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Climate and Visa Exemption Policies on International Tourism Revenue: A Cross-Country Panel Study

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Abstract

Climate change is a pressing issue in the whole world. It has harmed the tourism industry, human activities, life cycles, and the economy. There are various policies declared to solve the problems of climate change and tourism receipts. The objective of the study is to investigate the impact of climate change and policy-related issues on tourism receipts in Thailand, focusing on the effectiveness of climate policy and visa exemption policy. The collected data consists of 11 ASEAN-China countries from 1995 to 2023 using the STATA18 tools. There are 3 models in the investigation, including the environmental model with the climate change policy dummy variable, the economic model with the visa exemption dummy variable, and the combined model. The methods are compared by using random effects and a robust Poisson maximum likelihood estimator to measure how effective the policies are. The findings indicate that climate change initiatives boost both sustainable tourism and tourism receipts. A free visa for ASEAN-China countries boosts the quantity of tourists, but it doesn't significantly impact tourism receipts. According to the results, the government's integration of environmental, economic, and policy-related factors will help conserve sustainable tourism in Thailand over the long term. Sustainable tourism will solve the weather condition and support climate change policy. Moreover, the visa exemption policy should concern increasing tourism revenue and tourism immigrants.

Keywords: Climate Changes; Visa Exemption; Tourism Receipt; ASEAN-China Countries.

1. Introduction

Climate change is a definite long-term change in ecosystems, especially temperature and weather. It is one of the most significant challenges facing the world in recent decades. This not only has a giant effect on the environment and human lifecycle but also impacts all industry sectors, such as trade, consumption, technology, the tourism industry, etc. [1]. It is inevitable to demonstrate that human activities are the main cause of climate and weather change, which releases CO_2 emissions, causes unseasonal rain, and causes deforestation [2]. Particularly in the tourism industry, tourism activities play an important role as a source of carbon footprint for almost 10% [3]. Moreover, Thailand's tourism receipts mostly have increased from the natural-based tourism, including beaches, mountains, forests, and marine parks [4]. Hence, climate change has a huge effect on Thai tourism activities.

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The number of international tourists in Thailand has increased dramatically, around 88%, or 29 million arrival tourists, in 2024, and receipt revenue exceeds 1 trillion baht, particularly from ASEAN-China tourists [5]. Its continuous growth has provided a contribution to society, solving unemployment, the economy, and poverty problems and increasing new jobs in developed and developing countries for many decades [6]. The number of ASEAN-China tourists has risen to 10.6 million tourists, or 30% of the total number of international tourists in 2024. It's obvious that the number of ASEAN-China tourists has dramatically increased and is very important for the tourism sector [7]. And Thailand's government, therefore, uses the visa exemption policy to enhance and increase more ASEAN-China tourism demand [8]. However, some countries argue that visa exemption has not enhanced tourism receipts but has only increased tourism demand with longer stays [9]. And there is no study of tourism receipts and tourism policy in Thailand, especially the ASEAN-China group. Therefore, it remains an unclear question whether visa exemption for ASEAN-China leads to increased tourism receipts in Thailand.

The relationship between climate change and the tourism industry is explained by the UN Environment Program: climate change can lead to changes in the quality of the tourist season. It damages the local environment and impacts expenses and tourist attractions [10]. Therefore, climate change directly and indirectly affects the tourism industry by causing flooding, storms, and high temperatures, which in turn increase the costs of tourism services and activities. However, the heat waves in some countries attract many tourists [11]. Uddin et al. [12] reveal that trade and tourism have damaged both the long-term and short-term environmental quality, so the government must make environmental protection laws and sustainable tourism, because climate change has not only an impact on the environment and natural resources but also a huge influence on industry, human activities, life cycles, and the economy. For example, in Thailand, climate change has a huge effect on water supply and rainfall, which led to tourism activity changes and reduced local tourism revenue through unsustainable development in Koh Chang. It is facing water scarcity and saltwater intrusion [13]. The climate changes. El Niño has also damaged forest restoration and biodiversity in Doi Suthep-Pui National Park, Northern Thailand. It has influenced ecosystems, especially forest structure and species composition. Therefore, many local people try to request a more effective forest restoration strategy [14]. To solve this issue and balance the ecosystem and economy, the government, hence, has declared the Climate Change Master Plan (CCMP) policy since 2015 [15].

According to the previous studies, it's clear that climate change has a huge effect on the tourism industry through economic development in Thailand. The tourism industry has gradually increased, particularly ASEAN-China [16, 17]. Furthermore, the revenue of ASEAN-China tourism studies and climate changes is limited. A few studies investigate the effectiveness of enhancing tourism by the ASEAN-China visa exemption policy and solving climate change by the Climate Change Master Plan (CCMP) policy. Therefore, this gap leads the study to use quantitative analysis to explore the impact of climate change factors, economic factors, climate change policy, and the ASEAN-China visa exemption policy on international tourism receipts in Thailand across 11 countries over the period 1995 to 2023. The objective of this paper is to investigate the impact of climate change on tourism receipts in Thailand, focusing on the Climate Change Master Plan (CCMP) policy and the ASEAN-China visa exemption policy, and tries to answer the following research questions:

(1) How do environmental factors (e.g., temperature, rainfall, and forest degradation) impact tourism receipts in Thailand?

(2) How does the ASEAN–China visa exemption policy influence tourism receipts in Thailand?

(3) How does the Climate Change Master Plan (CCMP) impact tourism receipts in Thailand?

(4) How do combined climate change and free visa policy interventions affect the receipt of tourism in Thailand?

This article aims to contribute to the current literature with a simultaneous investigation of the impact of climate change on tourism receipts in Thailand, focusing on the Climate Change Master Plan (CCMP) policy and the ASEAN-China visa exemption policy for the period of 1995-2023. And the study tries to contribute to the econometric framework, current environment literature, visa exception literature, and the tourism industry in Thailand.

The results from this study can support open innovation by helping government and private sectors work together to create new ideas for climate-friendly tourism. It also gives useful information for studying tourist behavior, especially how ASEAN–China tourists react to climate and visa policies. This can help improve tourism services and make them more suitable for the changing environment.

The paper is designed as follows: Section 2 reviews the literature on climate change, economics, and policy-related topics; section 3 describes data collection, methodology, and framework; section 4 presents the result of the hypothesis; section 5 applies the framework and describes the discussion; section 6 concludes with policy implications; and section 7 presents the limitations of the study.

2. Literature Review

2.1. Climate Change, Environment, and Economic Growth

Climate change has a huge effect on the long-term domestic economy in the whole world in every sector, such as agriculture, marine, tourism, etc. Moreover, many studies reveal that climate change brings rising temperatures, shifting rainfall patterns, and extreme weather events, which affect travel plans [18, 19]. However, the studies mostly focus on the number of international tourists, with fewer studies representing the effect of climate change on tourism revenues. For example, it found that although a longer summer season has attracted more tourism demand, it has reduced international tourism in Egypt from 1990 to 2020. Tourists prefer to stay longer but spend less. However, a case study in Cyprus shows a short-run and long-run climate change effect on tourism revenue [9].

The tourism industry is one of the sectors to be responsible for climate change [3]. All the tourism activities in the whole world release 3.9-5.4 billion tonnes of carbon dioxide, or around 8-11% of carbon dioxide in the world. The activities include retail (12%), food and beverage (10%), agriculture (8%), service (8%), construction (3%), accommodation (6%), and others (4%) [20]. Many countries try to develop their tourism industry with various infrastructure service strategies, such as transportation, airports, railways, roads, ports, communication, hotels, resorts, etc., to increase more facilities and attract tourists [21]. However, the development of infrastructure and human activities such as establishing shopping malls and travelling by their cars will release emissions and damage the ecological system [22]. Transportation supports tourism, which also releases over 49% of emissions from activities, including plane, road, boat, railway, and others [23]. It's clear that released emissions have occurred in every part of tourism activities.

In contrast, climate change also has a giant effect on tourism sectors. Increasing temperature leads the pattern of tourism changes. Some tourists avoid the hot season and go to the winter season in other countries. Global warming is also reducing snowfall in the Alps by 8.4% per decade, which is having an impact on ski resorts [24]. The tourism demand model is used to explain the relationship of climate change and the tourism sector in many studies [25]. Income and pricing are the main economic factors that are used to predict unexpected tourism demand [26]. Moreover, to explain more about the climate change in the tourism model, some use precipitation, released CO_2 emissions, the power of wind, or energy consumption [18].

The empirical studies of climate change and tourism revenue in ASEAN-China countries and Thailand are limited. Various studies use economic models and fail to explain climate change and tourism revenue. And there is a lack of research on nature-based tourism. Thailand's economy depends on international tourism, which is sensitive to external factors. The COVID-19 event can be explained by how global travel is affected. In contrast, some studies argue that trying to increase tourists after an event is the cause of overtourism [27]. Overtourism damages the quality of tourism sites, ecosystems, biodiversity, and local culture and lifestyle. In the case of Maya Bay, Malaysia's Sipadan and Boracay Island are the best examples to show the overtourism problem that makes those tourism attractions close temporarily to exploit their resources. It indicates that the tourism industry without concern for the environment will have a giant effect on the economy, environment, and society through loss in tourism revenue, which must be used for restoring ecosystems damaged by overtourism. It can be explained that environmental degradation can change traveler destinations and bring long-term economic damage.

Moreover, the study of Elsayed [18] uses precipitation, carbon dioxide emissions, temperature, arable land, and gross capital formation to investigate tourism in Egypt by autoregressive distributed lag (ARDL). And it found that precipitation and temperature have a positive effect on investigative tourism, while carbon dioxide emissions have a long-term negative impact on international tourism. Moreover, Jayasinghe [28] uses autoregressive distributed lag (ARDL) to explore carbon dioxide emissions and tourism in India. Energy consumption, tourism, economic growth, and CO_2 emissions are used as variables in the study. And it found that energy consumption and tourism positively contribute to CO_2 emissions. Lee et al. [29] investigate the impact of tourism on economic growth and CO_2 emissions by using panel cointegration techniques and fixed-effects models in 43 European countries from 1988 to 2009. The result found that tourism, CO_2 emissions, and FDI have a positive effect on economic growth, while tourism and FDI have a negative effect on CO_2 emissions. To address the previous studies, it is not concerned about international tourism revenue and forest degradation but only about economic growth. This research, hence, develops a model to assess how environmental factors, including temperature, rainfall, and forest degradation, affect international tourism receipts in Thailand by using fixed-effects models.

2.2. Environmental Regulation and Tourism Industry

Natural Resources and Environmental Policy and Planning (ONEP) has established the long-term Climate Change Master Plan (CCMP) 2015–2050 in Thailand to eliminate climate changes and make adaptation and mitigation strategies for the whole industry. The aim of the Climate Change Master Plan is to conserve the environment and boost the economy at the same time [17].

The plan has divided the framework into 5 sections, including force, pressure, state, impact, and response. These are used to establish the policy to solve the balance of environmental pressures and economic activities, particularly in the tourism sector, which will face deforestation, carbon emissions, and extreme weather events.

Additionally, the Climate Change Master Plan (CCMP) supports environmental policies that enhance green growth and sustainable tourism by promoting low-carbon transportation, resource efficiency, and environmental regulation. There are many studies that explore the effect of environmental regulation on the tourism industry. For instance, environmental regulation decreases the amount of carbon emissions, but it is the cause of tourism development increasing in Japan [30]. However, Sun et al. [31] and Chen [32] show the positive direction of environmental regulation, which increases tourism development, tourism arrival, and tourism revenue through sustainable tourism in China. Gössling & Hall [33] confirm the relationship of policy maker and tourism revenue that governance can enhance the resilience and attractiveness of tourism destinations under environmental pressure. Due to a few studies of policymakers and tourism revenue, this study, therefore, would like to investigate the impact of Thailand's climate change policy on tourism receipts in Thailand. To show policy efficiency, Equation 1 will represent the climate change policy ($\emptyset_1 epolicy$) dummy variable, which is 1 if the availability of climate change policy ($\emptyset_1 epolicy$) ≥ year 2015 and 0 if the availability of climate change policy ($\emptyset_1 epolicy$) ≤ 2014.

2.3. Visa Exemption Policies and Tourism Industry

In 2024, the number of ASEAN-China tourists has increased to 30%. It shows that Thailand is becoming increasingly dependent on tourists from ASEAN and China, which is sensitive to external factors such as climate change and geopolitical tensions in the region [7]. The study of Hsiao [8] and Li [34] also confirms that tourism has a positive direction with economic growth and exchange rate in Thailand but not specifically in tourism revenue. However, Nyasha et al. [35] said that it found tourism expenditure has a negative effect on economic growth, while tourism revenue has a positive direction instead in Sub-Saharan Africa. This makes the study a must to investigate the relationship of tourism receipts and economic growth in Thailand.

According to visa-free policies, many countries use the policies as one of the instruments to increase inbound tourism. This way is not only advantageous for the tourism sector but also boosts the domestic economy. The visa-free travel policy has increased the number of tourists and tourism receipts by around 13% in South Korea and Japan [36]. The study found that the visa-exempt policy has not affected the number of tourism arrivals, but it has increased bilateral trade in OECD countries [37]. Although visa policy enhances tourism inflow, it will decrease trade and investment by using 194 destination countries and 214 origin countries [38].

The tourism industry is a significant driver of Thailand's economy, and the influx of tourists from ASEAN countries and China plays a crucial role in this sector. The visa exemption policy for ASEAN-China countries (fvisa), therefore, is used to enhance the tourism industry and aims to deepen regional integration and promote people-to-people exchanges. The study of Gu [39] reveals China's 72-hour visa-free transit policy using a spatial difference-in-differences (SDiD) that the policy has not had a huge effect on increasing the number of tourists, but the impact varied across different regions, with some cities experiencing shifts in tourist distribution patterns. China's broader visa-free policies have contributed to a significant increase in inbound tourism. In 2024, China has over 17 million foreign visitors, an increase, marking a 129.9% surplus compared to the previous year. These policies not only stimulate economic growth but also enhance China's global image. Moreover, the study of Moufida [40] reveals that free visas increase tourism demand and tourism revenue from exchange rates in Algeria. Meanwhile, the free visa policy has a negative effect on tourist quality and destination in Indonesia [41]. And visa facilitation also shows the negative influence on international tourist arrivals and tourism receipts in Nigeria, Africa [42]. The previous shows a few studies of visa requirements with tourism revenue. And no studies can confirm the potential of free visas, especially ASEAN-China. Therefore, this study uses the visa exemption policy for ASEAN-China countries to investigate the impact of the free visa policy on tourism receipts in Thailand in Equation 2, with the Thai government approving different year policies for ASEAN-China countries in Table 1.

Table 1. The period of visa exemption policy for ASEAN-China countries

Country	Year	Equation ($\emptyset_2 fvisa$)
Brunei Darussalam	2015	1 if year ≥ 2015, 0 is otherwise
Cambodia	2013	1 if year ≥ 2013, 0 is otherwise
Indonesia	2003	1 if year ≥ 2003, 0 is otherwise
Lao PDR	2004	1 if year ≥ 2004, 0 is otherwise
Malaysia	1995	1 if year ≥ 1995, 0 is otherwise
Myanmar	2015	1 if year ≥ 2015, 0 is otherwise
Philippines	1995	1 if year ≥ 1995, 0 is otherwise
Singapore	1995	1 if year ≥ 1995, 0 is otherwise
Viet Nam	2000	1 if year ≥ 2000, 0 is otherwise
China	2024	1 if year ≥ 2024, 0 is otherwise

Source: Ministry of Foreign Affairs, Thailand

2.4. Research Gap and Conceptual Direction

It's brief that the previous study shows the impact of climate change and policy-related issues on the tourism industry but does not focus on tourism revenue. Particularly for ASEAN-China tourism, there are a few studies on government policy and climate change conditions.

Hence, the panel data of climate change (environmental factors such as temperature, rainfall, etc.) and policy-related dummy variables (such as visa exemptions and Thailand's Climate Change Master Plan) have been shown in this paper. The economic indicator will be used to show how important tourism receipts are. Moreover, the study aims to investigate the impact of climate change and policy-related issues on tourism receipts. The goal is to better understand how Thailand's tourism sector can stay strong and sustainable in a changing world.

To illustrate that the policy is successful, it must prove that its efforts not only increase the number of tourists but that the policies can support environmental issues and the domestic economy. The primary purpose of this review is to ascertain if there is compelling evidence that the impact of climate change and policy-related tourism receipts in Thailand, focusing on climate change policy (epolicy) and the ASEAN-China free visa policy (fvisa), has had this result as the following hypothesis.

H1: epolicy ($\emptyset_1$) ≥ 2015, and epolicy ($\emptyset_1$) not ≤ 2014;

Then the efficient policy is occurred

H2: fvisa ($\emptyset_2$) ≥ the different period of visa exemption policy,

and 1995 ≤ fvisa ($\emptyset_2$) ≥ 2023; then the efficient policy has occurred

3. Data and Methodology

3.1. Data

The data analysis will be examined in this section. The total of international tourism receipts is collected from the World Bank Database from 1995 to 2023, which is the dependent variable. Moreover, environmental factors concerning climate change are selected from Thai meteorological data. To investigate the effect of ASEAN-China tourists on tourism receipts, the dummy variable of free visa policy will be used to experiment in different periods. The visa policy is used for 11 ASEAN-China countries, including Thailand, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Viet Nam, and China. Moreover, the effectiveness of the visa will depend on the time periods declared by the government. And the dummy variable of climate policy is used to examine the effect of climate (CCMP) policy on tourism receipts.

This study will be analyzed by the previous studies and theories using annual panel data, which explore the influence of climate change and policy prevention on international tourism revenue in Thailand. Both dependent and independent variable definitions will be shown in Table 2. Before estimation, variance inflation factors (VIF) have been used to test the multicollinearity of variables, which is less than 5 [22]. After testing, the stationarity of data will be estimated by the cross-sectional IPS (CIPS), the cross-sectional Fisher-augmented Dickey-Fuller unit root test (CADF), and the Fisher-Phillips-Perron unit root test (PP). Then the formulations have been analyzed by the random effect regression and a robust PPML, which followed the hypothesis.

Table 2. The variable definitions

Variables	Definitions	Unit
LNtou	Logarithm of Tourism Receipt	US$ Thousand
LNcar	Logarithm of Transportation Carbon Dioxide	Mt CO2e
LNfia	Logarithm of Forest Area	Percentage
LNrain	Logarithm of Annual Precipitation	Millimeter
LNtem	Logarithm of Average annual Temperature	Celsius
LNpgdp	Logarithm of ASEAN-China Gross domestic product	US$ Thousand
LNstrade	Logarithm of Trade Service	Percentage
LNusd	Exchange Rate of US dollar	US dollar
epolicy	Climate Change Policy Dummy Variable	1 if year for allow climate change policy 0 if year does not allow climate change policy
fvisa	Free Visa Dummy Variable for ASEAN countries and China	1 if Thailand allow free visa 0 if Thailand does not allow free visa

Table 2 has shown the variable definition, which is that the total of tourism receipts is a dependent variable. The formulations are separated into two independent variable groups, including climate change factors, which consist of transportation carbon dioxide, land area, annual precipitation, and average annual temperature, and economic factors, which combine ASEAN-China gross domestic product, trade service, and exchange rate of the US dollar. Because, in fact, tourism receipts are not only affected by climate change but also have been affected by various factors. This study uses economic indicators to find the importance of ASEAN-China tourism and compare how important environmental factors and economic factors are to international tourism receipts in Thailand.

3.2. Panel Unit Root Test

The panel unit root test is used to determine the stationary of data. Because of different variables in the study, the testing will be used to avoid spurious regression problem with the cross-sectional IPS (CIPS), the cross-sectional Fisher-augmented Dickey Fuller unit root test (CADF), and the Fisher-Phillips-Perron unit root test (PP) [43].

3.3. Panel Correlation Matrix

This study uses a correlation matrix to evaluate the relationship of the explanatory variables. The testing will detect the multicollinearity, unstable coefficient estimates, and inflated standard errors in the model. The result of correlation without the multicollinearity among independent variables will not be more than 0.80 [44].

Table 3. The Result of Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) LNtou	1.00									
(2) Lncar	0.61	1.00								
(3) Lnfia	0.69	0.52	1.00							
(4) Lnrain	0.04	-0.14	0.16	1.00						
(5) Lntem	0.35	0.60	0.25	-0.54	1.00					
(6) LNpgdp	0.30	0.28	0.32	0.01	0.15	1.00				
(7) Lnstrade	0.03	-0.49	0.16	0.42	-0.56	-0.05	1.00			
(8) Lnusd	-0.61	-0.57	-0.61	-0.15	-0.20	-0.31	-0.03	1.00		
(9) fvisa	0.25	0.31	0.19	-0.07	0.20	0.12	-0.14	-0.17	1.00	
(10) epolicy	0.61	0.67	0.33	-0.23	0.65	0.22	-0.60	-0.29	0.31	1.00

Note: 1) LNtou: the logarithm of ASEAN-China tourism receipt in Thailand, LNcar: the logarithm of Transportation Carbon Emission, LNfia: the logarithm of forest area, LNrain: the logarithm of annual precipitation, LNtem: the logarithm of annual temperature, LNpgdp: the logarithm of ASEAN-China's gross domestic product, LNstrade: the logarithm of trade service, LNusd: exchange rate of US dollar, fvisa: the dummy variable of free visa for ASEAN-China, epolicy: the dummy variable of climate change policy in Thailand.

Table 3 has shown the result of the correlation matrix among the explanatory variables in the model. The correlations between LNcar, LNtem, and the epolicy dummy variable are 0.69 and 0.65, respectively. It shows the strong relationship between environment and temperature factor. Moreover, LNfia has a positive correlation with LNtou of about 0.69. It can be predicted that the natural environment will increase tourism receipts. In contrast, the exchange rate (LNusd) has a negative correlation with LNfia and LNcar of about -0.61 and -0.57, representing economic and environmental factors. To reconfirm the multicollinearity problem, a Variance Inflation Factor (VIF) analysis is performed in the subsequent section.

3.4. Theoretical Framework

3.4.1. The Environmental Kuznets Curve (EKC) Hypothesis

There are 3 models in this study, including the environmental model, economic model, and combined model. The Environmental Kuznets Curve (EKC) hypothesis reveals ecosystem degradation raises economic development at first, but it will decrease after reaching revenue levels. Moreover, the Environmental Kuznets Curve (EKC) is also used to explain an inverted U-shaped relationship between environmental degradation and economic growth, which expanded to encompass tourism and environment in the model. Many previous studies show that the EKC hypothesis and tourism development both contribute to an increase in carbon emissions. However, increasing tourism revenue will reduce emissions in the final step [45, 46]. In South America, the researcher shows ecotourism initiatives reduce carbon emission [47]. Some studies have also found a negative relationship between the number of tourism arrivals and carbon emissions in Singapore [48]. In terms of the European Union, it found the long-run decreasing of the tourist arrivals and emissions by the EKC hypothesis [49]. Awan et al. [50] combines GDP, financial development, and carbon emission, which found sustainable tourism policies will solve the problem of tourism development and emission increasing in the SAARC region between 1995 and 2022. Moreover, Işık et al. [51] examined the EKC hypothesis within the context of G7 countries with tourism receipts as a variable. It's obviously seen that many regions use the EKC hypothesis explain their environment and tourism development. Although there are a few studies focusing on tourism receipts, this paper will apply the Environmental Kuznets Curve (EKC) hypothesis to confirm the

relationship between tourism receipts and environmental factors with the climate change policy dummy variable in Thailand, which is in the environment model as shown in Equation 1. And it will use economic factors to investigate how environmental factors influence the economy in the combined model as shown in Equation 3.

$$LNtou_{it} = \beta_0 + \beta_1 LNcar_{it} + \beta_2 LNfia_{it} + \beta_3 LNrain_{it} + \beta_4 LNtem_{it} + \emptyset_1 epolicy + u_{ijt} \quad (1)$$

3.4.2. Tourism Demand Theory

Tourism demand theory explores the determinants influencing individuals' decisions to travel, including income levels, relative prices, and preferences [52]. However, the impact of these factors can vary based on the type of travel. Long-run travel will be more sensitive to income and price changes than short-run travel [52]. The expense of tourist destinations has influenced tourism demand. While the number of tourist arrivals has increased tourism receipts [53].

The previous studies reveal the strong relationship between tourism receipts and economic factors with policies enhancing them in a positive direction, especially in Jamaica [54]. While some studies found bidirectional causality between tourism receipts and economic growth in several European countries by tourism demand theory [55]. In terms of economic factors, consumer price index (CPI), purchasing power parity (PPP), foreign direct investment (FDI), trade, and industry value added (IVA) are used to examine indirect effects on tourism demand through infrastructure and environment [56]. The exchange rate is frequently considered as a key determinant in tourism demand models. The exchange rate is also used to investigate the power of tourism demand. In Turkey, the study found the positive relationship between a stronger foreign currency and increasing the Eurozone and the USA's tourists by the GARCH approach [57]. However, in the USA, exchange rate fluctuations have a significant short-term impact on tourism demand, but the effect diminishes over time [58]. In India, the exchange rate is one of the tourism policies planned, but it has a long-run negative impact on tourism receipts [59]. Meanwhile, both the short-run and long-run negative directions of the exchange rate and tourism receipts are found in Malaysia [60]. The study also found exchange changes protect external competitiveness and reduce currency exposure of international tourists. The tourism-led growth hypothesis suggests that increased tourism revenues positively impact economic growth, which can lead to changes in the exchange rate [61].

Furthermore, tourism demand theory has intersected with international trade. Trade activities increase short-term and long-term international tourism demand in Thailand. It reveals that increasing the international tourism demand strategy is the best way to stimulate trade revenue [62]. In Cyprus and Malta, tourism forms the economic foundation, with earnings from tourism used to finance imports and sustain the tourism industry [63]. It seems that tourism enhances trade in services through exchange earnings and economic development [64]. Işık et al. [51] showed Caribbean tourism has different factors, such as climate similarity and cultural ties, and significantly influenced tourist arrivals. In terms of tourism receipts and economic factors in this study, tourism demand theory will be used to explain the hypothesis, as shown in Equation 2.

$$LNtou_{it} = \beta_0 + \beta_1 LNpgdp_{it} + \beta_2 LNstrade_{it} + \beta_3 LNusd_{it} + \emptyset_2 fvisa + u_{ijt} \quad (2)$$

3.4.3. The Combined of the EKC Hypothesis and Tourism Demand Theory

The Environmental Kuznets Curve (EKC) hypothesis and tourism demand theory together help explain the relationship between tourism growth, economic development, and the environment. At the early stages of tourism development, increased tourist activity may lead to environmental degradation. However, as income levels rise, countries often adopt more sustainable practices, leading to improvements in environmental quality over time. By combining the EKC with tourism demand theory, we can better understand how both environmental conditions and economic factors influence tourism receipts. This integrated approach allows us to examine how environmental changes affect tourism and how tourism, in turn, impacts economic growth and the environment.

This Combined Model offers a useful framework for analyzing the links between tourism revenue, economic development, and environmental sustainability in Thailand, as shown in Equation 3. It can support policymakers in designing strategies that promote sustainable tourism while achieving long-term economic and environmental goals.

$$LNtou_{it} = \beta_0 + \beta_1 LNcar_{it} + \beta_2 LNfia_{it} + \beta_3 LNrain_{it} + \beta_4 LNtem_{it} + \beta_5 LNpgdp_{it} + \beta_6 LNstrade_{it} + \beta_7 LNusd_{it} + \emptyset_1 epolicy + \emptyset_2 fvisa + u_{ijt} \quad (3)$$

3.5. Framework of Research Methodology

According to Figure 1, it shows the flowchart of research methodology that follows the research question. This paper applies panel data across 11 ASEAN-China countries from 1995 to 2023. Firstly, the data is examined by the Variance Inflation Factor (VIF) to find multicollinearity among variables. After that, the panel unit root test is used to analyze the stationarity of data and uses the correlation matrix to detect unstable coefficient estimates and inflated standard errors in the model in the third step. Fourthly, the EKC hypothesis is used to explain the relationship between ecology and economic growth along with tourism receipts in Thailand. Moreover, the climate change policy (CCMP) dummy variable will be the external factor to investigate the effect of the environment on tourism receipts. While the correlation of economic growth and tourism receipts is explained by tourism demand theory. And the visa exemption policy explains the potential of tourism policy. Fifthly, the combined model consists of an environmental model and

an economic model. It will be examined how environmental factors and economic factors work together on tourism receipts. All three models will be explored by the Hausman test and analyzed by the random effect and robust PPML estimator in the sixth step. Finally, it is analyzed into the result as shown in Figure 1.

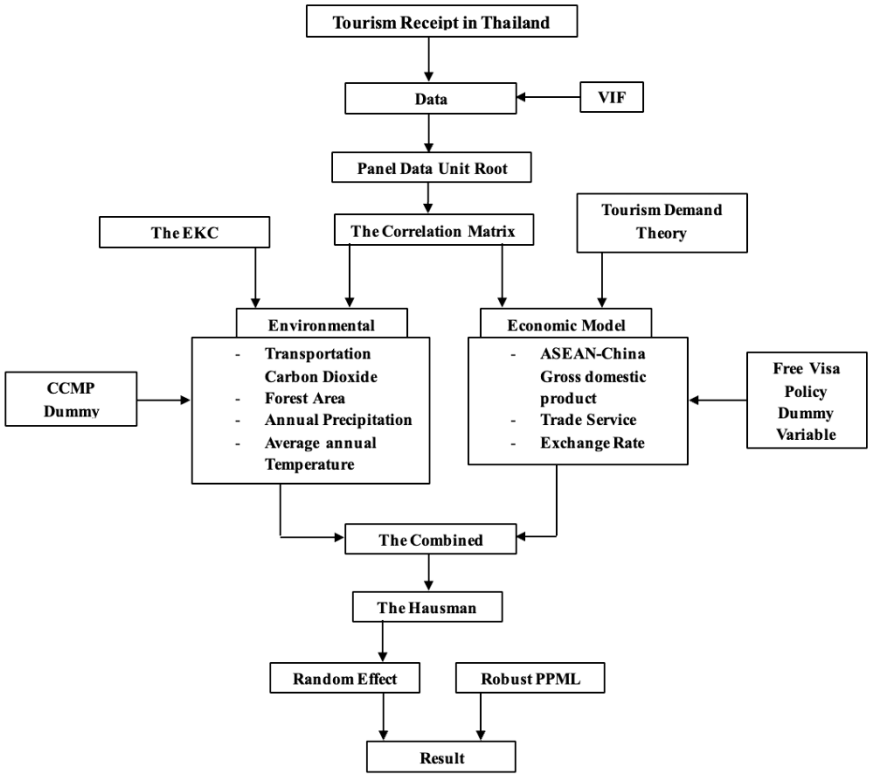

Figure 1. The Flowchart of Research methodology

4. Result

This investigation illustrates only the influence of climate change and policy intervention on international tourism receipts in Thailand from 1995 to 2023 by using a random effect and a robust PPML in STATA18. The strong balance and distribution of data have been shown as the result of descriptive statistics in Table 4. The variance inflation factors (VIF) will be used for economy and climate change implications and illustrate multicollinearity in the formulation. Moreover, the stationarity of data will be shown in Table 5. Table 6 will determine the result of random effect and a robust PPML.

Table 4. Summary Descriptive statistics

Variables	Obs.	Mean	SD	Min	Max
LNtou	290	23.65	0.75	21.84	24.89
LNcar	290	4.06	0.17	3.8	4.38
LNfia	280	3.65	0.02	3.62	3.67
LNrain	280	7.31	0.11	7.1	7.52
LNtem	260	3.31	0.01	3.28	3.34
LNpgdp	290	7.98	1.6	4.68	11.39
LNstrade	290	4.78	0.13	4.43	4.94
LNusd	220	3.54	0.1	3.42	3.76
fvisa	290	0.62	0.49	0	1
epolicy	290	0.31	0.46	0	1

Note: LNtou: the logarithm of ASEAN-China tourism receipt in Thailand, LNgdp: the logarithm of ASEAN-China's gross domestic product, LNntrade: the logarithm of net trade volume, LNstrade: the logarithm of trade service, LNcar: the logarithm of Carbon Emission, LNarea: the logarithm of arable land, LNtem: the logarithm of temperature, LNrainfall: the logarithm of precipitation, LNusd: exchange rate of US dollar, fvisa: the dummy variable of free visa.

Table 4 presents a summary of descriptive statistics generated using STATA 18 for 11 ASEAN–China countries over the period from 1995 to 2023. The logarithm of total tourism receipts in Thailand (LNtou) is used as the dependent variable, while the independent variables include ASEAN–China GDP, Thailand's foreign direct investment, net trade volume, trade services, carbon emissions, arable land, temperature, precipitation, and the U.S. dollar exchange rate. In addition, dummy variables for free visa policies and climate change policies are incorporated into the model to represent ASEAN–China travel support policies and ecosystem-related measures in Thailand. To

ensure balanced panel data and avoid heteroscedasticity, all variables are transformed into their natural logarithmic form. The variance inflation factor (VIF) results for economic and climate change variables are both 3.33, indicating the absence of multicollinearity in the model specification [65].

Due to data limitations, some observations are missing, as shown in Table 4. The average value of total tourism receipts in Thailand is approximately 19.68%. The average values of ASEAN–China GDP and foreign direct investment are approximately 25.85% and 22.21%, respectively. Furthermore, the average net trade volume is about 23.08%, which is close to its maximum value. The average value of trade services is approximately 3.13%, while the U.S. dollar exchange rate averages about 3.49%. Regarding climate change indicators, carbon emissions, arable land, temperature, and precipitation have average values of approximately 4.17%, 3.51%, 3.52%, and 7.41%, respectively. The free visa variable accounts for about 0.87%, representing travel policies for ASEAN–China countries, and it is expected that this policy will have a positive effect.

Table 5. The result of panel unit root test

Variables	CIPS		CADF		PP-test	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
LNtou	-	-	63.3239***	239.1402***	25.9956	87.0579***
LNcar	-	-	54.3058***	94.6551***	28.0870	266.7905***
LNfia	-	-	6.6560	10.7134	0.1446***	7.8531
LNrain	-	-	181.7529***	226.9054***	75.4731***	171.8543***
LNtem	-9.3892***	-16.1750***	150.4355***	326.1249***	201.1764***	451.4500***
LNpgdp	-	-	15.8641	63.9037***	10.1631	105.0979***
LNstrade	-2.4048***	-10.6943***	33.5273	178.0238***	13.7049	210.3092**
LNusd	1.3524	-3.5890***	6.8087	49.7203***	2.6735	60.4303***

Note: 1) *** Significant at 1%; ** Significant at 5%; and * Significant at 10%. 2) LNtou: the logarithm of ASEAN-China tourism receipt in Thailand, LNcar: the logarithm of Transportation Carbon Emission, LNfia: the logarithm of forest area, LNrain: the logarithm of annual precipitation, LNtem: the logarithm of annual temperature, LNpgdp: the logarithm of ASEAN-China's gross domestic product, LNstrade: the logarithm of trade service, LNusd: exchange rate of US dollar.

The following panel unit root test result has been shown in Table 5. The panel unit root test will be used to test the stationarity of the variables in this study to avoid spurious inference. Because of stochastic trends in the data, the variables will be analyzed for stationarity at levels I(0) or first difference I(1) in the data by using cross-sectional IPS (CIPS), the cross-sectional Fisher-augmented Dickey Fuller unit root test (CADF), and the Fisher-Phillips-Perron unit root test (PP) before investigating random effects and robust PPML in the next step [43].

Table 6. The result of a random effect and a robust PPML

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Random (Envi)	Random (Eco)	Random (Combined)	PPML (Envi)	PPML (Eco)	PPML (Combined)
LNcar	0.133		1.046**	0.007***		0.046***
	(0.294)		(0.445)	(0.000)		(0.001)
LNfia	24.876***		15.658***	1.055***		0.671***
	(1.464)		(4.526)	(0.000)		(0.004)
LNrain	0.040		-0.448*	0.001***		-0.019***
	(0.218)		(0.236)	(0.000)		(0.000)
LNtem	-5.387***		-2.166	-0.231***		-0.093***
	(1.829)		(2.453)	(0.000)		(0.001)
epolicy	0.577***		0.656***	0.024***		0.027***
	(0.079)		(0.113)	(0.000)		(0.000)
LNpgdp		0.017	0.004		0.001	0.000*
		(0.032)	(0.013)		(0.000)	(0.000)
LNstrade		0.977*	2.600***		0.041***	0.109***
		(0.517)	(0.363)		(0.003)	(0.000)
LNusd		-3.034***	-0.680		-0.128***	-0.028***
		(0.461)	(0.582)		(0.003)	(0.000)
fvisa		0.094	-0.008		0.004**	-0.000
		(0.100)	(0.042)		(0.002)	(0.001)
Constant	-50.185***	29.688***	-37.508**	0.041***	3.418***	0.547***
	(6.874)	(3.087)	(17.332)	(0.000)	(0.022)	(0.014)
Observations	260	220	190	260	220	190
R-squared				0.863	0.210	0.830
Number of countrycode		10	10			

Note: 1) *** Significant at 1%; ** 5%; and * 10%. 2) LNtou: the logarithm of ASEAN-China tourism receipt in Thailand, LNcar: the logarithm of Transportation Carbon Emission, LNfia: the logarithm of forest area, LNrain: the logarithm of annual precipitation, LNtem: the logarithm of annual temperature, LNpgdp: the logarithm of ASEAN-China's gross domestic product, LNstrade: the logarithm of trade service, LNusd: exchange rate of US dollar, fvisa: the dummy variable of free visa for ASEAN-China, epolicy: the dummy variable of climate change policy in Thailand.

Table 6 represents the impact of climate change and economic factors on total tourism receipts in Thailand from 1995 to 2023, using climate change policy and free visa policy as dummy variables. Because of the data limitation, the random effect is used to solve entity-specific effects and time-invariant variables. Moreover, the result of the Hausman test shows a chi-square value of 2.32 and a p-value of 0.3137, greater than 0.05. It fails to reject the null hypothesis. The random effect model, therefore, is preferred and appropriate in analysis [66]. And a robust PPML is also used to solve bias and heterogeneity problems in this study [67]. The values of R-squared are 86.3%, 21%, and 83%, respectively. The observation is 260.

The result illustrates the relationship among tourism receipts, environmental factors, and economic indicators by employing random effects and Poisson pseudo-maximum likelihood (PPML) estimations across three models: environmental (Envi), economic (Eco), and combined. These models incorporate variables from the Environmental Kuznets Curve (EKC) and tourism demand theory to understand the determinants of climate change, economic factors, and related policy issues.

In terms of the Environmental Model (Envi), the estimation shows a statistically significant positive direction coefficient (0.007***) of tourism receipt and carbon emission (LNcar), which means tourists are attracted to destinations with higher levels of development, which often correlate with higher emissions, according to the findings of Zhang [36].

The significant positive of forest area (LNfia) represents the tourist attraction in the natural forest area, which can be explained by the fact that tourists are seeking eco-tourism experiences in 1% significant, with findings of Kocak & Cavusoglu [68] that tourism development has a significant effect on forest areas but not every country. For example, the increase in tourists in Germany and the United States leads to afforestation, while China has experienced deforestation. The result of the combined model also contributes to tourism receipts and how tourism activities affect forest conservation efforts. It can lead to developing sustainable tourism strategies that balance economic growth with environmental preservation.

A negative effect of annual rainfall (LNrain) has been found after combining the economic factor with the findings of Gebbisa [37]. The case of Ethiopia shows that rainfall has a tremendous negative effect on travel decisions. However, adjusting weather patterns to promote sustainable tourism will enhance tourism receipts [37]. Moreover, temperature (LNtem) demonstrates that higher temperatures reduce tourism receipts, which are the cause of travel plan changes, discomfort, and health concerns, according to the findings of Chang [69].

A strong and important link between climate change policy (epolicy) and tourism receipts in random effects, around 57% to 65% at 1% significance, indicates that being sustainable and protecting natural attractions increases tourist interest and revenue, which will help grow sustainable tourism in Thailand.

In terms of the economic model (Eco), almost all independent variables have a positive direction with total tourism receipts in Thailand, except the exchange rate (LNusd). Gross domestic product's ASEAN-China partner shows a weak direct relationship with tourism receipts, which means the changing of GDP in ASEAN-China countries will not have a huge effect on tourism revenue in Thailand. Moreover, the result found increasing trade in services correlates with higher tourism receipts, possibly due to improved infrastructure and services. The negative coefficient of the exchange rate (LNusd) implies that a stronger exchange rate may reduce revenue, as it becomes more expensive for tourists to travel in Thailand. The finding is in contrast with the previous study, which says the visa exemption for ASEAN and China policy will increase trade in Thailand. However, the study of Czaika & Neumayer [38] reveals that visa policy enhances tourism inflow by 20% and gains more benefit from economic globalization, but reduces trade and investment. Furthermore, an analysis of the visa policy in conjunction with environmental factors clearly demonstrates that it has not negatively impacted tourism revenue.

The dummy variable of the free visa policy result has found that the policy can boost tourism demand by reducing travel barriers but does not have a huge effect on tourist receipts, which means the free visa policy for ASEAN-China countries has a benefit for the tourism industry but not for increasing revenue, with the finding of Gu [39] and Walsh & Tachavimol [70].

It's brief: Table 6 shows the positive relationship between climate changes, the economy, and tourism receipts with policy-related issues in Thailand over 30 years, except for annual rainfall (LNrain), temperature (LNtem), and the exchange rate (LNusd). Moreover, the research found a positive correlation between rainfall and tourism receipts in environmental factors but a negative correlation in the combined model. The climate policy dummy variable also confirms that the CCMP enhances tourism receipts and protects the ecosystem at the same time. Furthermore, the visa exemption dummy variable has a very weak positive effect on tourism receipts in the economic model, but a negative direction has been shown in the combined model.

The dummy results of climate change policy (epolicy) and free visa policy (fvisa) demonstrate the acceptance of H1 epolicy and H2 fvisa, which means the policy has efficiency and impact on tourism receipts. Climate change policy will lead to sustainable tourism and increase revenue. Whereas a free visa policy will boost tourism demand but not affect tourism receipts. The combined model of climate change and visa exemption policy provides the understanding of policy and the tourism sector in Thailand.

5. Discussion

The study uses data from 11 ASEAN-China countries to analyze the impact of climate change and policy-related issues on international tourism receipts in Thailand from 1995 to 2023 by using Random Effects (RE) and Poisson Pseudo Maximum Likelihood (PPML) with STATA18 and is shown as Table 6. The result divides into 3 models, consisting of the Environmental Model (Envi), the Economic Model (Eco), and the Combined Model (combined). The three model results can be answering the research questions.

In the Environmental Model (Envi), the result of PPML reveals carbon emissions released (LNcar), forest area (LNfia), and climate change policy (epolicy) have a positive direction with tourism receipts in Thailand, whereas annual temperature (LNtem) and annual precipitation (LNrain) have a negative correlation with the finding of the Environmental Kuznets Curve (EKC). It indicates that the environmental quality increases tourism attractiveness. But high rainfall and temperatures have a negative effect on tourism, with the findings of Elsayed [18]. It seems that increasing the number of tourists is the cause of high carbon emissions, such as construction, transportation, infrastructure, etc., through getting higher tourism revenue. In contrast, the positive of forest area shows the behavior of sustainable tourism changes by the government supporting policy. The study found that these indicate the conflict, the big problem of environment and economy.

The economic model (Eco) represents the tourism demand theory of tourism with a positive direction of GDP per capita (LNpgdp) and trade service (LNstrade). It shows tourism receipts increase economic growth and explains that tourist revenue and trade integration increase the number of international tourists, as shown in tourism demand theory. However, the exchange rate (LNusd) has a strong negative implication, and its explanation is that high pricing will decrease revenue and demand. It shows that if a tourist has a power of spending, it obviously increases tourism receipts. Therefore, the result can be used to attract high-spending and quality tourists.

The Combined Model (combined) consists of environmental factors, economic indicators, and policy-related factors. The result can reveal that effective climate change policies not only benefit ecological sustainability but also enhance Thailand's international tourism receipts. Some environmental factors, such as carbon emissions released (LNcar), forest area (LNfia), and climate change policy (epolicy), have a strong positive relationship with tourism receipts, whereas annual precipitation (LNrain) and annual temperature (LNtem) have a negative direction. Moreover, the positive and negative direction of ASEAN-China's gross domestic product (LNpgdp), trade service (LNstrade), and exchange rate (LNusd) on the coefficient represent macroeconomic drivers.

Additionally, the visa exemption policy for ASEAN-China countries (fvisa) is one supportive role for the tourism industry, but the changing of this policy will not have a huge effect on tourism receipts in the economic model by using random effect results and robust PPML. It is obviously seen that the dummy variable does not have a huge effect on tourism receipts, which means policy can attract the ASEAN-China tourists but cannot change tourist spending behavior. Although this dummy variable is not significant in every model, it helps to facilitate inbound tourism with findings of Tz-Li [41].

The environmental and economic factors are combined; some results of the formulations have changed. Therefore, from the previous study and the research result, it can be predicted that although high carbon emissions and enhanced tourism policy lead to an increase in the number of international tourists, tourism receipts, which are an economic driving force, are not related. It indicates an imbalance of environment and economy in Thailand. However, the climate change plan since 2015 is effective due to the positive forest area and tourism receipt results. The study can predict that if it increases the natural resource, it will attract more of the number of tourists. The policy can be expected to not only improve environmental quality but also increase Thailand's competitiveness as a tourism destination and attract sustainability tourists, particularly within the ASEAN-China travel sector. Moreover, there is the negative direction in the free visa dummy variable in the combined model. In fact, there are many factors that can affect tourism revenue in Thailand. The result shows that environmental factors and climate change policy have not changed in the combined model, but it decreases the potential of visa policy, which is the negative direction, as shown in Table 6. Because of higher tourism costs from ecosystem prevention, ASEAN-China tourists will not be spending and will further decrease the number of arrivals.

The paper can confirm that the Climate Change Master Plan (CCMP) has the potential to enhance the tourism sector and protect the ecosystem at the same time, especially sustainable tourism, like the findings of Alcoriza [71]. And it argues that the effectiveness of the ASEAN-China visa exemption policy has increased the number of tourists but not raised tourism receipts. Tourists will stay longer but not spend, according to the findings of Gu [39] and Walsh & Tachavimol [70]. Moreover, the study also found that if the tourism sector adjusts to changes in weather, tourism receipts will increase, according to Gebbisa [37].

It's brief that the finding shows the multidimensional view of tourism development in Thailand from 1995 to 2023. Both environmental factors and economic indicators are important for tourism receipts. Furthermore, integrated tourism strategies, including environmental sustainability, economic growth, and policy facilitation, are also the key to supporting tourism. For Thailand to maintain its competitiveness in the ASEAN-China tourism corridor, policymakers should ensure it maintains ecological assets, economic openness, and enhanced facilitative travel policies.

6. Conclusion

The purpose of the investigation is to explore the impact of climate changes and policy intervention on international tourism receipts in Thailand, focusing on climate change policy and visa exemption policy from 1995 to 2023.

According to the result, there is a positive and significant relationship among environmental factors, economic indicators, and tourism receipts. Thailand specifically uses its climate change policy to boost its tourism revenue and competitiveness. However, the ASEAN-China free visa increases the number of arrivals but does not have a huge effect on tourism receipts. If the tourism cost increases, ASEAN-China tourists will not be spending. The paper identifies this as the major issue. Therefore, maintaining a balance between environmental regulation and tourism is crucial for the government when formulating policy. The consistent performance of environmental policy across all models validates the strategic importance of sustainable tourism initiatives.

The study uses a random effect and strong PPML estimation with STATA 18 to demonstrate that economic factors such as GDP per capita, trade services, exchange rates, and tourism revenue are linked to the theory of tourism demand. Additionally, environmental factors like forest area, annual precipitation, and annual temperature demonstrate the natural conditions, while the impact of climate change on tourists' decision-making processes aligns with the EKC hypothesis.

To increase tourism receipts from ASEAN-China tourists in Thailand, the government should integrate economic stability frameworks, environmental preservation efforts, and supportive policies. It is not only to increase ASEAN-China tourism receipts but also to conserve long-term sustainable tourism in Thailand. The government should enhance sustainable tourism to address weather conditions and support the CCMP policy. Moreover, the ASEAN-China visa exemption must be revised to balance the increase in tourism expenditure with the needs of tourism immigrants. The future study will analyze sustainable tourism in relation to policy and green technology to enhance the tourism sector.

6.1. Limitations

This study has certain limitations that should be acknowledged. First, the data for free visas for Chinese people occurred in 2024, while the period of study is from 1995 to 2023. Therefore, the dummy variable analysis will not involve Chinese data. Secondly, there are a variety of crucial factors in the environment and economy. Because of multicollinearity in the model, some factors are excluded and dropped from the sample. Thirdly, the limitation of the study's findings and conclusions in the combined model.

7. Declarations

7.1. Author Contributions

Conceptualization, S.T., S.P., P.P., K.K., and P.R.; methodology, S.T., S.P., and P.P.; software, S.T., S.P., and P.P.; validation, P.P., K.K., P.R., and M.G.; formal analysis, S.T., S.P., and P.P.; investigation, K.K. and P.R.; resources, S.T. and S.P.; data curation, P.P., K.K., and P.R.; writing—original draft preparation, , S.T., S.P., P.P., K.K., and P.R.; writing—review and editing, M.G.; visualization, S.T. and S.P.; supervision, S.P.; project administration, S.T.; funding acquisition, S.T. and S.P. All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

The data presented in this study are available in the article.

7.3. Funding

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7.5. Institutional Review Board Statement

Not applicable.

7.6. Informed Consent Statement

Not applicable.

7.7. Declaration of Competing Interest

The authors declare that there are no conflicts of interest concerning the publication of this manuscript. Furthermore, all ethical considerations, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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