables are sourced from various reputable sources including the UN ESCAP and World Bank for population data, World Bank for GDP per capita, and the International Monetary Fund (IMF) and World Bank for the debt-to-GDP ratio.

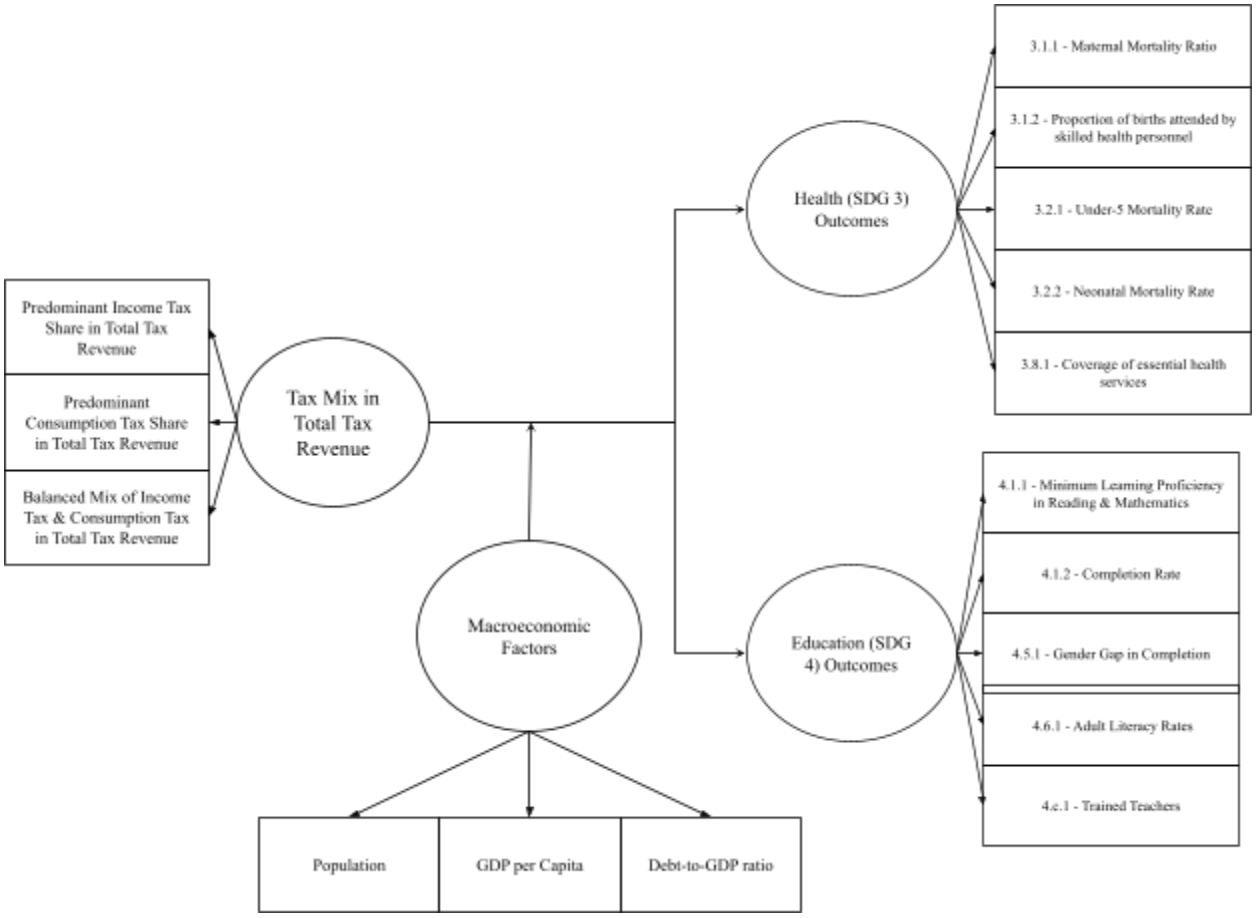
As shown in the provided framework, the researchers are examining how the independent variables impact the indicators of the dependent variables, as moderated by the selected macroeconomic variables.

1.4.3. Operational Framework

The operational framework shown in Figure 2 below shows the more detailed components of each variable. The independent variable is composed of three: predominant income tax share in total tax revenue, predominant consumption tax share in total tax revenue, and balanced mix of income tax and consumption tax in total tax revenue. The dependent variables: Health (SDG 3) and Education (SDG 4) have their respective selected indicators that are based on the Sustainable Development Goals. SDG 3 or Good Health and Well-Being have five specific, selected indicators for measurement purposes namely: 3.1.1 - maternal mortality rate, 3.1.2 - proportion of births attended by skilled health personnel, 3.2.1 - under-5 mortality rates, 3.2.2 - neonatal mortality rate, and 3.8.1 - coverage of essential health services. On the other hand, SDG 4 or Quality Education has five specific indicators too: 4.1.1. - minimum learning proficiency in reading and mathematics, 4.1.2 - completion rate, 4.5.1 - gender gap in completion, 4.6.1 - adult literacy rates, and 4.c.1 - trained teachers. Lastly, the moderating variables are composed of the population, GDP per capita, and debt-to-GDP ratio.

Figure 2.

Operational Framework of the Study



1.5. Assumptions of the Study

The study focused on the relationship of tax structures on the SDG 3 and SDG 4 outcomes, with moderating effects of macroeconomic factors of population, GDP per capita, and debt-to-GDP ratio. For this study, the following assumptions were made:

1. **Taxation** is a fundamental and critical public financing mechanism that drives the performance and progress towards achieving both health (SDG 3) and education (SDG 4) outcomes (OECD, n.db).

2. The effects of the **COVID-19 pandemic** caused a significant distortion in both national fiscal priorities and health (SDG 3) and education (SDG 4) outcomes (Benedek et al., 2021), and that the methodology to be used after testing the models would adequately control this impact to isolate the potential long-term effects.
3. The **secondary** data gathered were from reliable, reputable, and internationally recognized sources such as, but not limited to, the World Bank, United Nations, OECD, and IMF, and the data collected from the, are adequately valid and accurate for the econometric models to be applied in the study.

1.6. Research Hypothesis

The following hypotheses are to be tested in this study:

On health (SDG 3) outcomes

1. Main hypothesis
    a. H_{0a}: There is no significant relationship between the composition of a country's tax structure and the health (SDG 3) outcomes among Asia-Pacific economies.
    b. H_{1a}: There is a significant relationship between the composition of a country's tax structure and the health (SDG 3) outcomes among Asia-Pacific economies.
2. Predominant Income Tax Share and Health (SDG 3) Outcomes
    a. H_{0a1}: There is no significant relationship between a higher share of income taxes in total tax revenue and the health (SDG 3) outcomes among Asia-Pacific economies.
    b. H_{1a1}: There is a significant relationship between a higher share of income taxes in total tax revenue and the health (SDG 3) outcomes among Asia-Pacific economies.

3. Predominant Consumption Tax Share and Health (SDG 3) Outcomes
    a. H_{0a2}: There is no significant relationship between a higher share of consumption taxes in total tax revenue and the health (SDG 3) outcomes among Asia-Pacific economies.
    b. H_{1a2}: There is a significant relationship between a higher share of consumption taxes in total tax revenue and the health (SDG 3) outcomes among Asia-Pacific economies.
4. Balanced Mix of Income and Consumption Tax Share and Health (SDG 3) Outcomes
    a. H_{0a3}: There is no significant relationship between a balanced mix of income and consumption taxes and the health (SDG 3) outcomes among Asia-Pacific economies.
    b. H_{1a3}: There is a significant relationship between a balanced mix of income and consumption taxes and the health (SDG 3) outcomes among Asia-Pacific economies.
5. Moderating Effects on Health (SDG 3) - Population
    a. H_{2_0a}: Population does not moderate the relationship between tax structure and health (SDG 3) outcomes.
    b. H_{2a}: Population moderates the relationship between tax structure and health (SDG 3) outcomes.
6. Moderating Effects on Health (SDG 3) - GDP per capita
    a. H_{3_0a}: GDP per capita does not moderate the relationship between tax structure and health (SDG 3) outcomes.

   b. H_{3a}: GDP per capita moderates the relationship between tax structure and health (SDG 3) outcomes.

7. Moderating Effects on Health (SDG 3) - Debt-to-GDP ratio
   a. H_{4_0a}: Debt-to-GDP ratio does not moderate the relationship between tax structure and health (SDG 3) outcomes.
   b. H_{4a}: Debt-to-GDP ratio moderates the relationship between tax structure and health (SDG 3) outcomes.

On education (SDG 4) outcomes

1. Main Hypothesis (Education)
   a. H_{0b}: There is no significant relationship between the composition of a country's tax structure and the education (SDG 4) outcomes among Asia-Pacific economies.
   b. H_{1b}: There is a significant relationship between the composition of a country's tax structure and the education (SDG 4) outcomes among Asia-Pacific economies.
2. Predominant Income Tax Share and Education (SDG 4) Outcomes
   a. H_{0b1}: There is no significant relationship between a higher share of income taxes in total tax revenue and the education (SDG 4) outcomes among Asia-Pacific economies.
   b. H_{1b1}: There is a significant relationship between a higher share of income taxes in total tax revenue and the education (SDG 4) outcomes among Asia-Pacific economies.
3. Predominant Consumption Tax Share and Education (SDG 4) Outcomes

   a. H_{0b2}: There is no significant relationship between a higher share of consumption taxes in total tax revenue and the education (SDG 4) outcomes among Asia-Pacific economies.
   b. H_{1b2}: There is a significant relationship between a higher share of consumption taxes in total tax revenue and the education (SDG 4) outcomes among Asia-Pacific economies.

4. Balanced Mix of Income and Consumption Tax Share and Education (SDG 4) Outcomes
   a. H_{0b3}: There is no significant relationship between a balanced mix of income and consumption taxes and the education (SDG 4) outcomes among Asia-Pacific economies.
   b. H_{1b3}: There is a significant relationship between a balanced mix of income and consumption taxes and the education (SDG 4) outcomes among Asia-Pacific economies.

5. Moderating Effects on Education (SDG 4) - Population
   a. H_{2_0b}: Population does not moderate the relationship between tax structure and education (SDG 4) outcomes.
   b. H_{2b}: Population moderates the relationship between tax structure and education (SDG 4) outcomes.

6. Moderating Effects on Education (SDG 4) - GDP per capita
   a. H_{3_0b}: Population does not moderate the relationship between tax structure and education (SDG 4) outcomes.
   b. H_{3b}: GDP per capita moderates the relationship between tax structure and education (SDG 4) outcomes.

7. Moderating Effects on Education (SDG 4) - Debt-to-GDP ratio
    a. H_{4_0b}: Population does not moderate the relationship between tax structure and education (SDG 4) outcomes.
    b. H_{4b}: Debt-to-GDP ratio moderates the relationship between tax structure and education (SDG 4) outcomes.

1.7. Significance of the Study

International Development Institutions (UN, World Bank, ADB, OECD, and IMF). The study aims to provide a cross-country analysis across the Asia-Pacific economies which could assist the international institutions in enriching an in-depth analysis of the impact of tax mix towards reaching health (SDG 3) and education (SDG 4). As the institutions foster SDG-aligned tax policies, the study could provide a framework of understanding the progress between tax structure and the sustainable development targets.

Policymakers and Fiscal Authorities. This sector could benefit the most from this study since they primarily design tax systems and complementary policies. The findings could create stronger foundations in designing equitable tax systems that enhance economic behavior without compromising the human development outcomes. The consideration of analyzing the moderating effects of the selected macroeconomic variables could assist in aligning the economic factors with the achievement of sustainable development goals.

Business Leaders. Highlighting how tax structures can influence the human development landscape could be beneficial to business leaders and private sectors. The study could allow decision-makers to create structure that fits anticipated policy shifts considering the impacts it could manifest on investments, operations, competitiveness, and socio-economic

realm. The results could guide the business leaders with its responsibility to adhere with the Sustainable Development Goals complementing public policies.

Future Researchers and Contribution to Existing Literature. This study contributes to the existing studies on taxation and sustainable development goals. While previous studies showcased the broad effect of tax mix towards the achievement of all the sustainable development goals, this study specifically focused on the impact towards health (SDG 3) and education (SDG 4) which could expound the differentiated effects. With the integration of macroeconomic factors as moderating variables in the study, the economic dynamics across the Asia-Pacific region are profoundly examined. This study could enrich the ongoing discourse towards the development of varying policies to achieve the sustainable development goals.

Academe. This study may benefit the academe by providing an evidence-based linkage between tax structures and sustainable development outcomes. Through examining the correlation between the tax structure and the indicators of health (SDG 3) and education (SDG 4) outcomes, this research could be integrated into classroom discussions and curriculum development in economics, taxation, and other related courses. The evidence-based study could serve as a practical reference for cases or discussions especially for instances where real-world implications of tax structures, economics, and human development are analyzed.

1.8. Scope and Limitations of the Study

The scope of the study is focused on examining the composition of the tax structures and the correlation on achieving the selected SDGs health (SDG 3) and education (SDG 4) on the selected countries in the Asia and Pacific Regions. The researchers will not focus on tax revenues and tax bases as external factors heavily influence these and entrust upon the powers of those having policy making ability (Felipe, 2017).

The researchers will instead focus on the selected types of taxes in terms of tax composition which include the personal income tax and corporate income tax for direct taxes, and goods and service tax and value-added tax for indirect taxes. Upon reviewing the comprehensive databases of the Asia-Pacific countries, these are the common taxes applied. Other tax related topics such as tax compliance and tax collection will not be delved into in this study. According to Baldry (2020), one of the most used forms of indirect tax in the Asia and the Pacific Region is Value Added Tax (VAT) or Goods and Services Tax (GST). This shows the importance of indirect taxes in a country's source of funds and how it is being useful for those economies. Together with direct taxes that is commonly applied on Asia Pacific countries

The scope of the study is a period of 10 years under the years 2014 - 2023. This includes the periods before, during, and after the Pandemic. Although the impact of the Pandemic will not be heavily focused in the study, this will cause inherent implications because of the forced changes in priorities in the several countries. This could affect health (SDG 3) and education (SDG 4) outcomes where models selected will intercept. The researchers selected health (SDG 3) and education (SDG 4) outcomes because they are the goals categorized by the OECD under human capital development. Moreover, studies have shown that tax mix has an interestingly

indirect relationship to these developments. Lastly, taxation was selected because it provides the funds needed to distribute resources (Halim & Rahman, 2022).

For the geographical context of this research, the researchers set an inclusion criteria for the countries in the Asia and Pacific Region. The researchers opted for Asia and the Pacific Region due to the extensive and diverse economies. Aside from the influx of population—one of the macroeconomic factors of the study—there is also an observed growth in the different economies included in these territories (Asian Development Bank [ADB], 2025).

The inclusion criteria was utilized in harmony with the purposive sampling. This inclusion criteria is utilized to ensure that all the included countries meet the requirements set and that they are appropriate to the research objective (Memona et al. 2025). The inclusion criteria considered the geographic scope of the study being the Asia and the Pacific Region, and the time frame covered—10 year period—from 2014 to 2023. Only the data on the aforementioned period are collected to ensure consistency between data and tax structure. The countries must have at least one tax type from direct tax and indirect tax are present. The researchers also included in the inclusion criteria that there must be available data from OECD, WorldBank and other verifiable and reputable international organizations. Lastly, the researchers also considered if they are not blacklisted from any regulatory body and are not under international sanctions maintaining integrity. There are 29 countries from the Asia and Pacific region that are included in the study after performing the purposive sampling and inclusion criteria. Not all countries in the APAC region are catered to because of these methods. Countries included are Armenia, Australia, Azerbaijan, Bangladesh, Bhutan, Cambodia, Cook Island, China, Fiji, Georgia, Hong Kong SAR, Indonesia, Japan, Kazakhstan, Kyrgyzstan, Laos,

Malaysia, Maldives, Mongolia, New Zealand, Pakistan , Papua New Guinea, Philippines, Samoa, Singapore, South Korea, Solomon, Thailand, Vietnam.

1.9. Definition of Terms

Succeeding terms are used in this research study:

Corporate Income	Corporate Income refers to earnings and revenue earned by legal entities (Jesus et al., 2024).
Debt to GDP Ratio	Debt to GDP Ratio refers to an indicator measuring government debt outstanding over the GDP of the year (OECD, 2024b).
GDP per Capita	GDP per Capita pertains to the sum of gross value added by all resident producers in the economy divided by mid-year population (World Bank Group, n.dc).
Goods and Services Tax (GST)	Goods and Services Tax pertains to indirect taxes similar to value added tax issued on goods or services (Baldry 2020).
Education	Education refers to the process of acquiring knowledge, skills, values, and attitudes through various forms of learning (Doharey et al., 2023)

Health	Health relates to the state of complete physical, mental, and social well-being (World Health Organization [WHO], n.d).
High Income	High income indicates the classification of the countries following the World Bank's categorization based on the country's gross national income that is more than $13,935. (United Nations Industrial Development Organization, 2024; World Bank Group, 2025)
Middle Income	Middle income indicates the classification of countries following the World Bank's categorization based on the country's gross national income ranging from $1,136 to $13,935. (United Nations Industrial Development Organization, 2024; World Bank Group, 2025)
Predominance Tax Mix	Predominance Tax Mix refers to when a tax structure's share in total tax revenue exceeds by 10% than that of the other tax structure (International Monetary Fund [IMF], 2021;

	OECD et al., 2023).
Tax Mix	Tax Mix relates to the share of a particular taxation to the overall total tax revenue garnered by the government. (Beljic & Glavaski, 2025)
Personal Income	Personal Income refers to an individual's income that includes salaries and wages, business income, and all other income added together and taxed as a single income (Jesus et al., 2024).
Sustainable Development Goals	Sustainable Development Goals relates to a list of goals that commonly targets peace and prosperity for all the people globally by 2030. This is a call to action to different countries and an understanding that one's action could impact the future outcomes of others. It aims to develop a sustainable balance socially, economically and environmentally (United Nations Development Programme [UNDP], n.d).
Value Added Tax (VAT)	Value Added Tax pertains to indirect taxes

issued on goods or services (Baldry, 2020).

Chapter 2: Review of Related Literature

2.1. Introduction

Taxes are the funds of the government that are being collected to pay off for government spending in order to meet public needs (Balasoiu et al., 2023). In order to gain these funds the government issues tax based on personal income, corporate profits and on goods and services and the greater funds there are the more the government can achieve its goals. According to Kutasi and Marton (2024), there is a positive effect between the tax structure and the economic growth on the 25 chosen European countries from the study, highlighting the shift of taxes more towards indirect taxes that positively impacts the economic growth. These taxes earned are used for the benefit of the people. There is a sense of burden that is being transferred from the government to its citizens as the higher the tax rates the greater the tax burden thus could affect the growth of a country (Shapir-Tidhar et al., 2023). There can be a positive correlation between SDGS and taxes, but it is noteworthy that the impact of taxes are different from the various SDGs (Rahman, 2023). This is also supported by A. Halim and Rahman (2022), who focus their study on BRICS (Brazil, Russia, India, China and South Africa) and CIVET (Columbia, Indonesia, Vietnam, and Egypt) countries where it was mentioned that there is a positive relationship between corporate tax and the SDGs. It also mentioned that including personal income tax and sales tax further increases the chance of achieving the SDGs. This shows that there is a positive relationship on taxation and SDGs. But there is no specific SDG mentioned in these present studies that directly affects these achievements. Moreover, there is an existing gap between the countries being studied by previous literatures, as these were focused on limited countries but covered a longer time period.

2.1.1. Direct Tax

Income earned through various activities by individuals and corporations are subject to direct taxation. This is where income is being taxed and paid directly to the government (Balasoiu et al., 2023). According to Fortea (2025), a study conducted on G7 group, some of the world's advanced economies, showed that there is a direct positive impact on the total tax revenue gathered from direct taxes that was mentioned to be personal and corporate income. This is also supported by the OECD (2025) for Asia Pacific countries that from the total tax revenue gathered 16.5% of these came from the personal income tax. It is initially thought that through these income there will be a greater total tax revenue garnered by the government. On the other hand, for the country Thailand personal income tax together with corporate income tax have a negative impact on the country's economic growth. While also in the same study, personal income tax and corporate income tax have a positive impact on the economic growth of China, and only corporate income tax have a negative effect. (Kaewsopa et al., 2022) This shows that despite being in the same Asian region there are still different effects on how tax structure affects a country's economic growth. There is also another study by Eradın and Durmaz (2025) that mentioned there are no significant results in the relationship between direct taxation on the overall SDGs focusing on the countries listed on the OECD. These show that despite the present studies there are still various findings between studies despite including the same country subject, hence showing that SDG effects are dependent on the countries income levels (Rahman, 2023).

2.1.2. Indirect Tax

Indirect taxes are explained to be taxes that are passed on to the buyer of properties or services. It is also explained as tax burdens that are passed on to consumers who are benefitting

from the goods or services (Balasoiu et al., 2023). The total tax revenue garnered by each country is necessary to finance the development they are aiming for (OECD et al., 2022). Essentially, there can be an increased share of total tax from goods and services in comparison to direct taxes due to the fact that consumers cannot avoid consuming goods or services. This is also strengthened by a study conducted in Vietnam, wherein for the country's total tax revenue, 60% of this is collected from consumption tax and viewed as an easy way of tax collection (Nguyen et al., 2019). Furthermore, among the total tax revenue garnered almost one-fifth (⅕) of the Asia Pacific region's revenue came from Value Added Tax (VAT). This is in comparison with the other tax structures available in the region. This claim is also strengthened in a statistics wherein 25.8% of the total tax revenue of the region came from Value Added Tax (VAT). However, these numbers are collectively from the total revenue of the region thus are shared by various countries implementing Value Added Tax (VAT). While it is known that the Asian Pacific region is a mix of low income, developing and advanced countries, it may be hard for some of these countries to impose Value Added Tax (VAT) or income tax, especially when derived from the citizens' compensation. However, income tax may be one of the main sources of tax revenue and may help in economic growth especially when there is decreased consumer demand on goods and limited purchasing power and Value Added Tax (VAT) revenues are decreasing (OECD, 2025).

2.2. SDG 3: Good Health and Well-Being

Good health and well-being (SDG 3) is one among the 17 Sustainable Development Goals (SDGs) set by the United Nations (2015). Its primary goal by 2030 is ensuring physically and mentally healthy lives and promoting well-being for all, with the targets of achieving universal health coverage (UHC) and access to quality health care, reducing mortality rates, and

combating communicable diseases (United Nations International Children's Emergency Fund [UNICEF], n.da; United Nations, 2015). Health (SDG 3) is a key area of interest for researchers investigating on the SDGs because of how health challenges affect the progress in achieving the SDGs by 2030, taking into example how the COVID-19 outbreak not only contributed to the increase in sickness and deaths in the world population, but also on how it contributed to economic recessions and a disruption in the structures designed to achieve the goals (Martin-Blanco et al, 2022; Raji and Demehin, 2023). The studies aforementioned emphasize the role of health in economic and social progress. According to Sorooshian (2024), Health (SDG 3) was identified as the SDG that was most conducive to research when it comes to contributions to investments in policies and programs that could lead to progress in achieving its targets. However, studies from The Lancet (2017) and Stafford-Smith et al. (2017) examined the Health (SDG 3) indices and determined that a higher SDG index has more progress on the SDG indicators, but challenges pertaining to equitability among countries and perverse outcomes may arise despite having the resources and existing research to be able to implement and achieve the SDGs.

The human capital theory by Becker (1964) was developed by Grossman (1972), recognizing health, along with education, as one of the indicators of human capital and an important investment for economic growth and development (Todaro and Smith, 2014). The theory of Grossman introduced the concept of health and education as joint investments for development and how fiscal policies for health and education improvements must be present (Soares, 2015). However, a study from Yang (2020) showed empirical evidence that higher health expenditures do not always result in economic growth as stated in the theory, which suggests that health expenditure should be coordinated with the level of human capital in order to

achieve sustainable development in developing countries. The theory of public finance (Musgrave, 1989) provides the mechanism as to the financing of sustainable development through taxation as it contributes to achieving the SDGs, which explains the connection between tax structures and health outcomes.

Xiang et al. (2025) further examined that while economic growth and financial development can support better health outcomes, the impact of such depends on how countries would manage demographic pressures, implying that macroeconomic indicators such as population growth and GDP per capita significantly influences the relationship between public health expenditures and health outcomes, such that population growth increases mortality rates, and higher GDP per capita improves health outcomes in the short-term. External debt also poses a significant barrier in achieving the SDGs, especially in low-income and middle-income countries wherein a large proportion of their budget is for external debt settlement, which hinders their ability to invest in healthcare services and provision of access of such (Lopez et al., n.d). Financing is directly related to the achievement of SDGs, especially if countries consider economic indicators related to population, GDP, and external debts when proposing and implementing policies to invest on when achieving such SDGs (Lopez et al., n.d; Xiang et al., 2025; Yang, 2020).

Stafford-Smith et al. (2017) introduced the concept of interlinkage and interdependence as an approach to implementing policies in achieving the SDGs. This was supported by empirical evidence from Dvulit et al. (2025) wherein the progress in achieving SDG 10 on reducing inequalities, particularly on income inequality, affects the health and well-being of a country. This also leads back to the human capital theory (Becker, 1964; Grossman, 1972) wherein health as an indicator of human capital can contribute to the well-being of a human and investing on

such indirectly increases income. However, the disparities within the income distribution and earnings of different areas in a country also limits the access to healthcare services, which explains that reducing income inequality positively affects health and well-being in terms of its access and coverage (Dvulit et al., 2025). With this, governments must propose reforms that would not just focus on achieving SDGs but also on effective management wherein there would be coordination with health institutions in order to strengthen health policies and standards, making healthcare more accessible for the well-being of all at all ages.

2.3. SDG 4: Quality Education

Quality education (SDG 4) is one among the 17 Sustainable Development Goals set by the United Nations. Its primary goal is to ensure that all individuals achieve quality education through promoting inclusiveness and equitable opportunities of education access. According to UNICEF (n.d), more than the access and quality, it is believed that it is through education (SDG 4) where disparities could be addressed. Moreover, it is believed that education acts as a foundational element for other SDGs, creating ripple effects that promote health, gender equality, economic development, and among others. When children receive quality platforms to develop their skills up to its full potential, they grow into skillful and productive citizens who serve as catalysts for eradicating poverty and improving the quality of life. This interlinkage between education and economic development has long been emphasized in international discussions since the 1980s. One of the earliest records about establishing the importance of education in economic development is the 1987's *Our Common Future* (UN-DESA, n.d) — one of the pioneering discussions that laid the groundwork for the modern sustainable development discourse. Subsequently, the following talks have mentioned the crucial contribution of education to the future's betterment. While the consensus on education's importance is long

standing, most literature remains conceptual with limited empirical evaluation of how education could translate into measurable development outcomes across diverse contexts.

The human capital theory (Becker, 1994; Schultz, 1991), is one of the earliest theories which links education—one of the indicators of human capital—and its capability of enhancing skills and productivity leading to economic growth. However, researchers have challenged the limitations of the human capital theory. The human capital theory faced criticisms about its inadequacy in considering other critical factors such as the economic backgrounds and environmental dimensions. Based on the study conducted by Marginson (2017), the theory failed to input contextual factors that are attributable to the unequal distribution despite having quality education. This remains a challenge for deeply understanding other contexts affecting the absolute claim that a quality education would automatically result in breaking inequalities of life. Thus, the empirical evidence suggests that mediating factors should be considered to evaluate the true impact of education.

Education is not just a single-effect goal, but a multiplier that brings domino effect across other SDGs according to recent studies that expanded the discourse. It is a powerful and rippling effect tool that addresses the gap of sustainable development agenda such as poverty reduction (SDG 1), good health and well-being (SDG 3), and decent work and economic growth (SDG 8). Empirical studies have shown that education is a foundational factor that helps in fostering creativity leading to the launching of new ideas, turning ideas into entrepreneurship, increases innovation and research, providing multiple job opportunities, and therefore achieves economic sustainability (Turhan, et al., 2023; Zhou & Luo, 2018; Koc et al., 2025). However, many of these studies are centralized in developed economies, leaving a notable gap in assessing how it would then impact low-income countries and developing economies. Systemic barriers such as

resource scarcity, governance quality, and inequality hinder the achievement of education quality. This gap calls for further research to explore whether education is a bare economic growth factor or depends on local policy environments. Furthermore, education is reinforced by international organizations as a driver and resilience-builder of long-term economic development (World Bank, n.da; OECD, 2022; Ozturk, 2001). These make education a crucial sustainable agenda to study when understanding the nuance of economic development.

Tax is a principal domestic financing mechanism for public education. However, the composition of tax revenues — the tax mix — determines not only how much funding is available but who bears the burden and how equitably resources are mobilized. Based on OECD's 2023 report, high income countries significantly spend more than the amount that low-income countries spend; yet differences persist not only because of the levels of revenue but also how it is raised and redistributed. Therefore, the literature profoundly examines the difference between a progressive tax system and indirect tax mix in terms of the achievement of better education outcomes.

Direct taxes include both corporate and personal income taxes. This type of tax enhances equity by wealth redistribution where higher-income earners have to pay more taxes than those with lower incomes. The taxes generated from wealthier segments are used to mobilize resources through public service, like education funding, which assist those in low-income households. A model-based evidence of direct taxes or progressive income taxes on yielding education outcomes was studied. It was revealed that direct taxes could yield better education outcomes (Krueger & Ludwig, 2013), thereby manifested as supporting evidence for reforms where progressive income tax is used as a strategy to improve education or human capital accumulation. Jacobs (2012) further theorizes that progressive tax reduces inequality by enabling

public investment in human capital for lower-income groups. Policy reports (World Bank Group, 2017; UNESCO, 2022) and case studies (ActionAid Uganda, 2023; Stosky & Jaber, 2022) reveal that the progressive income tax systems can support education through increased funding for subsidies, scholarships, and funding for public education, improving the access and inclusiveness especially for marginalized groups.

Many studies are purely theoretical but only a few provide robust causal estimates linking increase in direct-tax shares to improve learning outcomes (e.g. test scores, proficiency) rather than inputs or spendings. Additionally, taxpayers' behavioral response is under-studied Since progressive taxes push the burden to wealthier segments, some studies reveal that there are disincentives or discouragement in pursuing education. The more productive a person would be, the more they are burdened with heavy taxes (Ewijk & Tang, 2006; Muslim, 2023) which potentially dampens the incentives for human capital accumulation. Aside from that, developing countries in Latin America challenge the theoretical models about direct taxes and its effect on economic development. The study showed that direct taxes yield redistributive gains only if collection is effective — prevention from leakages (Bergolo et al., 2023).

Indirect taxes are composed of VAT, sales taxes, and excise tax (for some countries). Indirect taxes are administratively simpler as they can raise revenue quickly compared to direct taxes. Besides, its flexibility lies on how manageable it is that the tax burden can be shifted to another party. Studies from various international organizations have discussed that indirect taxes are easier to collect which in turn enables easier resource mobilization for public spending especially in developing countries where reforms for indirect taxes are the most common (Akitoby et al., 2019; Benitez et al., 2023). However, these studies did not directly address the

relationship between indirect taxes and education outcomes. It was only discussed how indirect taxes could collect more funds that would be for the purpose of public services.

There are a few studies about indirect taxes and its contribution to economic growth, particularly addressing education outcomes, compared to direct taxes. Indirect taxes demonstrate a highly significant and negative influence on foreign direct investment or FDI in developing countries and negative also in terms of unemployment rate in developed countries (Hakim et al., 2022). This is in contrast to several studies mentioning that indirect taxes have positive effects on economic growth. Some studies have shown that tax has a negative significant effect on economic growth in the long run, while some suggest that tax is in favor of the adverse association with economic growth (Shahmoradi et al., 2019).

Multiple studies have shown that macro economic factors, specifically the population, GDP per capita, and debt-to-GDP, affects how effective the taxes are translated into access and quality of education. First, population. The population size plays a crucial role in the attainment of education outcomes. For instance, in the Asia-Pacific region, population growth affects the quality of education in a sense that the rapid growth in population and increasing dependency on youth could strain the resources placed for education. This means that more funds would be needed to suffice the growing numbers in the region ensuring the maintenance of quality and accessibility. Despite the growing numbers of the youth in the region, it is evident that the aging population is slowing which could, conversely, indicate overall improvements in education due to reduced pressure on schooling systems (United Nations, 2023). However, fewer children does not automatically guarantee better outcomes in social factors like education. Second, the GDP per capita is a measure of the total economic output of a country divided by the country's population (Brancu & Brancu, 2025). In the context of education, a higher GDP per capita often

correlates with greater educational attainment. This is because a higher GDP per capita results in wealthier status of nations, and wealthier nations tend to have more resources to fund social development sectors like education (World Bank Group, 2025). According to the OECD (2025), countries with higher income levels tend to have more spendings in their education per student which is in contrast with lower income countries. It shows that education spending is dependent on the level of incomes per country. Higher income countries spend more than $20,000, while lower income countries spend $5,000. The difference shows how the GDP per capita is relative to the spending behavior. In the context of the APAC region, the average years of schooling is tied with the country's GDP per capita growth (Yan, 2018). However, this does not show that the higher the spending is, the greater the quality of education would be. Studies revealed an inverse relationship between economic growth and the debt-to-GDP ratio, while the debt-to-GDP ratio has an indirect relationship with education outcomes (Asteriou et al., 2020). Rising debts would often result in negative economic growth, consequently reducing the investments in education. Rising debts could take a large portion of the country's revenue which may leave a low portion to education and other social investments. Despite these linkages, there are only limited references available that discuss the direct link between education outcomes and GDP per capita and debt-to-GDP ratio.

2.4. Macroeconomic Factors

Macroeconomic factors could affect the tax collection of a country. It is worth noting that these are only factors that influence the relationship between variables. One of the possible reasons a country could experience a decreasing number of tax revenues could be due to change in population mix. According to the United Nations Organization (2023) there has been a change in the demographics of the Asia Pacific region. Some of these changes were to have a more

aging population, having a smaller family size, and a decline in fertility. While on the other hand, when a country increases its population the more income earners it could have and at the same time the more consumer taxes would be earned. There is a study that shows that direct taxes have a positive relationship on the population, while an opposite result is seen for indirect taxes as seen in developing countries (Francis et al., 2024). According to Fadhilah and Wijaya (2023), for the countries included in the Asia - Pacific Economic Cooperation (APEC) it was found that there is a direct relationship between the growth of population with the increase in Value Added Tax (VAT) revenue of the country. This is supported by a study that mentioned that as the population ages the less they contribute to direct taxes and are more likely to contribute on indirect taxes as their spending increases especially in democratic countries (Luo, 2019).

Another factor that could cause an effect on the tax collection of a country is its country's GDP per capita. A study by Chettri et al. (2023) that focuses on South Asian countries found that there is a positive relationship between the increase in GDP per capita and the tax revenues a country generates. They also mentioned that having a better life quality and opportunities would help a country's citizens to have better work and having to pay tax would increase the total tax revenue collected. This also was mentioned by the study of Juliannisa and Artino (2022) that focused on the ASEAN countries. It is found that technology, labor and entrepreneurship are part of the important factors in the success of GDP per capita. Although labor does not have a significant effect but is part of developing knowledge that in turn helps entrepreneurs that have a significant impact on the GDP per capita. Having a positive GDP per capita could help improve public health in the long run as part of health (SDG 3) and as evidenced in Bangladesh (Xiang et al., 2025). It is also seen that as a country have better health and education expectancy the better GDP per capita an economy will have showing a direct relationship, as improved health and

education show citizens better performance as seen on a study on OECD member countries (Aytemiz et al., 2024). These studies show that a healthier and smarter economy for citizens provides a positive growth on GDP per capita a country has.

Another macroeconomic factor that could affect the tax collection of a country is the debts they have incurred. This is usually measured using the debt-to-GDP ratio that is usually seen in reports, or journals that have gathered data. One reason that these debts could affect a certain country is due to the fact that these are paid using also the total tax revenues earned. Going back to the reason that taxes are the government's main source of funding, and having high debt might require more tax revenues collected. According to Ferrarini et al. (2023), there are risks for countries in Asia and the Pacific who are experiencing great impacts of rising inflation and high sensitive price changes for necessary goods and services as these factors cause the government's budget to have a negative impact and for the debt ratio to increase. It was also seen that there is about 58% of debt-to-GDP ratio by 2025 that could be caused by decreasing exchange rates while the US dollars used when incurring debts are at its rising rates. With this, there is a need for proper budget prioritization to be done and proper spending to be planned. This is also mentioned by Viphindratin et al. (2023) where it focused on ASEAN member countries and it mentioned that government spending increases its public debt. With that it affects all the other factors in growing its economy, and is seen as one of the main factors constraining Southeast Asian countries. This is also agreed by Bisiriyu and Dhar (2025) that as the country incurs more debt the more difficult it is for a country to achieve its goals especially for health (SDG 3) and education (SDG 4). Such results are not constant for all SDGs and have various effects, while on the other hand, Detoya et al. (2025) mentioned that not because there is an increased debt-to-GDP ratio there is a poor economic performance as studied in the

Philippines but it is seen that there is still a negative impact with high debt-to-GDP ratio. As mentioned there is a need for effective debt management especially when wanting to improve the well being of citizens.

2.5. Synthesis

This study emphasizes the purpose of taxation to generate revenues for governments to provide public goods and services, thus promoting social welfare and economic growth. Generally, taxes positively affect the progress of achieving the SDGs in various economies (Halim and Ramhan, 2022; Kutasi and Marton, 2024; Rahman, 2023). Countries have varying tax mixes which show that even though taxes generally positively affect SDG outcomes, the same could not be said for all countries because of the varying tax mix, along with the economic development classification of a country (Fortea, 2025; Kaewsopa et al., 2022). In the case of direct taxes, higher share on direct taxes have a positive impact on tax revenues which in turn assumes a positive effect on the attainment of SDG outcomes as stated by the studies of Fortea (2025) and Kaewsopa et al. (2022), however, various findings have yet to support this assumption as the impact of direct taxes on SDG outcomes and economic growth depends on the income levels of countries (Eradın and Durmaz, 2025; Rahman, 2023). Indirect taxes, on the other hand, may be easier to collect if consumption taxes are imposed; however, its regressivity in nature could compromise the impact of income tax especially in low-income and middle-income countries (Nguyen et al., 2019; OECD, 2025). The achievement of health (SDG 3) and education (SDG 4) outcomes are essential for economic development as health and education are important investments for income improvements and contribute to achieving other SDGs (Soares, 2015; Todaro and Smith, 2014). However, in achieving these goals, studies show that possibilities of perverse outcomes and challenges in doing such may arise as focusing on one

SDG may compromise another (Dvulit et al., 2025; The Lancet, 2017; Stafford Smith et al., 2017). Public financing through taxation is directly related to the achievement of SDGs, especially if countries consider economic indicators when proposing and implementing policies to invest on when achieving such SDGs (Lopez et al., n.d; Xiang et al., 2025; Yang, 2020). Even with health (SDG 3) and education (SDG 4) having various existing research as guides on how to be able to address the issues that arise and progress into achievement of these goals, there are still economic factors affecting the quality of health and education which becomes evident as to why some studies show tax structures and SDG outcomes becoming insignificantly related to one another (Ozturk, 2001; Rahmna, 2023; Sorooshian, 2024). The researchers also noted observations on the macroeconomic factors affecting tax revenues and SDG outcomes, wherein higher population and GDP per capita increase tax revenues, and higher debt-to-GDP ratio indicates poor economic performance towards achieving the SDGs (Bisiriyu and Dhar, 2025; Francis et al., 2024; Luo, 2019; Chetri et al., 2023). Because of this, this study adds the moderating effect of macroeconomic factors as an assumption based on existing studies and empirical evidence that these impact the relationship of tax structure and tax revenues into the achievement of health (SDG 3) and education (SDG 4) outcomes.

2.6. Research Gap

The gap the study wants to address is not just in terms of the geographical aspect of studying more about the Asia and the Pacific region, but also more specifically on how tax mix, the combination of direct and indirect taxes of a certain economy together with the moderating factors of population, GDP per capita and debt-to-GDP of a certain country affects the outcomes of the economies in reaching a better health and education outcomes that is being measured through the Sustainable Development Goals (SDGs). Most of the studies the researchers found

online are focusing on tax rates and tax revenues together with the effects of politics in these tax rates as seen in the study of Adelusi (2025) wherein it focused on Nigeria and the relationship of taxation, governance and the Sustainable Development Goals (SDGs). Furthermore, most existing studies focus on overall Sustainable Development Goals (SDGs), and addresses the problem as a whole rather than per goal. It is notable however that politics is an inherent part of studying taxation, but the researchers will not dwell into those in this study. Aside from these being outside the scope of the study these also are some of the topics that are undisclosed and usually are lacking data. This study will focus more on specific Sustainable Development Goals (SDGs) that are health and education.

Chapter 3: Methodology

3.1. Research Design

The study applies a panel data regression analysis using econometric methods designed to investigate how the composition of taxes—particularly the share of income taxes and consumption taxes—affects the performance of the Good Health and Well-Being (SDG 3) and Quality Education (SDG 4) across the selected countries in the Asia-Pacific region from the period 2014 to 2023.

The panel data design combines cross-sectional country analysis within the Asia-Pacific region and the time series (2014 to 2023) with selected econometric methods. The purpose of the selected research design is to capture the heterogeneity and temporal dynamics. Applying this approach allows a control towards the unobservable effects such as policy-related differences, governance quality aspects, culture, and institutional differences that vary across countries, therefore controlling the potential biases and segments or factors that are not considered in the study.

The selection of the 29 countries in the Asia-Pacific Region were based on inclusion criteria. The aim of the usage of the inclusion criteria is to ensure that the data integrity and representativeness of the country are considered. The following criteria were used in the selection process: (1) geographic scope in the Asia-Pacific region, (2) availability of data within the time frame of 2014 to 2023, (3) availability of data sources from reputable international sources such as OECD, World Bank, IMF, and among others, (4) absence of FATF or any other regulatory body's blacklisting, and (5) countries that are not under any international sanctions which might hamper data availability and integrity. Countries such as North Korea, Iran,

Myanmar, and Russia were excluded due to international sanctions, data unavailability, or high-risk classifications. Other countries such as India, Iran, Macao, Myanmar, Nepal, Sri Lanka, Tajikistan, Timor-Leste, Turkey, Turkmenistan, and Uzbekistan were excluded because of the lack of data sources from the international bodies, where the data extracted from these sources are crucial to the study.

The analysis explores how the tax mix composition, specifically the share of income tax and consumption tax in total revenues, affects the achievement of Sustainable Development Goal 3: Good Health and Well-being, and Sustainable Development Goal 4: Quality Education outcomes.

3.2. Population and Respondents

This study aims to center on the countries within the Asia and the Pacific Region. The researchers aim to utilize a purposive sampling design wherein the researchers select the sample based on the criteria set based on the research objectives the study aims to answer (Memona et al. 2025).

3.3. Sampling Design

There will be an inclusion criteria set by the researchers, focusing on the geographic scope (if the country is within the Asia-Pacific region), time frame from the periods 2014 to 2023, availability of data in data sources from OECD and World Bank, not blacklisted from regulatory bodies, and not under any international sanctions.

Changes in the tax rates specifically on sales tax, income tax and corporate tax are to be observed over the covered period to establish the tax effects on health (SDG 3) and education (SDG 4). It is acknowledged that when no changes are observed, it may be inferred that the

changes seen in the country's SDG measures are due to other external factors aside from taxation. This is disclosed to avoid confusion wherein other external factors could be affecting the changes in the country's SDG measures that are not connected to the changes in tax rates and or structure.

To see a thorough study on the effects of taxation on health (SDG 3) and education (SDG 4), the study includes a set of 29 economies showing countries within the Asia and Pacific Region. The selected countries are seen on Table 1 that is based on the United Nations Industrial Development Organization (2024).

Table 1.

List of included countries.

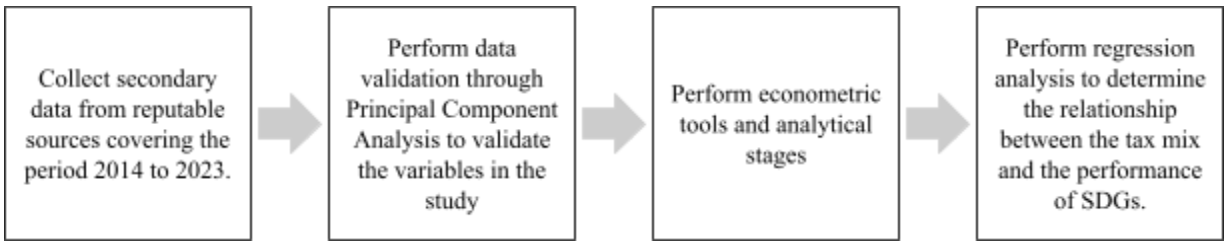
Country Classification	Included Countries
Middle Income in Asia and Pacific Region (22)	Armenia, Azerbaijan, Bangladesh, Bhutan, Cambodia, China, Fiji, Georgia, Indonesia, Kazakhstan, Kyrgyzstan, Laos, Malaysia, Maldives, Mongolia, Pakistan, Papua New Guinea, Philippines, Samoa, Solomon Island, Thailand, Vietnam
High Income in Asia and Pacific Region (7)	Australia, Cook Island, Hong Kong SAR, Japan, New Zealand, Singapore, South Korea

3.4. Research Procedures

The research procedures of this study outlines the four-step process undertaken coherent with the objectives of the study: data collection and preparation, data validation, data analysis, and data interpretation and presentation.

Figure 3.

Diagram of Research Procedure



3.4.1. Procedures for Data Collection

Independent Variable: Tax Structures

The independent variable for this study is the tax structure composition of each country in the Asia-Pacific region. The tax structure composition shows the relative shares of income and consumption taxes in the total tax revenues based on the data available in the OECD reports. There are two major tax mix examined in this paper: (1) the total income tax share comprised of the combined share of corporate income tax (CIT) and personal income tax (PIT) as a percentage of total tax revenue, and (2) the share of value-added tax (VAT) and/or goods and services tax (GST) as a percentage of total tax revenue, representing the consumption tax share.

The selected independent variables are compiled annually from the period 2014 to 2023 for 29 selected Asia-Pacific countries. For a consistent and balanced policy design the variables are expressed as ratios to the total tax revenue to ensure that the proportional contribution of each tax category is captured. The countries are classified into three predominant tax compositions: predominant income-tax, predominant consumption tax, and balanced mix. A country is believed to be considered as having a predominant income tax if its income tax share exceeded consumption tax by 10%, and vice versa for consumption tax predominance. However, countries having a less than 10% difference between income tax share and consumption tax share are

considered to be classified as balanced tax mix. The 10% threshold is consistent with OECD and IMF practices, where countries classification amongst practical researches by these international organizations fall between 8% to 12%. Such range or cutoff determines the policy bias or tax type reliance of a country (IMF, 2021; OECD et al., 2023).

Dependent Variables: SDG 3 and SDG 4 Indicators

Among the numerous indicators or proxies pertaining to the national progress towards the achievement of health (SDG 3) and education (SDG 4), the following indexes are selected from the database provided by the United Nations SDG Reports. The analysis utilizes performance indicators instead of government spending for each sector.

SDG 3 (Good Health and Well-Being)

The following indicators collectively represent preventive health measures and effective curative healthcare systems, emphasizing quality, health outcomes, and accessibility for all.

1. Under-five mortality rate (3.2.1)
2. Neonatal mortality rate (3.2.2)
3. Maternal mortality rate (3.1.1)
4. Proportion of births attended by skilled health personnel (3.1.2)
5. Coverage of essential health services (3.8.1)

SDG 4 (Quality Education)

The following indicators represent quality of education, accessibility, and equity.

1. Minimum learning proficiency in reading and mathematics (4.1.1)
    a. Early grade

   b. Primary
   c. Lower secondary education
2. Completion rates (4.1.2)
   a. Primary
   b. Lower secondary education
   c. Upper secondary education
3. Proportion of trained teachers (4.c.1)
   a. Pre-primary
   b. Primary
   c. Lower secondary education
   d. Upper secondary education
4. Adult literacy rate (4.6.1)
5. Gender gap in completion (4.5.1)

The nature of health (SDG 3) and education (SDG 4) proxies are multidimensional, thus, this study employs the Principal Component Analysis (PCA) to aggregate the indicators into composite indices for health and education outcomes to reduce dimensionality. Furthermore, this technique ensures an objective performance index.

No single standardized indicator exists to represent overall performance in health (SDG 3) and education (SDG 4). Hence, this study constructs composite indices for each goal by aggregating multiple official SDG indicators reported by the United Nation and World Bank. Each variable is standardized using z-scores to ensure comparability and then averaged to obtain a single index per country-year observation.

Moderating Variables: Macroeconomic Factors

This study considers macroeconomic variables that may influence the relationship between the tax mix and the SDG performance. The selected macroeconomic variables are: population, GDP per capita, and debt-to-GDP ratio. Population measures the demographic pressures on the country. According to the UN DESA (n.d), population impacts development, particularly the achievement of sustainable development goals, as it strains the country's resources. Next, the GDP per capita is selected as a macroeconomic moderating variable as a proxy for the countries' income levels and fiscal spaces. Third, the debt-to-GDP ratio which represents the financial sustainability and the potential inverse impact on social indicators. These factors allow the researchers to profoundly understand whether the impact of tax mix on health (SDG 3) and education (SDG 4) performances vary depending on a country's demographic size, economic capacity, or fiscal management repercussions. The data will be obtained from international reliable sources such as the World Bank and the IMF.

Table 2.

Description of Variables and A Priori Expectations

Variables	Measurement	Expected Sign	Sources
Dependent Variable			
SDG 3: Good Health and Well-Being*	Under-five mortality rate (3.2.1) Neonatal mortality rate (3.2.2) Maternal mortality rate (3.1.1) Proportion of births attended by skilled	+	SDG Index Portal

Variables	Measurement	Expected Sign	Sources
	health personnel (3.1.2) Coverage of essential health services (3.8.1)		
SDG 4: Quality Education*	Minimum learning proficiency in reading and mathematics (4.1.1) ● Early grade ● Primary ● Lower secondary education Completion rates (4.1.2) ● Primary ● Lower secondary education ● Upper secondary education Proportion of trained teachers (4.c.1) ● Pre-primary ● Primary ● Lower secondary education ● Upper secondary education Adult literacy rate (4.6.1)	+	SDG Index Portal

Variables	Measurement	Expected Sign	Sources
	Gender gap in completion (4.5.1)		
Independent Variables			
Direct Tax or Income Tax Share	Taxes on income and profits as percentage of total taxation (% of Total Tax)	+/-	OECD Annual Reports - Asia and the Pacific Region (2014 to 2023)
Indirect Taxes or Consumption Tax Share	Taxes on goods and services as percentage of total taxation (% of Total Tax)	+/-	OECD Annual Reports - Asia and the Pacific Region (2014 to 2024)
Moderating Variables - Macroeconomic Context			
Population	Annual % growth of total population	-	World Bank
GDP per Capita	USD	+	World Bank
Debt-to-GDP ratio	Gross debt as percentage of GDP (% of GDP)	+/-	IMF, World Bank

*Note: PCA to aggregate and form into composite indices, per country, per year

**Note: Table 2 — Description of Variables and A Priori Expectations are adapted from Halim, A., & Rahman, M. (2022). *The effect of taxation on sustainable development goals: evidence from emerging countries*. https://doi.org/10.1016/j.heliyon.2022.e10512.

3.4.2. Procedures for Data Analysis

This part of the study shows the parameters and models to be used to validate the data previously collected.

Principal Component Analysis. PCA is a statistical tool that reduces dimensionality among variables like the SDG indicators. Most studies have shown a single index representing all the performance measures for the 17 Sustainable Development Goals. However, each SDG, particularly health (SDG 3) and education (SDG 4), have multiple indicators separated under various targets which are multidimensional in nature. There are five selected indicators for health (SDG 3) that are related to mortality and health service coverage (3.1.1, 3.1.2, 3.2.1, 3.2.2, and 3.8.1). There are also five selected indicators for education (SDG 4) that are focusing on education attainment, literacy, and quality (4.1.1, 4.1.2, 4.c.1, 4.6.1, and 4.5.1). There is no single standardized indicator or aggregated indicator existing that could best represent the performance of health (SDG 3) and education (SDG 4), as their scores individually. The practice of selecting several indicators that represent targets for each SDG is a similar approach applied by Moyer and Hedden (2019) in their study about sustainable development goals due to the absence of individual SDG scores. Most studies that are using sustainable development goals as their variables utilized research-composite measures to summarize and aggregate the indicators into one performance score. Raw data for each indicator was standardized for some studies (Kroll, 2015). In this instance, PCA will be using z-scores standardized data to obtain a single index per country, per SDG, per year to ensure its comparability.

Standardized using z-score:

$$Z_{ijt} = \frac{X_{ijt} - \overline{X}_j}{s_j}$$

Panel Data Regression Analysis

Breusch-Pagan Test

To have the best linear unbiased estimators, three assumptions must be satisfied. One of them is the Breusch Pagan Test. This is a test done to ensure the coherency and consistency of the statistical model chosen in performing a regression analysis. Wherein the discrepancy in the error terms is constant among all levels of the independent variable, and to be able to have a reliable conclusion (Breusch & Pagan, 1979). The opposite of this is having heteroscedasticity, which could lead to different error terms among the independent variables and could lead to inappropriate conclusions and this also violates the best linear unbiased estimator, this could be fixed by adjusting the years or adding more samples for the study. This is seen in the study by Balasoiu et al. (2023) wherein they tested the impact of direct taxation to economic growth on different European countries. Since they used panel data, the Breusch-Pagan Test is essential to ensure that despite the differences between European countries they can still have a reliable conclusion. This is similar to this study, as the researchers aim to test the cross country outcomes of health (SDG 3) and education (SDG 4). Together with the effects of the tax mixes and moderating factors that are playing a role in the study.

Variance Inflation Factor (VIF)

Also part in getting the best linear unbiased estimator, out of the three assumptions that must be satisfied, another one of them is the Variance Inflation Factor (VIF). This is done to ensure that variables are not that highly linear with one another. There must be no multicollinearity among independent variables. It is important that variable 1 does not highly impact variable 2 as it will distort the analysis of the results. This is done on a per variable basis and having a high variance inflation factor (VIF) means that the variable has to be dropped to improve the reliability of the model (Shrestha, 2020). As seen in the study by Pratiwi and Septiani (2025) wherein they studied analyzing the effects of income and tax knowledge on the

compliance behavior of taxpayers. The study included independent variables of income tax and understanding taxes which showed no multicollinearity, thus ensuring that the variables can be used for the test. This is similar to this study of testing independent variables of indirect taxes such as Value Added Tax (VAT) and direct taxes such as personal and corporate income tax and if there are no multicollinearity among the independent variables.

Wooldridge Test

Lastly, part of the three assumptions that must be satisfied is having no auto correlation, also part in getting the best linear unbiased estimator. It is assumed that different observations should not be auto correlated with one another. When looking for the effects of variables there are instances where results are not seen immediately, hence having instances of using lag that you delay checking the results on a different period. As having an auto correlation could affect the results of the test. As seen in the study of Damajanti and Karim (2017), entitled the effects of tax knowledge on individual taxpayers compliance, it tested autocorrelation and cross sectional data since the tax knowledge of an individual may change over time. Similar to this study, that includes several years and the actions of previous years could affect the outcomes of the future years. This is used in analyzing the study as to whether to analyze them every year or every other year and so forth depending on the results.

Panel Data Testing - Cross Dependence Test. The cross-sectional dependence test developed by Pesaran (2004) is used for panel data testing in determining the common factors within cross-country panels in the Asia-Pacific region. This method of testing is relevant in large cross section dimensions because overlooking the existence of cross dependence of common factors in countries may result in inaccurate, inconsistent, and a biased analysis of the panel data

(De Hoyos and Sarafdis, 2006). The Pesaran Cross Dependence test was developed as a single diagnostic test that is applicable to a variety of panel data models, based on a simple average of all pair-wise correlation coefficients of the Ordinary Least Squares (OLS) residuals from the individual regressions in the panel (Pesaran, 2004). This method of data testing assumes that data across different units are interdependent of one another and not independent, which is relevant to this study considering the heterogeneity of the tax structures and its relationship with the SDG 3 and 4 outcomes of the countries within the Asia-Pacific region.

Test of Time Series or Periods

Unit Root Tests. Unit root tests determine if a time series variable is stationary or non-stationary. A unit root in the context of time series means that the variable is non-stationary, which is more challenging to model because of its volatility over time (De Lima E Silva et al., 2020). Stationary time series, on the other hand, indicates that the variable is constant or is not heavily dependent on time. Determining which unit root test to utilize in this study depends on the results from the cross-dependence test. If cross-dependence does not exist among the panel data or the time series variables are non-stationary, the Maddala and Wu unit root test (1999) will be applied. However, if cross-dependence exists among the panel data or the time series variables are stationary, the Pesaran unit root test (2007) will be applied. Conducting a unit root test after the cross dependence test ensures the validity and reliability of the data analysis (Bai and Ng, 2010).

Model Selection

In determining the most appropriate model for the panel data regression analysis, this study follows the structured model selection approach.

Breusch-Pagan (BP) LM Test. In panel data analysis, it is vital to choose the appropriate model through several testing, one of which is the Breusch-Pagan (BP) LM Test. This test examines which model is more appropriate to be chosen for the study. The options are: simple pooled Ordinary Least Squares (OLS) model or the random-effects model. The BPLM test determines the existence of cross-sectional variance of units (in this case the selected countries in the Asia-Pacific region) in the panel data. The rejection of the null hypothesis means that the RE model is necessary to capture the unobservable heterogeneity, otherwise, pooled OLS is sufficient (Karadayi, 2023). In capturing the unnoticed heterogeneity, this provides more reliable estimates of the impact of the tax mix on the SDG outcomes. Moreover, this test allows the prevention of standard errors and biases.

$H_{0\text{-}B}$*: There is no significant variance across the 29 selected countries in the Asia-Pacific region.*

$H_{1\text{-}B}$*: There is significant variance across the 29 selected countries in the Asia-Pacific region.*

Hausman Test. After testing which among the simple pooled OLS and RE model should be chosen, and when it suggests that the RE model should be used, the Hausman Test should be performed next. This test justifies the selection between RE model or Fixed Effects (FE) model (Baltagi, 2014). The RE model should be selected if the unobserved country-effects are uncorrelated with the independent variables, otherwise, the RE estimates will show biases that pursue the selection of FE model instead.

$H_{0\text{-}H}$*: The unobserved country-specific effects are uncorrelated with the independent variables and moderating factors.*

$H_{1\text{-}H}$: The unobserved country-specific effects are correlated with the independent variables and moderating factors.

Chow Test. Chow Test or F-Test is a test performed to determine which among the pooled OLS or Fixed Effects is better. The null hypothesis depicts that across all cross-sectional units, the intercepts are the same (equal to 0). If the resulting F-statistic is statistically significant, reject the null hypothesis, which indicates that the unobserved heterogeneity is significant and that the fixed effects model is more preferable to perform (Greene, 2018, as cited in Mukete et al., 2021).

$H_{0\text{-}C}$: The intercepts are the same across the 29 selected countries in the Asia-Pacific region.

$H_{1\text{-}C}$: The intercepts are different across the 29 selected countries in the Asia-Pacific region.

Fixed Effects Models. The Fixed Effects model is an econometric model effective for addressing the unobserved variable bias in a constant time factor that might be unobserved but possess correlation with the variables (Basumatary & Devi, 2022). Using the Fixed Effects model, the time-invariant confounders are isolated to gather more reliable estimates within each unit over time (Wooldridge, 2010). To see the individual effects of the predominance of type of tax shares in the tax mix or balanced mix, as moderated by the selected macroeconomic variables, on the achievement of health (SDG 3) and education (SDG 4) outcomes, the following models below for the fixed effects are to be used.

For predominant income tax share, both health (SDG 3) and education (SDG 4) outcomes:

$$SDG\ 3_{it} = \propto_i + \beta_1 INC_{it} + \gamma_1 (INC_{it}\, xPop_{it}) + \delta_1 (INC_{it}\, xGDPpc_{it}) + \theta_1 (INC_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$$SDG\ 4_{it} = \propto_i + \beta_1 INC_{it} + \gamma_1 (INC_{it}\, xPop_{it}) + \delta_1 (INC_{it}\, xGDPpc_{it}) + \theta_1 (INC_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$\propto$ = fixed effects; λ = optional year fixed effects; ε = error term; i = country; t = the year; β = the coefficient of the direct effect of the independent variable; γ = the coefficient of population; δ = the coefficient of GDP per capita; θ = the coefficient of debt-to-GDP ratio

For predominant consumption tax share, both health (SDG 3) and education (SDG 4) outcomes:

$$SDG\ 3_{it} = \propto_i + \beta_2 CONS_{it} + \gamma_2 (CONS_{it}\, xPop_{it}) + \delta_2 (CONS_{it}\, xGDPpc_{it}) + \theta_2 (CONS_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$$SDG\ 4_{it} = \propto_i + \beta_2 CONS_{it} + \gamma_2 (CONS_{it}\, xPop_{it}) + \delta_2 (CONS_{it}\, xGDPpc_{it}) + \theta_2 (CONS_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$\propto$ = fixed effects; λ = optional year fixed effects; ε = error term; i = country; t = the year; β = the coefficient of the

direct effect of the independent variable; γ = the coefficient of population; δ = the coefficient of GDP per capita; θ = the coefficient of debt-to-GDP ratio

For balanced tax share, both health (SDG 3) and education (SDG 4) outcomes:

$$SDG\ 3_{it} = \propto_i + \beta_3 BAL_{it} + \gamma_3(BAL_{it}\, xPop_{it}) + \delta_3(BAL_{it}\, xGDPpc_{it}) + \theta_3(BAL_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$$SDG\ 4_{it} = \propto_i + \beta_3 BAL_{it} + \gamma_3(BAL_{it}\, xPop_{it}) + \delta_3(BAL_{it}\, xGDPpc_{it}) + \theta_3(BAL_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$\propto$ = fixed effects; λ = optional year fixed effects; ε = error term; i = country; t = the year; β = the coefficient of the direct effect of the independent variable; γ = the coefficient of population; δ = the coefficient of GDP per capita; θ = the coefficient of debt-to-GDP ratio

Random Effects Models. The Random Effects (RE) model is also an econometric model used when the unobserved effects are assumed to be uncorrelated with the independent variables of the study (Wooldridge, 2010). The fixed constants are selected randomly, in contrast with the Fixed Effects model. To see the individual effects of the predominance of type of tax shares in the tax mix or balanced mix, as moderated by the selected macroeconomic variables, on the achievement of health (SDG 3) and education (SDG 4), the following models below for the random effects are to be used.

For predominant income tax share, both health (SDG 3) and education (SDG 4) outcomes:

$$SDG\ 3_{it} = \beta_0 + \beta_1 INC_{it} + \gamma_1(INC_{it}\, xPop_{it}) + \delta_1(INC_{it}\, xGDPpc_{it}) + \theta_1(INC_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$$SDG\ 4_{it} = \beta_0 + \beta_1 INC_{it} + \gamma_1(INC_{it}\, xPop_{it}) + \delta_1(INC_{it}\, xGDPpc_{it}) + \theta_1(INC_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

β_0 = random effects with an assumption that the effects are uncorrelated ; Λ = optional year fixed effects ; ε = error term; β = coefficient of the direct effect of the independent variable ; γ= coefficient of population ; δ = coefficient of GDP per capita ; θ = coefficient of debt-to-GDP ratio.

For predominant consumption tax share, both health (SDG 3) and education (SDG 4) outcomes:

$$SDG\ 3_{it} = \beta_0 + \beta_2 CONS_{it} + \gamma_2(CONS_{it}\, xPop_{it}) + \delta_2(CONS_{it}\, xGDPpc_{it}) + \theta_2(CONS_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$$SDG\ 4_{it} = \beta_0 + \beta_2 CONS_{it} + \gamma_2(CONS_{it}\, xPop_{it}) + \delta_2(CONS_{it}\, xGDPpc_{it}) + \theta_2(CONS_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

β_0 = random effects with an assumption that the effects are uncorrelated ; Λ = optional year fixed effects ; ε = error term; β = coefficient of the direct effect of the independent variable ; γ= coefficient of population ; δ = coefficient of GDP per capita ; θ = coefficient of debt-to-GDP ratio.

For balanced tax share, both health (SDG 3) and education (SDG 4) outcomes:

$$SDG\ 3_{it} = \beta_0 + \beta_3 BAL_{it} + \gamma_3(BAL_{it}\, xPop_{it}) + \delta_3(BAL_{it}\, xGDPpc_{it}) + \theta_3(BAL_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

$$SDG\ 4_{it} = \beta_0 + \beta_3 BAL_{it} + \gamma_3(BAL_{it}\, xPop_{it}) + \delta_3(BAL_{it}\, xGDPpc_{it}) + \theta_3(BAL_{it}\, xDebtGDP_{it}) + \lambda_t + \varepsilon_{it}$$

β_0 = random effects with an assumption that the effects are uncorrelated ; Λ = optional year fixed effects ; ε = error term; β = coefficient of the direct effect of the independent variable ; $\boldsymbol{\gamma}$= coefficient of population ; δ = coefficient of GDP per capita ; θ = coefficient of debt-to-GDP ratio.

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