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The Twin Deficit Hypothesis in Developed Nations: A Panel Analysis of Tourism and Non-Tourism Economies

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Abstract: *This paper examines the relationship between fiscal and current account imbalances, commonly referred to as the "twin deficits," in tourism-dependent versus non-tourism developed economies. Using annual data from 2000 to 2020, the analysis employs Difference-in-Differences panel regression (DiD-PR), panel unit root tests, Panel Generalized Method of Moments (PGMM), and Granger causality tests (GCT). The findings indicate that fiscal and external balances align consistently with the Current Account Targeting Hypothesis (CATH) across the Total and Control Country datasets, suggesting fiscal adjustments to external imbalances. In tourism-dependent economies, initial PGMM estimates show marginal support for CATH, which strengthens with robustness checks and causality tests. DiD-PR results confirm that tourism exposure significantly mediates the fiscal–external balance nexus. These findings highlight the structural distinctiveness of tourism-driven economies and provide policy insights for tailoring fiscal strategies in tourism-reliant versus diversified developed countries.*

Keywords: Twin Deficits; Current Account Targeting Hypothesis; Granger Causality; Tourism Economy; Fiscal Imbalances

JEL Classification: O19

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Introduction

The primary aim of this paper is to examine the relationship between budget and trade deficits in a set of developed countries, with a particular focus on those heavily reliant on tourism. We hypothesise that countries with high tourism dependency may be more vulnerable to perpetuating trade deficits, especially when the tourism sector is impacted by exogenous shocks such as pandemics, natural disasters, geopolitical instability, economic crises, currency fluctuations, climate change, or energy shocks. This vulnerability raises concerns about the sustainability of living standards when domestic production capacity cannot fully compensate for lost tourism earnings. In open economies, there is a need for absorption capacity to align with domestic production possibilities. If tourism revenues slow down, this misalignment may lead to persistent budget deficits and a corresponding rise in public debt, further threatening long-term economic stability.

Several developed countries have experienced persistent trade and budget deficits since 2000, particularly those vulnerable to external economic shocks or with structural imbalances. For instance, the United States has maintained a negative trade balance due to high levels of imports compared to exports, alongside fiscal deficits driven by substantial government spending. While the U.S. is not categorized as tourism-dependent, its case illustrates how even large and diversified economies can face enduring twin deficits.

In contrast, a subset of Mediterranean and tourism-receptive developed countries—such as Greece, Italy, Spain, Portugal, and Croatia—have faced twin deficits stemming from their heavy reliance on tourism revenues and high import levels. These nations are particularly sensitive to global disruptions; events like the 2008 financial crisis and the COVID-19 pandemic have severely impacted tourism, thereby intensifying both external and fiscal imbalances.

Research analysing the link between trade deficits and budget deficits in 33 European countries from 1970 to 2010 reveals that a 1% decline in the government budget surplus-to-GDP ratio results in a 0.37% decline in the current account-to-GDP ratio. The study further emphasises the differing effects of both current and historical budget values on the trade balance across two distinct sub-periods (Forte & Magazzino, 2013: 289). These twin deficits have created significant challenges for economic sustainability and growth in these countries.

This study aims to test how various theoretical mechanisms predict the causes of the twin deficit issue, including KP and RE, and how they apply to two tiers of developed countries: tourism-dependent countries and control countries. KP suggests a positive relationship between the two deficits, while RE argues that budget and trade deficits are not correlated. Annual national accounts data will be used to examine the relationship between the two deficits from 2000 to 2020. Additionally, DiD-PR and PGMM will be employed to conduct GCT. This approach will assess the direction of

causality between both deficits relative to GDP, examining the nature of the causal mechanisms involved.

Literature review

The relationship between current account deficits and budget deficits has been extensively studied in economic literature; however, a definitive consensus on their causal connection remains elusive. This research topic has primarily been examined through two competing frameworks: the Keynesian Proposition (KP) (Keynes, 1936) and Ricardian Equivalence **(RE)** (Barro, 1989). The KP posits that budget deficits can lead to trade deficits through increased import demand, while RE argues that budget deficits have no effect on national savings or trade balances due to consumers' anticipation of future taxes. Despite a thorough search on Google Scholar, it is noteworthy that no existing literature explicitly uses the term "twin deficit" in relation to a group of tourism-oriented countries. Furthermore, most studies on the twin deficit hypothesis focus on developing countries, likely because the issue is more pressing in those contexts. This gap in research presents an opportunity to explore tourism-oriented developed nations, where the twin deficit relationship might behave differently due to their economic structure.

To enrich our analysis, we draw insights from a variety of recent studies, creating a balanced perspective on this important economic issue. For instance, Hussain et al. (2024) examine Pakistan's twin deficit hypothesis using an autoregressive distributed lag (ARDL) model, confirming a long-run unidirectional causality from fiscal deficits to the balance of trade. Similarly, Ahmad and Aworinde (2019) explore the causal connections between fiscal and current account deficits across 12 African nations, uncovering both unidirectional and bidirectional relationships. These findings underscore the importance of considering both deficits in policy development.

Building on this theme, Chang et al. (2023) revisit the twin deficits hypothesis for the U.S. from 1791 to 2019, revealing a nonlinear long-run relationship. In a related study, Ajilore and Usman (2021) investigate locational asymmetry within the West African Monetary Zone (WAMZ) using the Quantile Autoregressive Distributed Lags (QARDL) approach, confirming variability across countries. These studies demonstrate the significant role of geographical and economic context in shaping the twin deficit relationship. Extending the twin deficits hypothesis, Tomić (2013) introduces the concept of the triple gap to assess structural imbalances in the Croatian economy, emphasizing its policy relevance amid fiscal constraints related to the causal interpretation of Granger test results.ts and external vulnerabilities.

Further exploring variations in this relationship, Kim (2024) finds a time-varying dynamic between budget and trade balances in U.S. post-WWII data, showing shifts across economic regimes. Banerjee (2024) similarly critiques the UK's balance of

payments under Bretton Woods, arguing that multiple shocks, beyond fiscal policy, contributed to its difficulties. These findings underscore the complexity of the twin deficit hypothesis in developed economies.

In the context of energy policy, Ozkan and Okay (2024) associate renewable energy with current account deficits in OECD countries, demonstrating that renewable energy generation mitigates current account imbalances and strengthens the twin deficit hypothesis. Additionally, Sadeghian et al. (2024) investigate the twin and triple deficit hypotheses in Iran, uncovering interconnected budget and current account deficits, which align with the Keynesian approach. In their comparative study of EU member states and candidate countries, Aristovnik and Djurić (2010) examine the empirical relationship between fiscal balances and current accounts, ultimately rejecting the validity of the twin deficits hypothesis in most cases and highlighting the complexity of the Feldstein-Horioka puzzle in assessing capital mobility across regions.

Several other studies provide further insights into developed nations. The public finance sustainability in 19 Eurozone countries from 1995 to 2020 was the topic of a study by Afonso and Coelho (2024), which revealed panel cointegration between revenues and expenditures and identified a mix of Ricardian and non-Ricardian fiscal behaviours, among other peculiarities. In contrast, Nawaz et al. (2023) examine Pakistan, finding support for the Ricardian view with no causality between fiscal and trade deficits. Nautiyal et al. (2023) and Liu and Gu (2023) also contribute to the debate by exploring these relationships in India and the U.S., respectively, providing mixed evidence that supports both Keynesian and Ricardian perspectives.

Gurbanov et al. (2023) shift the focus to resource-rich nations, revisiting the twin deficit hypothesis in the context of climate change. Their study finds bidirectional causality in a few cases, complicating the traditional understanding of the twin deficits. Okoli et al. (2021) similarly explore the BRICS economies, identifying threshold effects that further complicate the relationship between budget and trade deficits.

Older empirical literature also plays a critical role in this debate. Several studies support the REH, including research by Evans (1988), Miller and Russek (1989), and Dewald and Ulan (1990), which found no correlation between budget and trade deficits. This perspective has been corroborated by additional research from Rahman and Mishra (1992), Evans and Hasan (1994), and Kaufmann et al. (2002), providing a solid counterargument to the Keynesian view.

On the other hand, a contrasting body of research supports the Keynesian perspective. Darrat (1988), Abell (1990), and Bahmani-Oskooee (1992) argue for a close link between these deficits, a view further supported by Ibrahim and Kumah (1996) and Piersanti (2000). These studies demonstrate the interconnectedness of budget and trade deficits, particularly in times of fiscal expansion.

We conclude that the mixed and often contradictory empirical evidence on this topic has perpetuated controversy in both earlier and more recent studies.

Theoretical Framework

The national income accounting identities traditionally serve to illustrate the interconnections between various sectors of final output consumption, such as the government budget balance and the trade balance. In this empirical analysis, we adopt a Keynesian open economy framework to explore these relationships. In an open economy, gross domestic product (GDP), denoted as Y, is the sum of private consumption expenditures (C), gross private domestic investment expenditures (I), government spending (G), and net exports (X–M):

$$Y = C + I + G + X - M \tag{1}$$

Furthermore, GDP can also be expressed as the sum of private consumption expenditures (C), private domestic savings (S), and taxes (T), which reflects the allocation of disposable income between spending, saving, and tax contribution:

$$Y = C + S + T \tag{2}$$

By equating these two expressions for GDP, we derive a relationship between government budget balance (FB), current account balance (CAB), and capital flows since it's central to understanding the interaction between fiscal policy and external economic balances within a Keynesian open economy framework. The equation:

$$T\text{-}G=(X\text{-}M)+(I\text{-}S) \tag{3}$$

demonstrates that the government budget balance (T – G) is linked to both the CAB, represented by net exports (X – M), and the difference between investment and savings (I – S). This difference, (I – S), reflects net capital flows, where a deficit (I > S) implies capital imports (borrowing from abroad), and a surplus (I < S) indicates capital exports (lending abroad).

Rewriting the equation (3), we can express the CAB as:

$$CAB=FB+NCI \tag{4}$$

where FB=T–G is the fiscal deficit (or surplus, if positive), and NCI refers to net capital income, which includes income flows from abroad such as remittances, dividends, and interest on foreign investments. This formulation indicates that the CAB is influenced not only by the FB but also by capital income flows from abroad, which are part of the broader balance of payments framework.

This relationship underscores the importance of fiscal policy in shaping the external balance of the economy. A fiscal deficit, for instance, may lead to a deterioration in the CAB if it results in greater borrowing from abroad. However, the effects of

fiscal policy on the current account are also mediated by international income flows, which can offset or amplify the impact of fiscal imbalances. Thus, changes in fiscal policy (i.e., changes in $T–G$) have direct implications for the external balance, but these effects are modified by cross-border income movements.

Our further theoretical overview aims to explore the potential relationship between the CAB and the FB. Scholarly work to date has identified four possible mechanisms, summarized by Table 1, which can be categorized into three main types: unidirectional causality, bidirectional causality, and neutrality or no causality. These mechanisms are grounded in established economic theories, including the Keynesian Absorption Theory (KAT), derived from the Mundell-Fleming Model (Mundell, 1963; Fleming, 1962), the Current Account Targeting Hypothesis (CATH) (Sachs, 1981), the Feldstein-Horioka Puzzle (FHP) (Feldstein and Horioka, 1980), and the Ricardian Equivalence Hypothesis (REH) (Barro, 1989).

Table 1: Summary of Causality Types and Theoretical Frameworks

Hypothesis	Causality Type	Theoretical Framework
FB Granger causes CAB	Unidirectional	Keynesian Absorption Theory (KAT)
CAB Granger causes FB	Unidirectional	Current Account Targeting Hypothesis (CATH)
Bi-directional causality	Bi-directional	Feldstein-Horioka Puzzle (FHP)
Independence between CAB and FB	No causality	Ricardian Equivalence Hypothesis (REH)

Source: Authors' own analysis

Here's a deeper dive into these theoretical perspectives.

In the context of one-directional causality from the FB to the CAB, the KAT suggests that an increase in the fiscal deficit stimulates aggregate demand, resulting in higher consumption and investment. This surge in demand often results in increased imports, worsening the CAB. Additionally, the higher fiscal deficit can drive up domestic interest rates, attracting foreign capital inflows and causing the domestic currency to appreciate. This currency appreciation reduces the competitiveness of exports, further deteriorating the CAB. Therefore, the fiscal deficit negatively impacts the current account by driving higher imports and weakening export competitiveness, resulting in a worsening CAB.

In tourism-dependent economies, an increase in the fiscal deficit often results from public spending aimed at maintaining or expanding tourism infrastructure, such as airports, hotels, and public services. This increased spending can boost aggregate demand, leading to a surge in imports, especially food and capital goods, which are essential for the tourism sector. Given that domestic production in these countries often cannot compete with global prices, the rise in imports worsens the CAB. In this context, the KAT mechanism is evident: a worsening fiscal deficit directly impacts the CAB by increasing the demand for imports, which exceeds export revenues. The higher demand for imported goods can lead to persistent trade deficits, creating

pressures on the CAB. Additionally, public investment in tourism infrastructure may drive up interest rates, attracting foreign capital inflows, which could appreciate the domestic currency, further reducing the competitiveness of exports and worsening the CAB.

On the other hand, the CATH offers a different perspective, proposing that a worsening CAB can lead to a higher fiscal deficit. A deteriorating CAB might signal economic challenges, such as declining competitiveness or external shocks, which in turn could slow economic growth. This reduction in growth decreases the tax base, prompting the government to increase borrowing in an effort to stimulate the economy, thereby exacerbating the fiscal deficit. Thus, under the CATH, a negative shock to the current account can lead to fiscal imbalances due to lower revenues and increased borrowing.

In tourism-dependent nations, framed by the CATH, a deteriorating CAB—caused by increased imports and external shocks, such as declines in tourism demand—might lead to economic distress. This could reduce tax revenues (due to slower economic growth) and force governments to increase borrowing to stimulate the economy, thereby worsening the fiscal deficit. For example, if a country experiences a drop in tourist arrivals due to external factors (e.g., global economic downturns or pandemics), the resulting fall in export earnings could leave the country with a worsening CAB. In response, the government may implement expansionary fiscal policies, such as increasing public spending to promote recovery. This would further increase the fiscal deficit (FB), illustrating a causal link from CAB to FB, as suggested by CATH.

The idea of bi-directional causality is emphasised through the lens of international capital mobility and the FHP Despite capital being mobile across borders, the puzzle suggests a strong link between domestic saving and investment. In this view, fiscal deficits can affect the CAB by increasing demand for imports and causing currency appreciation, as seen in the Keynesian model. Conversely, a deteriorating current account can signal economic distress—such as weaker exports or external shocks—which reduces growth and government revenues. In response, fiscal policy becomes expansionary, leading to higher fiscal deficits. This perspective points to a feedback loop, where fiscal deficits and current account balances influence each other, reinforcing mutual effects.

In tourism-dependent countries, fiscal deficits can lead to reduced national savings, as the government borrows to finance its spending. This could result in a higher current account deficit, as the country finances the fiscal deficit with foreign capital inflows, rather than domestic savings.

Finally, the REH suggests a neutral relationship between FB and the CAB. According to this theory, fiscal deficits do not impact the CAB because private agents adjust their savings behaviour in anticipation of future tax increases. Households, expecting that a fiscal deficit today will be matched by higher taxes tomorrow, increase their savings accordingly. This rise in private savings offsets the fiscal stimulus,

resulting in no net impact on aggregate demand or the external balance. Under the REH, the relationship between the fiscal deficit and the CAB is neutral, as private savings behaviour effectively neutralizes any potential effects of fiscal policy.

In tourism-dependent economies, however, the REH may not hold as strongly due to structural constraints, such as a limited domestic savings base and a reliance on foreign capital to finance investments. In such economies, private agents may not fully compensate for the government's borrowing by increasing their savings. The government's fiscal deficit may still lead to higher imports and worsen the CAB, despite the private sector's attempts to save more. Thus, while REH suggests neutrality between FB and CAB, the specific characteristics of tourism-dependent economies—such as their reliance on imports and foreign capital—might cause deviations from this hypothesis, leading to a more noticeable impact of fiscal deficits on the CAB.

Empirical Analysis Design

The primary objective is to examine whether higher dependence on tourism-driven economies, compared to a control group of developed countries, increases vulnerability to budget deficits driven by trade deficits. We use "tourism-dependent economies" to refer to a broad category of developed countries with a significant reliance on tourism, while terms like "share of tourism in a particular year" represent individual instances.

Our focus is on the causal relationship between CAB and fiscal deficits FB across these two broad categories of economies. Causal questions can be framed in two ways: retrospective, such as, "Did tourism-dependent economies experience cycles in tourism earnings that led to trade surpluses or deficits?" and prospective, such as, "Will a more diversified economic structure reduce trade cycles and fiscal imbalances?" Additionally, we may consider other questions that capture the complexities of the relationship between these two variables.

However, due to data limitations, we avoid retrospective or prospective analysis of individual instances. Instead, we focus on general categories to simplify the analysis and apply Ockham's razor by concentrating on key variables.

Difference-in-Differences panel regression (DiD-PR) as a Preliminary Analysis

In this section, we outline our motivation for employing a DiD-PR as a preliminary analysis before conducting the Arellano-Bond Panel Generalised Method of Moments Estimation (AB-PGMM). Our primary objective is to explore the causal relationship between CAB and FB in the context of tourism-dependent economies compared to a control group of developed countries.

The rationale for this exercise stems from our interest in informally searching for evidence of causality between these key variables. We aim to understand how the treated variable—derived from higher tourism dependence—interacts with time and influences the behaviour of current account and budget deficits. Specifically, we seek to extract potential differences in the behaviour of treatment versus control countries, particularly in the context of the twin deficit discussion.

If the DiD regression provides evidence that supports our causal conjecture between CAB and FB, along with other relevant covariates, it will set the stage for a more formal Granger causality analysis in the next phase of our empirical work. This progression will make sense, particularly if the lagged exogenous variables substantiate the framework that the dependent variable may indeed be affected by the independent variable.

Through this initial analysis, we hope to gain insights that can guide our subsequent modeling and enhance the robustness of our findings regarding the interconnectedness of fiscal and trade balances in different economic contexts.

AB-PGMM Estimation

We employ the AB-PGMM estimator, well-suited for dynamic panel data models, to address endogeneity and unobserved heterogeneity. In this context, fiscal and trade balances are interrelated, and past values of both variables potentially influence current outcomes. The AB-PGMM method corrects for endogeneity by using lagged values of the dependent variable (from at least two periods earlier) and other right-hand-side variables as instruments, mitigating biases caused by reverse causality or omitted variables.

Given the persistence often observed in FB and CAB, the appropriate use of instruments is crucial to avoid bias from the correlation between lagged dependent variables and error terms. The Arellano-Bond method uses lagged values of the dependent variable and the right-hand-side variables to resolve these endogeneity issues. We rely on criteria such as the Akaike Information Criterion (AIC) and Schwarz-Bayesian Criterion (SBC) to determine the optimal lag length before specifying the panel GMM model, which will be done examining th panel VAR.

Panel VAR and Causality

So, we start by employing the Panel VAR framework, treating all variables as endogenous, to model dynamic relationships over time. This framework enables us to account for the interdependencies between FB and CAB and capture short-term dynamics across countries. It is particularly useful when there is no strong theoretical consensus on the causal relationships between these variables.

The Panel VAR model is specified as follows:

$$Y_{i,t} = \alpha_i + \Gamma(L)Y_{i,t} + \varepsilon_{i,t} \quad (5)$$

Where i (i = 1, ..., N) represents the group of countries, t (t = 1, ..., T) denotes the time period, and Yi,t is a vector of endogenous stationary variables: the FB and the CAB. Γ(L) is a matrix polynomial in the lag operator L, αi denotes country-specific effects, and εi,t represents idiosyncratic errors.

We perform a bivariate Panel VAR estimation using the fiscal imbalance (FB) and current account imbalance (CAB), selecting optimal lags based on AIC and SBC criteria. While unit root issues are not anticipated, unit root testing is conducted to confirm the stationarity of variables. The matching of these variables is supported by economic theory, where the CAB directly influences FB, as demonstrated in the theoretical chapter of this paper.

Estimating Equation (5) using pooled OLS introduces an endogeneity problem due to country-specific effects influencing variables across periods (Nickell, 1981). To mitigate this, we first difference all variables to eliminate individual effects. However, this transformation still leaves a correlation between the lagged dependent variable and the error term.

To address this issue, the Arellano-Bond approach uses lagged values of the dependent variable (from at least two periods earlier) and right-hand-side variables as instruments in a GMM estimator. This ensures that past values of variables are not correlated with the error terms, providing a robust method to resolve endogeneity concerns.

GCT and Wald Statistics

After fitting the AB-PGMM model, we investigate the causal relationship between fiscal and current account balances in both tourism-dependent economies and a control group, and across the full range of countries. Granger causality tests are performed using Wald statistics, based on the estimated coefficients of lagged variables from the GMM model.

The Granger causality framework is used to test whether the lags of a variable Xi,t (e.g., the current account balance) improve the forecasting of Yi,t (e.g., the fiscal balance). By reversing the roles of the variables, we can also investigate whether fiscal balances Granger-cause current account balances. The model is specified as:

$$Y_{i,t} = \alpha_0 + \sum_{l=1}^{m} \beta_l Y_{i,t-l} + \sum_{l=1}^{m} \delta_l X_{i,t-l} + \sum_{l=1}^{m} \phi_l Z_{i,t-l} + u_{i,t} \quad (6)$$

Where Yi,t represents budget imbalances for country i at time t, Xi,t represents the current account disequilibrium for the same country and time period, and Zi,t is

a control vector that includes country-specific socioeconomic factors. While the control variables Zi,t. The index i denotes the countries observed over T periods, and l represents the time lag. The primary focus of the GCT is on the relationship between Yi,t and Xi,t.

To assess whether shocks to current account imbalances significantly impact fiscal balances, we apply the Wald test to the lagged coefficients of the relevant explanatory variables. A significant Wald statistic indicates the presence of Granger causality between the two variables. Specifically, the hypothesis that the current account balance (CAB) Granger-causes the fiscal balance (FB) is tested by imposing the following restriction on the parameters in Equation (6):

$$\text{H0: } \sum_{l=1}^{m} \delta_l = 0.$$

This null hypothesis states that the lagged coefficients of the CAB are jointly equal to zero in the FB equation. If the p-value associated with the Wald statistic falls below conventional significance levels (e.g., 0.10 or 0.05), we reject the null hypothesis, indicating that the current account balance Granger-causes the fiscal balance. In other words, a statistically significant result suggests that past values of CAB contain predictive power for FB.

Similarly, we can reverse the roles of the variables to test whether FB Granger-causes CAB, using the same framework. The application of Wald tests across different samples—tourism-dependent economies, the control group, and the full dataset—provides valuable insights into the direction and strength of the dynamic relationship between fiscal and external imbalances.

In the final assessment, as outlined earlier in Table 1, the study evaluates the outlined four hypotheses.

This categorization clarifies the relationships between the FB and the CAB based on established economic theories. By exploring these hypotheses, the study aims to gain a deeper understanding of the dynamic link between fiscal policies and external economic balances. The goal is to identify whether the relationship is unidirectional, bidirectional, or non-existent between these two key economic measures, aligning with established economic theories.

Data Overview

The balanced dataset covers the period from 2000 to 2020 and includes 36 developed countries, comprising 16 tourism-dependent nations: Austria, Czechia, Denmark, Estonia, France, Greece, Croatia, Hungary, Ireland, Iceland, Lithuania, Latvia, Portugal, Singapore, the Slovak Republic, and Slovenia. The control group consists of 20 other developed countries: Australia, Belgium, Canada, Switzerland, Chile,

Germany, Finland, the United Kingdom, Israel, Italy, the Republic of Korea, Luxembourg, Mexico, the Netherlands, Norway, New Zealand, Poland, Sweden, Türkiye, and the United States.

While other nations could have been included, we chose not to impute missing data for those countries to ensure the integrity of our dataset and maintain a balanced framework. This dataset primarily aims to explore the relationships between budget deficits and current account imbalances, defined as the sum of net trade and the excess of investment over private savings, all expressed as a percentage of GDP.

With this data in hand, we will examine causality over the observed period, applying it across tourism-dependent nations and the broader group of developed countries. Additionally, several control variables will be utilized to account for potential confounding factors influencing the relationships studied. These control variables will help ensure a balanced dataset(s), allowing for a more accurate analysis of the interplay between budget deficits and current account imbalances.

All data used in this analysis are sourced from the World Development Indicators (WDI) and were extracted using the WDI package (version 2.7.8) in the R programming language (Arel-Bundock, 2022: 1–8). This package facilitates efficient access to a wide range of economic and social indicators published by the World Bank.

To classify countries into treatment and control groups, we constructed a Tourism Development Index (TDI) by combining two key indicators: total tourist arrivals and tourism receipts, both obtained via the WDI package. Each component was given equal weight (50%) and normalized by population to generate per capita values, enabling meaningful cross-country comparisons. This adjustment ensures that larger economies do not dominate the index due to scale effects alone.

The resulting per capita values were then rescaled and converted to produce a unified index suitable for econometric analysis. Based on the final TDI, countries falling above the fourth quartile (top 25%) were classified as tourism-dependent, while those below this threshold formed the control group.

Although the 25% cutoff may appear somewhat arbitrary, it offers a practical and conceptually clear means of distinguishing countries with consistently high tourism intensity. Alternative thresholds (e.g., top 15% or 30%) were tested, but they led only to minor shifts in group composition without improving analytical robustness. Given the continuous nature of the TDI, the chosen classification strikes a balance between empirical tractability and interpretability, avoiding overfitting while maintaining meaningful group differentiation.

Despite their rich cultural heritage and significant tourism infrastructure, we remark that Italy and Turkey may not be classified in the high Tourism Development Index (TDI) category due to their larger populations and potentially lower tourism intensity per capita, which dilutes the overall impact of tourism relative to their total population size.

Before presenting the summary statistics, we outline the variables used in this study.

Table 2: Used Variables in Analysis

Variables	Description	Source (WDI Code)
FB	Fiscal or budget (in)balance as a percentage of GDP	Derived from GC.NLD.TOTL.GD.ZS (Net lending/ borrowing as % of GDP)
CAB	Current account in(balance) as a percentage of GDP	BN.CAB.XOKA.GD.ZS (Current account balance as % of GDP)
gdp_pc	GDP per capita	NY.GDP.PCAP.CD (GDP per capita, current US$)
pubdeb	Public debt as a percentage of GDP	GC.DOD.TOTL.GD.ZS (Central government debt as % of GDP)
infl	Inflation rate	FP.CPI.TOTL.ZG (Inflation, consumer prices, annual %, base 100 in 2010)
reint	Real interest rate	FR.INR.RINR (Real interest rate, %)

Source: Authors' own framework

The summary statistics for the full dataset, as well as for the control and tourism-dependent countries, are reported in Tables A1–A3 in the Appendix.

By analysing the CAB variable across datasets, we observe a higher mean in the control dataset (1.2) compared to the tourism dataset (-2.2) and the total dataset (0.5), indicating that countries in the control group tend to have a better current account position on average.

In contrast, FB (fiscal balance) shows a more negative mean in the tourism dataset (-3.1) compared to both the control dataset (-1.1) and the total dataset (-1.6). This suggests that tourism-oriented countries may experience larger fiscal deficits per capita.

The mean GDP per capita (gdp_pc) is significantly lower in the tourism dataset (26,519.2) compared to the control (41,757.9), indicating a disparity in economic performance. Public debt is slightly higher in the tourism dataset (72.1) than in the control (62.6), which may reflect different fiscal policies or economic conditions.

The variable infl represents the consumer price index (CPI), set to a base year of 2010 (index = 100). The dataset spans a balanced time frame, covering years both before and after the base year. Average CPI values across the period are below 100: 99.1 in control countries, 95.9 in tourism-dependent countries, and 97.7 in the full sample. These values reflect generally weaker price dynamics over the period, particularly in the tourism group, potentially indicating stronger deflationary pressures. Real interest rates are also higher in tourism-dependent countries (3.9%) compared to the control group (3.2%), which may affect borrowing and investment conditions.

Evaluation of Results

Model Selection and Justification

Our empirical analysis begins with a Difference-in-Differences with Panel Regression (DiD-PR) approach, initially estimated using a random effects (RE) model. The

choice of RE is supported by the Hausman test ($p = 0.032$), indicating no significant correlation between the regressors and unobserved individual effects. In addition, the Ramsey RESET test ($p = 0.215$) suggests that the model's functional form is appropriate and that omitted variable bias is unlikely.

To ensure robustness, we complement the RE estimates with fixed effects (FE) and Hausman-Taylor instrumental variable (HT-IV) models. These alternative specifications help address potential endogeneity concerns and unobserved heterogeneity, particularly given the relatively limited set of observed covariates. The HT-IV model is especially useful in this context, as it allows for the inclusion of time-invariant regressors—addressing a key limitation of the FE model, which absorbs such variables.

Finally, the panel structure—featuring a division between tourism-dependent and control country groups—satisfies the condition N<T, which favors RE estimation. Nonetheless, by employing FE and HT-IV models alongside RE, we ensure that our findings are robust to different assumptions about the correlation between explanatory variables and unobserved effects.

Difference-in-Differences (DiD) Framework

The treatment group comprises countries with high tourism dependency, while more economically diversified countries serve as the control group. Although this classification facilitates a DiD approach, there is no discrete policy intervention or clearly defined treatment event. As such, the analysis captures differential trends rather than the effects of a well-timed exogenous shock.

This observational nature of the DiD design calls for cautious interpretation. The DiD estimator reflects how fiscal or external balances evolve differently over time across groups, rather than measuring a clean average treatment effect. In this context, post-treatment trends are interpreted as relative changes between the treated and control groups, rather than strict causal impacts.

Table 3: Comparison of DiD Estimators for Fiscal Balance (FB) (Does CAB Cause FB)

Variable	DiD-RE	DiD-FE	HT-IV
lag(CAB,1)	-0.101*	-0.137***	-0.112**
	(-2.47)	(-3.21)	(-2.71)
treated	-3.324*	(Absorbed)	-1.872
	(-2.52)		(-1.11)
DiD	2.374***	2.278***	2.258***
	(5.24)	(5.00)	(4.95)
Diagnostics			
Hausman Test (p)	—	0.032	0.082
Observations	792	792	792

Source: Authors' own calculation.

Notes: The treated variable is absorbed in the FE model as it is time-invariant and collinear with country fixed effects. z-values in parentheses; ***p < 0.001; **p < 0.01; *p < 0.05.

To address potential collinearity between treatment and time effects, each regression model was split into distinct components focusing on treatment and time variables separately. This approach enhances the stability of our estimates and reduces bias, thereby ensuring the robustness of our findings.

The results from Table 3 indicate that the lagged current account balance (CAB) has a statistically significant negative effect on the fiscal balance (FB) across all estimators. This suggests that past external imbalances tend to worsen fiscal deficits, consistent with intertemporal budget dynamics. The DiD coefficient is positive and significant in all models, indicating that over time, tourism-dependent countries improved their fiscal balances relative to the control group.

The treated variable, which captures the average difference between tourism-dependent and control countries, is negative and significant in the RE model. This implies that, on average, tourism-dependent economies tend to run larger fiscal deficits—likely reflecting their exposure to volatile and seasonal revenue streams. In the FE model, the treated effect is absorbed due to collinearity with fixed effects.

Table 4: Comparison of DiD Estimators for Current account Balance (CAB) (Does FB Cause CAB)

Variable	DiD-RE	DiD-FE	HT-IV
lag_FB_1	-0.092**	-0.098***	-0.092**
	(-3.01)	(-3.21)	(-3.01)
treated	1.829	(Absorbed)	1.829
	(0.91)		(0.91)
did	-1.338***	-1.347***	-1.338***
	(-3.43)	(-3.46)	(-3.43)
Diagnostics			
Hausman Test (p)	—	0.198	—
R-squared	0.036	0.035	0.036
Observations	792	792	792

Source: Authors' own calculation; notes: Ibidem.

Table 4 presents the reverse relationship—whether fiscal balances Granger-cause movements in the current account. The lagged fiscal balance (FB) is negative and significant in all estimators, suggesting a deterioration in the external balance following fiscal deficits. The DiD coefficient is also negative and significant, implying that, over time, tourism-dependent countries experienced worsening current account balances relative to the control group.

This pattern may be driven by an overdependence on external tourism receipts, which, when disrupted, simultaneously affect fiscal and external indicators. It may also reflect structural vulnerabilities in the external sector due to fiscal mismanagement or external shocks.

Transition to Granger Causality and PGMM Estimation

The consistent significance of lagged variables in both directions (CAB → FB and FB → CAB) provides preliminary evidence of a dynamic interdependence between fiscal and external balances. These findings align with the notion of Granger causality, where past values of one variable help forecast another. At first glance, the observed co-movement—particularly within tourism-dependent countries—may hint at a Feldstein-Horioka-type pattern, in which external and domestic balances remain closely linked, suggesting limited capital mobility even in economies traditionally considered open. This could reflect not only structural frictions but also growing constraints on cross-border capital flows—a trend that, in hindsight, appears increasingly relevant amid the broader rethinking of economic openness leading up to 2025. However, this interpretation remains speculative and requires more rigorous empirical validation.

While the DiD-PR results provide valuable insight into the differential trends between tourism-dependent and control countries, they do not establish causality within a dynamic panel framework. To address this, the next stage of our analysis employs Arellano-Bond Panel GMM (AB-PGMM) estimations, which formally test for Granger causality while accounting for potential endogeneity and persistence in the data. The inclusion of lagged explanatory variables in the DiD framework is consistent with a dynamic specification, and their statistical significance motivates the transition to a more robust causal modeling approach. This shift enables a deeper exploration of the fiscal–external balance nexus and the mediating role of tourism dependence.

Unit Root Test

As Granger causality (GC) tests require stationary data, we conducted a series of standard panel unit root tests to ensure the robustness of our analysis. Specifically, we employed the Breitung, Im-Pesaran-Shin (IPS), and Fisher-type tests to assess the stationarity of all variables, both in levels and first differences. These tests are well-suited for panel datasets with relatively short time dimensions, as they leverage the cross-sectional variation to improve statistical power — a key advantage given the structure of our data.

The results, summarized in Appendix Tables A4–A9, confirm that most variables are stationary either at levels or after first differencing, depending on the dataset (i.e., full sample, tourism-dependent countries, and control group). In particular, the majority of variables are found to be stationary at the 1% significance level, and those that exhibited non-stationarity at levels achieved stationarity after first differencing. This outcome eliminates the need to adopt a cointegration framework and resolves initial concerns regarding how to proceed with the causality analysis.

Stationarity and Variable Transformation: Addressing Unit Root Concerns

As shown in Figure A1-A4 (Appendix), we observed clear evidence of trending behavior in key control variables—notably *gdp_pc*, *inflation*, and others—across countries at the individual level. Combined with unit root test results confirming that these exogenous variables are stationary only after first differencing (particularly in our short sample panels), this supporrts the need to transform the data prior to applying time-series-based panel methods. Without addressing these non-stationarities, applying approaches such as Vector Autoregression (VAR) or Panel Generalized Method of Moments (PGMM) could lead to spurious results and misleading inferences about Granger causality.

To mitigate these concerns, we adopted the Arellano-Bond Panel GMM (AB-PGMM) estimator, applying a first-difference transformation to all variables. This approach not only ensures stationarity but also effectively eliminates individual-specific fixed effects and deterministic trends from the data. By doing so, we reduce the risk of spurious correlations and enhance the reliability of our dynamic panel estimations, particularly in assessing the causal interplay between fiscal and external balances.

These techniques provide the foundation for conducting Wald Granger causality testing, enabling a rigorous exploration of the causal relationships between the twin deficit variables and the exogenous variables. Transforming all variables to first differences ensures the validity of the Granger causality tests.

Lag Calibration: Andrews-Lu Criteria

To determine the optimal lag length, we employed the Andrews-Lu criteria—namely, the Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), and Hannan-Quinn Information Criterion (HQIC). These criteria compare penalized goodness-of-fit across models, with lower values indicating a better model fit. The Andrews-Lu criteria enabled a streamlined and precise lag determination process that aligns with the PGMM framework.

Based on the results presented in Table A10 (Appendix), we selected a lag structure of one lag for both the full dataset and the control group, while opting for a two-lag structure in the tourism-dependent group.

This ensures alignment with our analytical requirements and reflects the dynamics of the respective datasets.

This approach, implemented through the computing routine, simultaneously addresses both dependent variables—CAB and FB (representing the twin deficits)—by incorporating their lagged values as instruments. The Andrews-Lu criteria were used to calibrate these lags, ensuring that the chosen lag structure effectively captures the interdependencies between the current and past values of both deficits, as well as their interactions with the exogenous variables.

Lags of the dependent variable from at least one period earlier were utilized as GMM-style instruments. Given that the results of Granger causality tests can be sensitive to the choice of lag length in the time-stationary VAR model presented in Eq. (5), it is crucial to specify the lag structure appropriately.

The Pesaran CD Test

The Pesaran CD test for cross-sectional dependence across all countries produced a z-value of 38.405, which is consistent with the results from the other two split datasets. This strong z-value provides substantial evidence against the null hypothesis of no cross-sectional dependence. In light of this evidence, we adjusted our AB-PGMM modeling approach by employing robust standard errors to account for cross-sectional dependence.

Dynamic AB-PGMM Estimations: Diagnostics

To affirm the robustness of our dynamic AB-PGMM estimations across the three datasets, we estimated three separate regressions, each pairing different dependent (CAB and FB) variables within a system-GMM framework implemented via the panelvar package, which accommodates idiosyncratic fixed effects and system-specific structure. For each regression, we conducted standard post-estimation diagnostics—including the Hansen test—to assess instrument validity. The results generally support the robustness of the models, although minor differences arise due to variations in model design and dataset characteristics: in the Total Countries Dataset, the Hansen test (Chi-squared = 9.44, $p = 0.051$) lies near the conventional significance threshold, indicating marginal but acceptable instrument validity; in the Control Countries Dataset, the Hansen test (Chi-squared = 8.3, $p = 0.543$) provides strong support for instrument validity; and in the Tourism-Dependent Dataset, the Hansen test (Chi-squared = 7.4, $p = 0.094$) also supports validity, though the result is somewhat closer to the threshold of concern. To further assess model stability, we examined the roots of the companion matrix for each of the three panel VAR regressions. In all cases, the roots remained well within the unit circle, confirming that the estimated systems are dynamically stable—a conclusion further supported by the stability plots presented in Appendix Figures A5–A7.

Dynamic AB-PGMM Estimations: GCT with CAB as the Dependent Variable

In this section, we present the core results of the dynamic AB-PGMM estimations within a Granger-causality framework, with the CAB as the dependent variable.

Tables 5-7 detail the estimations where the CAB is the dependent variable, analysed both in isolation and alongside the FB and a vector of control variables (GDP per capita, public debt, inflation rate, and real interest rate) as instruments.

Table 5: Difference PGMM Model Results for CAB (Total Countries Dataset)

Term	Estimate (SE)
lag(CAB, 1)1	0.3503 * (0.1697)
lag(FB, 1)1	-0.0508 (0.0988)
gdp_pc	-0.0001 (0.0001)
pubdeb	0.0015 (0.0011)
infl	0.0053 (0.0234)
reint	-0.0656 * (0.0325)

Source: Authors' own calculation

Note: ***p < 0.001; **p < 0.01; *p < 0.05

Table 6: Difference PGMM Model Results for CAB (Control Countries Dataset)

Variable	Estimate (SE)
lag1_CAB	0.040* (0.018)
lag1_FB	0.037 (1.178)
gdp_pc	-0.000 (0.001)
pubdeb	0.000 (0.010)
infl	0.006* (0.003)
reint	-0.007 (0.121)

Note: Ibidem.

Table 7: Difference PGMM Model Results for CAB (Tourism-Dependent Countries)

Term	Estimate (SE)
lag(CAB, 1:2)1	0.398*** (0.104)
lag(CAB, 1:2)2	0.143* (0.072)
lag(FB, 1:2)1	-0.050** (0.018)
lag(FB, 1:2)2	-0.022* (0.010)
gdp_pc	0.000 (0.000)
pubdeb	0.006 (0.005)
infl	-0.027** (0.01)
reint	-0.057 (0.056)

Source: Authors' own calculation

Note: Ibidem.

The robust coefficient results from the Arellano-Bond dynamic panel GMM estimations across the full dataset provide valuable insights into the relationship between fiscal balance (FB) and the current account balance (CAB). The first lag of FB (-0.0508) is statistically insignificant, suggesting a likely non-Granger causality

from FB to CAB. This indicates that changes in the budget deficit do not significantly help predict future shifts in the CAB. This is further supported by the formal Wald statistic for the Granger causality test, which is also insignificant at the 0.05 level (see Table 8), confirming no notable impact of FB on CAB.

The first lagged values of CAB are significant, with a coefficient of 0.3503, demonstrating strong autocorrelation in the CAB. This indicates that past values of CAB are reliable predictors of its future outcomes, as the CAB exhibits persistence in its time dynamics.

Additionally, the variable real interest rate (reint) plays a notable role in the model as both a control variable and a potential instrument. The coefficient of -0.0656 is statistically significant at the 0.05 level, indicating that higher real interest rates are associated with a decrease in the CAB. Including reint in the model helps account for monetary policy effects and strengthens the robustness of the estimations by controlling for factors that might otherwise bias the results. This underlines the importance of reint in understanding the dynamics of the CAB alongside fiscal and economic variables.

In the control model, the first lag of FB are statistically insignificant, reinforcing the conclusion that Granger causality fails to provide positive evidence of a directional relationship from FB to CAB. This lack of significance aligns with results shown in Table 15, further supporting the notion that changes in FB do not substantially influence the CAB in the countries under consideration.

However, the first lag of CAB (0.040*) demonstrate strong autocorrelation, with statistically significant coefficients and a p-value of < 0.001. This shows that that past current account balances remain robust predictors of future balances, underscoring the persistence of CAB dynamics over time.

Notably, inflation (infl) emerges as a significant predictor in this model, with a coefficient of 0.006 (p-value < 0.01). This indicates that higher inflation rates are associated with a positive impact on the CAB for the control countries. The strong significance of inflation suggests that price level changes may play a critical role in influencing trade balances and, by extension, current account balances.

The tourism model provides a distinct perspective on the relationship between fiscal balance (FB) and the current account balance (CAB). The coefficients for the first two lags of FB (–0.050** and –0.022*) are statistically significant, with p-values less than 0.01 and 0.05, respectively, indicating that FB has a significant and immediate influence on CAB in the context of tourism-dependent countries. This contrasts with the results observed in the control and total country datasets, where the effects of FB were largely insignificant. These findings suggest that fiscal balance plays a more pronounced role in shaping current account dynamics in economies heavily reliant on tourism.

Additionally, among the control variables, only inflation is statistically significant (p < 0.01) in this model. This suggests that, in tourism-dependent countries, inflation—alongside the fiscal balance and the persistence of CAB dynamics—plays

a more critical role in explaining variations in the current account balance than the other included macroeconomic controls.

Table 8: Granger Causality Testing Results (Does FB Cause CAB)

Model	Wald	p-value	Coefficient	CI Lower	CI Upper	Significance
Total	0.051	0.821	0.029	-0.222	0.280	No
Tourism	0.002	0.969	-0.002	-0.109	0.105	No
Control	0.080	0.778	0.041	-0.245	0.328	No

Source: Authors' own calculation

Note: Ibidem.

Dynamic AB-PGMM Estimations: GCT with FB as the Dependent Variable

This section investigates the dynamics between the CAB and the FB, with FB now treated as the dependent variable. The results from the Arellano-Bond dynamic panel GMM estimations offer insights into how CAB influences FB. In this results section, we avoid laborious interpretations, as many findings derived from Tables 9-11 —especially the diagnostic tests—remain consistent with those from the previous section where CAB was the outcome variable.

Table 9: Difference PGMM Model Results for FB (Total Countries Dataset)

Term	Estimate (SE)
lag(CAB, 1)1	0.694* (0.288)
lag(FB, 1)1	0.798 *** (0.197)
gdp_pc	0.001 ** (0.00051)
pubdeb	-0.004 (0.003)
infl	-0.100 (0.059)
reint	-0.022 (0.053)

Source: Authors' own calculation

Note: Ibidem.

Table 10: Difference PGMM Model Results for FB (Control Countries)

Term	Estimate (SE)
lag1_CAB	-0.021 (0.091)
lag1_FB	-0.040** (0.018)
lag2_CAB	0.017 (0.118)
lag2_FB	-0.114 (0.209)
gdp_pc	0.002** (0.001)
pubdeb	-0.002 (0.003)
infl	-0.103 (0.081)
reint	0.049 (0.054)

Source: Authors' own calculation **Note:** Ibidem.

Table 11: Difference PGMM Model Results for FB (Tourism-Dependent Countries)

Term	Estimate (SE)
lag(CAB, 1:2)1	0.057(0.033)
lag(FB, 1:2)1	0.261 *(0.113)
lag(CAB, 1:1)1	-0.002 (0.101)
lag(FB, 1:2)2	0.224 *(0.111)
gdp_pc	0.003* (0.0015)
pubdeb	0.000(0.004)
infl	0.048(0.054)
reint	-0.164 *(0.074)

Source: Authors' own calculation **Note:** Ibidem.

In the full model, past values of the current account balance (CAB) appear to have no significant effect on the fiscal balance (FB). Specifically, the first lag of CAB yields a coefficient of 0.694, indicating statistical significance. These findings suggest that CAB does play a meaningful role in explaining changes in the budget deficit. In parallel, the first lag of FB shows a highly significant positive effect on its future values, with a coefficient of 0.798 and a p-value of less than 0.001. This result indicates strong persistence in budget deficits over time, emphasizing the importance of past fiscal outcomes in shaping future fiscal balances.

The coefficient for gdp_pc is positive (0.001) and statistically significant at the 5% level, suggesting that higher GDP per capita has a modest but meaningful impact on fiscal balance outcomes. However, this result should be interpreted cautiously, as it reflects a correlation within the model and not necessarily a causal relationship.

The Granger causality (GC) test, which compares restricted and unrestricted models, provides further insights into the relationship between the current account balance (CAB) and the fiscal balance (FB). The Wald statistic of 5.799, coupled with a p-value of 0.016, offers strong evidence that CAB Granger-causes changes in FB. This result aligns with the earlier regression findings, reinforcing the conclusion that CAB plays a critical role in driving variations in fiscal balance across the full country sample. Importantly, by disentangling causal inference from simple correlation, the GC test confirms that CAB is a statistically significant driver of fiscal balance dynamics—reflected in a coefficient of 0.694 and a 95% confidence interval ranging from 0.129 to 1.260.

In the control model, the first lag of the current account balance (lag1_CAB) shows an insignificant negative effect (-0.021, $p = 0.091$) on fiscal deficits, providing no robust evidence that worsening current accounts improve budget balances. Meanwhile, the highly significant first lag of fiscal deficits (lag1_FB, -0.040, $p = 0.018$) indicates strong self-adjustment mechanisms, where past deficits prompt corrective fiscal actions. The significant positive association between GDP per capita (as a control variable) and budget deficits (coefficient = 0.002, $p < 0.05$) suggests potential

procyclical fiscal behavior in control countries, where periods of higher economic output may lead to increased government spending or tax cuts that modestly widen deficits. This finding aligns with theoretical expectations of expansionary fiscal policies during growth phases. However, the marginal effect size indicates that such responses remain limited in magnitude among these economies. The Wald test (statistic = 4.966, p = 0.026) further confirms the presence of Granger causality running from the current account balance (CAB) to the fiscal balance (FB) in the control group. This result supports the hypothesis that CAB Granger-causes FB, providing additional evidence that fluctuations in the current account are a significant driver of fiscal balance dynamics among control countries. The effect is statistically significant, with a coefficient of 0.757 and a 95% confidence interval ranging from 0.091 to 1.423. The empirical analysis reveals three fundamental insights about fiscal dynamics in tourism-dependent economies that challenge conventional understandings of the twin deficits hypothesis.

Tourism-dependent economies exhibit distinctive fiscal adjustment patterns characterized by strong short-term persistence. The statistically significant positive coefficient of 0.261 on the first lag of budget deficits indicates moderate inertia, where fiscal imbalances tend to perpetuate themselves in the short run. This persistence is further confirmed by the significance of the second lag, which also exhibits a significant positive coefficient of 0.224, suggesting a continued path-dependence in fiscal dynamics. The absence of negative or insignificant lag effects indicates that mean-reversion behavior is limited or delayed, reflecting a possibly rigid fiscal environment. This pattern likely reflects the complex interplay between institutional constraints, political budget cycles, and the unique economic structure of tourism-reliant nations, where fiscal adjustments may occur through delayed or punctuated responses rather than gradual correction.

Contrary to theoretical expectations of countercyclical fiscal policy, the results show a statistically significant positive relationship between GDP per capita and budget deficits, with a coefficient of 0.003. This finding supports the hypothesis of procyclical fiscal behavior in tourism-dependent economies, where periods of economic expansion—often driven by tourism booms—coincide with widening, rather than narrowing, fiscal deficits. Structural factors such as increased government spending during revenue windfalls, limited capacity to save tourism surpluses, and political incentives to boost visible expenditures during economic highs may all contribute to this phenomenon.

Additionally, the real interest rate (reint) shows a statistically significant negative effect on the fiscal balance (coefficient = –0.164, SE = 0.074, $p < 0.05$), indicating that rising borrowing costs are associated with worsening budgetary imbalances. This suggests that higher real interest rates—whether due to tighter global monetary conditions or domestic inflation adjustments—further strain fiscal positions in these economies.

Together, these findings underscore the vulnerability of tourism-driven economies to external shocks and the challenges of maintaining fiscal discipline amid procyclical spending tendencies and exposure to interest rate volatility.

The Granger causality test results presented in Table 12 provide additional insight into the directional relationship between external and fiscal balances, particularly within tourism-dependent economies.

The Wald statistic of 3.033, with a p-value of 0.082, offers marginal evidence—significant at the 10% level—that the current account balance (CAB) Granger-causes changes in the fiscal balance (FB). While this result does not meet the conventional 5% significance threshold, it suggests a potentially meaningful, albeit modest, influence of external sector dynamics on fiscal outcomes. The positive coefficient of 0.057, with a 90% confidence interval ranging from -0.007 to 0.122, points to a weak but possibly relevant linkage whereby current account conditions may help predict short-term fiscal adjustments. This marginal causality is consistent with the structural characteristics of tourism economies, where large and volatile external inflows—such as tourism receipts—may indirectly shape government revenue streams and expenditure planning.

Table 12: Granger Causality Testing Results (Does CAB Cause FB)

Model	Wald	p-value	Coefficient	CI Lower	CI Upper	Significance
Total	5.799	0.016	0.695	0.129	1.260	* (Yes)
Tourism	3.033	0.082	0.057	-0.007	0.122	. (Marginally)
Control	4.966	0.026	0.757	0.091	1.423	*(Yes)

Source: Authors' own calculation

Note: Control variables are included in PGMM estimation.

Robustness Analysis of Panel Granger Causality Tests

To validate the robustness of our previous Granger causality results derived from the AB-PGMM framework, we implemented a complementary panel Granger causality procedure using the Fixed Effects specification. This choice was supported by the Hausman test results, which consistently favored the Fixed Effects model over pooled alternatives across all three model variations. This outcome was anticipated, as our DiD-PR analysis section had similarly identified Fixed Effects as the preferred panel specification, further confirming its superior suitability for inference.

The results, displayed in Table 13, reveal consistent patterns that largely confirm our earlier findings. For the total country sample, the Fixed Effects test strongly confirms the causal relationship from CAB to FB (Wald = 37.700, $p < 0.001$), while rejecting any evidence of causality in the reverse direction. Similarly, in the control group, CAB is shown to Granger-cause FB (Wald = 16.238, $p < 0.001$), again aligning

with prior PGMM estimates. No causal effect was found from FB to CAB in this subgroup. For tourism-dependent countries, the test confirms strong one-way causality from CAB to FB (Wald = 44.236, $p < 0.001$), further reinforcing the directional relationship observed in the PGMM estimation. No significant feedback from FB to CAB was detected.

These robustness checks bolster confidence in our earlier AB-PGMM-based conclusions, confirming that current account balances systematically precede and help explain fiscal balance dynamics across all three model settings. Overall, the more rigorous GMM-based results provide stronger and more reliable evidence of the unidirectional causality from CAB to FB, which remains robust across alternative estimation strategies.

Table 13: Robusness test of Granger Causality Testing

Model	Test	Wald	p-value	Significance
Total (1-lag)	FB → CAB	0.000959	0.975	
Total (1-lag)	CAB → FB	37.700	8.38e-10	***
Control (1-lag)	FB → CAB	0.0336	0.854	
Control (1-lag)	CAB → FB	16.238	5.59e-05	***
Tourism (2-lags)	FB → CAB	0.0159	0.900	
Tourism (1-lags)	CAB → FB	44.236	2.91e-11	***

Granger causality tests were conducted using the Fixed Effects specification, as Hausman test results across all three model variations consistently favored Fixed Effects over pooled models, confirming their superior suitability for inference.

Therefore, in our subsequent interpretation, we will adhere to the earlier Granger causality findings, which are stronger because they originate from the AB-PGMM estimation.

Discussion on the Alignment of Empirical Evidence with Theoretical Causal Mechanisms Between CAB and FB

The empirical results derived from both the Arellano-Bond PGMM estimations and the robustness-checked Granger causality tests consistently support a unidirectional causal relationship from the current account balance (CAB) to the fiscal balance (FB). This evidence aligns most closely with the Current Account Targeting Hypothesis (CATH), which posits that fiscal policy reacts to developments in the external sector, particularly current account imbalances.

In the full model, the statistically significant Wald tests confirm that changes in the CAB precede and predict future shifts in the FB. This causality direction contradicts the traditional Twin Deficits Hypothesis (TDH) and the Keynesian Absorption Theory (KAT), both of which argue for the opposite direction—namely, that fiscal

deficits drive current account deterioration. Instead, our findings affirm the logic of CATH, wherein governments adjust fiscal policy—often through austerity or expansionary measures—in response to external imbalances.

This interpretation is supported by the empirical literature. Kalou and Paleologou (2012), using data from Eurozone members, and Marimuthu et al. (2021), examining both high- and low-income ASEAN economies, provide strong empirical support for CATH. These studies demonstrate that CAB deteriorations often precede fiscal adjustments, particularly in economies facing external constraints or vulnerability to capital flow volatility. Similarly, Stravelakis and Rubinić (2023), utilizing a VCEM model on 11 EU member states from 1995 to 2019, identify significant CATH-aligned dynamics in countries such as Czechia, France, Germany, and Greece.

In the tourism-dependent model, although the initial PGMM results suggest only marginal significance, the robustness tests using fixed effects reveal strong Granger causality from CAB to FB. This outcome further validates the CATH framework within structurally unique economies. Tourism-dependent countries, often exposed to volatile external demand, may be particularly inclined to adjust fiscal policy in response to swings in the current account. This pattern corroborates findings by Marimuthu et al. (2022), who argue that CAB deteriorations can serve as leading indicators of fiscal stress in structurally vulnerable economies. These findings also challenge the relevance of the Ricardian Equivalence Hypothesis (REH) in these contexts, as the data points to active fiscal responses rather than passive private sector adjustments. Moreover, they cast further doubt on the applicability of the Feldstein–Horioka Puzzle, which was only tentatively suggested during preliminary testing and appears to be a spurious result in this setting.

The control model, which includes developed countries less reliant on tourism, also reveals statistically significant causality running from the CAB to the FB. These results emphasize that even among more diversified economies, governments remain responsive to external imbalances. This aligns with the findings of Born et al. (2019), who demonstrate how current account pressures can lead to politically motivated fiscal consolidations, and Ghosh et al. (2013), who introduce the concept of "fiscal fatigue": the idea that sustained external deficits push governments toward fiscal tightening to regain macroeconomic balance.

Together, these findings present a cohesive framework: across all model variations—full, tourism-dependent, and control—the data supports CATH as the prevailing causal mechanism. The implications are fiscal policy in developed economies is not only a driver of macroeconomic dynamics but also a reactive tool used to correct external imbalances. critical: This challenges older frameworks like KAT and REH, which either overlook the reactive nature of fiscal policy or assume forward-looking private sector behavior that neutralizes fiscal effects.

Conclusion

This study explores the complex relationship between budget deficits and current account balances in developed nations, with a particular focus on distinguishing between tourism-dependent and non-tourism economies. Grounded in a robust econometric framework—including dynamic panel estimations and Granger causality (GC) testing—our analysis provides valuable insights into the directional nature and structural determinants of the so-called "twin deficits."

The findings consistently reveal that the current account balance Granger-causes the fiscal balance, suggesting that governments adjust their fiscal stance in response to external sector developments. This pattern is most clearly observed in the full and control models, where statistically significant results support the Current Account Targeting Hypothesis (CATH). This outcome questions the conventional notion that fiscal deficits lead to current account imbalances, suggesting instead that fiscal policy reacts to external pressures.

In tourism-dependent economies, the relationship appears more subtle. While robustness checks confirm a statistically significant influence of the current account on the fiscal balance, the primary dynamic panel results offer only marginal evidence. This suggests that CATH may still be relevant in this group, but further testing is warranted to confirm its robustness in structurally unique contexts characterized by high external volatility and limited fiscal flexibility.

The control model, representing less tourism-reliant developed economies, confirms the presence of significant feedback from the current account to the fiscal balance. This supports the idea that fiscal policy in such contexts may serve as an adjustment mechanism aimed at correcting external imbalances, especially when macroeconomic stability is at stake.

While Granger causality testing has provided valuable insights into the temporal dynamics between fiscal and external balances, it is important to emphasize its conceptual limitations. GC identifies predictive relationships based on temporal precedence but does not establish causality in a strict structural sense. Macroeconomic systems are inherently complex, shaped by institutional dynamics, feedback loops, and external shocks—all of which may not be fully captured by the GC framework. To address these concerns, this study has complemented GC testing with robustness checks and alternative econometric methods, ensuring reliable and meaningful results while acknowledging the need for cautious interpretation.

Ultimately, this study contributes to a deeper understanding of the interlinkages between fiscal and external balances in developed economies. It underscores the importance of structural characteristics—such as tourism dependency—in shaping the direction and magnitude of these interactions. The evidence supports a shift in perspective: rather than viewing fiscal deficits as the primary drivers of external imbalances, it may be more accurate to consider external dynamics as shaping fiscal outcomes.

At the same time, it is important to acknowledge certain limitations of this study, which also provide valuable avenues for future research. Incorporating controls for exogenous shocks—such as financial crises, pandemics, or geopolitical events—through dummy variables or similar approaches could improve the robustness of the findings. While the paper employs PGMM to address endogeneity concerns, future studies could bolster the identification strategy with System GMM or alternative estimation techniques to account for persistence and trending in key explanatory variables. Furthermore, disaggregating tourism-dependent economies at the industry level using metrics such as tourism revenue volatility or firm-level microeconomic data could uncover important structural heterogeneities that remain obscured in aggregated analyses.

Additionally, while this study focuses on fiscal imbalances, a deeper exploration of structural economic reforms—such as diversification strategies for tourism-reliant economies—could offer actionable policy recommendations for mitigating twin deficits. Finally, extending the analysis to include developing nations with similar economic structures would enhance the generalizability and policy relevance of these findings, particularly in regions where fiscal and external dynamics may differ substantially from those in developed economies.

Taken together, the results of this study suggest that the Current Account Targeting Hypothesis offers the most consistent explanation of fiscal–external dynamics in developed economies. However, tourism-dependent countries, with their unique vulnerabilities and structural complexities, present a particularly promising area for further empirical exploration. By addressing the limitations identified here, future research can provide even deeper insights into the intricate relationship between fiscal and external balances across a broader range of economic contexts.

Declarations

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Availability of data and material

The data that support the findings of this study are openly available in the website of World Bank (www.worldbank.org).

Code Availability

The computer program results are shared through the tables in the manuscript.

Authors' Contributions

Zdravko Šergo: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing.
Ana Težak Damijanić: Writing – review & editing, Validation, Supervision.
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Appendix

Table A1: Summary Statistics for the Total Dataset

Variable	CAB	FB	gdp_pc	pubdeb	infl	reint
Mean	0.5	-1.6	34985.1	66.8	97.7	3.5
SD	6.4	4.4	22045.8	42.3	18.2	2.8
Median	0.72	-1.5	35506.5	57.5	99.3	3.2

Source: Authors' own calculation

Table A2: Summary Statistics for Control Countries Dataset

Variable	CAB	FB	gdp_pc	pubdeb	infl	reint
Mean	1.2	-1.1	41757.9	62.6	99.1	3.2
SD	5.1	4.2	23243.6	40.2	19.6	2.5
Median	0.9	-1.6	40300.3	52.4	99.0	3.1

Source: Authors' own calculation

Table A3: Summary Statistics for Tourism-Dependent Countries Dataset

Variable	CAB	FB	gdp_pc	pubdeb	infl	reint
Mean	-2.2	-3.1	26519.2	72.1	95.9	3.9
SD	7.7	4.5	17034.6	44.4	16.0	3.2
Median	-1.9	-2.4	18077.3	65.5	100.0	3.6

Source: Authors' own calculation

Table A4: Panel Unit Root Test Results for Complete Panel Dataset

Variable	Test	Statistic	p-value
CAB	IPS	-6.570***	0
CAB	Fisher	195.258***	0
CAB	Breitung	14.027***	0
FB	IPS	-4.490***	0
FB	Fisher	143.189***	0
FB	Breitung	14.644***	0
gdp_pc	IPS	-1.573	0.058
gdp_pc	Fisher	97.797**	0.023
gdp_pc	Breitung	23.007***	0
pubdeb	IPS	-5.083***	0
pubdeb	Fisher	336.591***	0
pubdeb	Breitung	-2.484**	0.013
infl	IPS	0.138	0.555
infl	Fisher	145.417***	0
infl	Breitung	26.944***	0
reint	IPS	-15.180***	0
reint	Fisher	536.362***	0
reint	Breitung	1.893	0.058

Source: Authors' own calculation

Note: H0, all panels contain unit roots; Ha, at least one panel is stationary. Reject the null of unit root at the level of significance ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Table A5: Panel Unit Root Test Results for Complete Panel Dataset (At First Difference)

Variable	Test	Statistic	p-value
gdp_pc	IPS	-10.588***	0.000
gdp_pc	Fisher	123.183***	0.000
gdp_pc	Breitung	-2.137*	0.043
infl	IPS	-10.807***	0.000
infl	Fisher	132.004***	0.000
infl	Breitung	-1.897*	0.034
reint	IPS	-11.634***	0.000
reint	Fisher	128.234***	0.000
reint	Breitung	-1.756*	0.036

Source: Authors' own calculation

Note: Ibidem.

Table A6: Panel Unit Root Test Results for Tourism Dependent Countries

Variable	Test	Statistic	p-value
CAB	IPS	-3.699 ***	0.000
CAB	Fisher	77.977 ***	0.000
CAB	Breitung	10.284 ***	0.000
FB	IPS	-4.877 ***	0.000
FB	Fisher	88.838 ***	0.000
FB	Breitung	9.769 ***	0.000
gdp_pc	IPS	0.621	0.733
gdp_pc	Fisher	27.643	0.687
gdp_pc	Breitung	17.206 ***	0.000
pubdeb	IPS	-0.910	0.181
pubdeb	Fisher	115.230 ***	0.000
pubdeb	Breitung	-2.042 *	0.041
infl	IPS	-2.055 *	0.020
infl	Fisher	95.219 ***	0.000
infl	Breitung	22.099 ***	0.000
reint	IPS	-10.536 ***	0.000
reint	Fisher	248.411 ***	0.000
reint	Breitung	0.129	0.897

Source: Authors' own calculation

Note: Ibidem.

Table A7: Panel Unit Root Test Results for Tourism Dependent Countries (At First Difference)

Variable	Test	Statistic	P-value
gdp_pc	IPS	-7.170***	0
gdp_pc	Fisher	138.274***	0
gdp_pc	Breitung	3.933***	0
pubdeb	IPS	-13.372***	0
pubdeb	Fisher	368.201***	0
pubdeb	Breitung	-12.737***	0
reint	IPS	-25.197***	0
reint	Fisher	807.540***	0
reint	Breitung	-8.527***	0

Source: Authors' own calculation

Note: Ibidem.

Table A8: Panel Unit Root Test Results for Control Countries

Variable	Test	Statistic	p-value
CAB	IPS	10.284 ***	0.000
CAB	Fisher	-3.699 ***	0.000
CAB	Breitung	77.977 ***	0.000
FB	IPS	9.769 ***	0.000
FB	Fisher	-4.877 ***	0.000
FB	Breitung	88.838 ***	0.000
gdp_pc	IPS	17.206 ***	0.000
gdp_pc	Fisher	0.621	0.733
gdp_pc	Breitung	27.643	0.687
pubdeb	IPS	-2.042 *	0.041
pubdeb	Fisher	-0.910	0.181
pubdeb	Breitung	115.230 ***	0.000
infl	IPS	22.099 ***	0.000
infl	Fisher	-2.056 *	0.020
infl	Breitung	95.219 ***	0.000
reint	IPS	0.129	0.898
reint	Fisher	-10.536 ***	0.000
reint	Breitung	248.411 ***	0.000

Source: Authors' own calculation

Note: Ibidem.

Table A9: Panel Unit Root Test Results for Control Countries (At First Difference)

Variable	Test	Statistic	p-value
gdp_pc	Breitung	-9.231***	0.000
gdp_pc	IPS	-75.544***	0.000
gdp_pc	Fisher	1.095.378***	0.000
pubdeb	Breitung	-11.780***	0.000
pubdeb	IPS	-36.582***	0.000
pubdeb	Fisher	992.094***	0.000
reint	Breitung	-10.640***	0.000
reint	IPS	-27.705***	0.000
reint	Fisher	914.435***	0.000

Source: Authors' own calculation

Note: Ibidem.

Table A10: Optimal Lag Length According to Andrews-Lu Criteria

Selection no. of lags	BIC	AIC	HQIC
Full	1	1	1
Tourism	2	2	2
Control	1	1	1

Source: Authors' own calculation

Note: Refers to the range of countries included in the dataset.

Figure A1: GDP per capita Trend

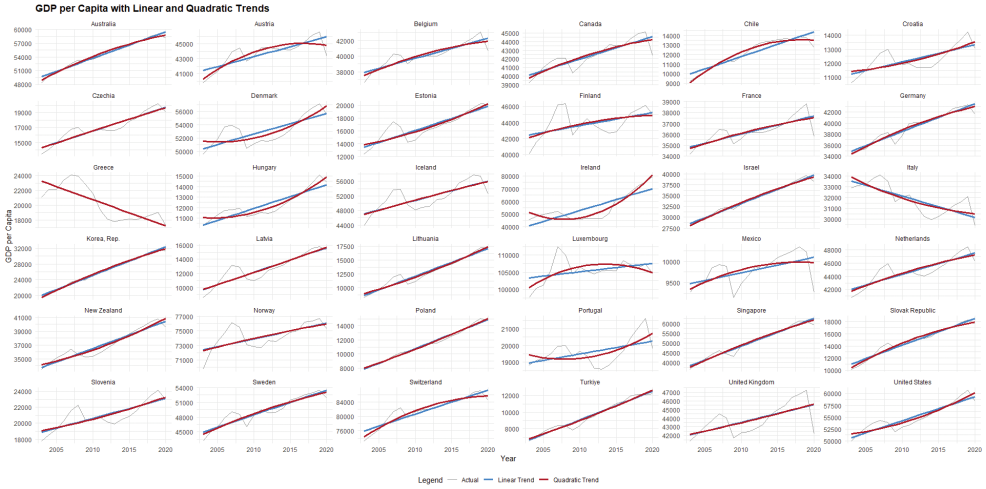

Figure A2: Public Debt Trend

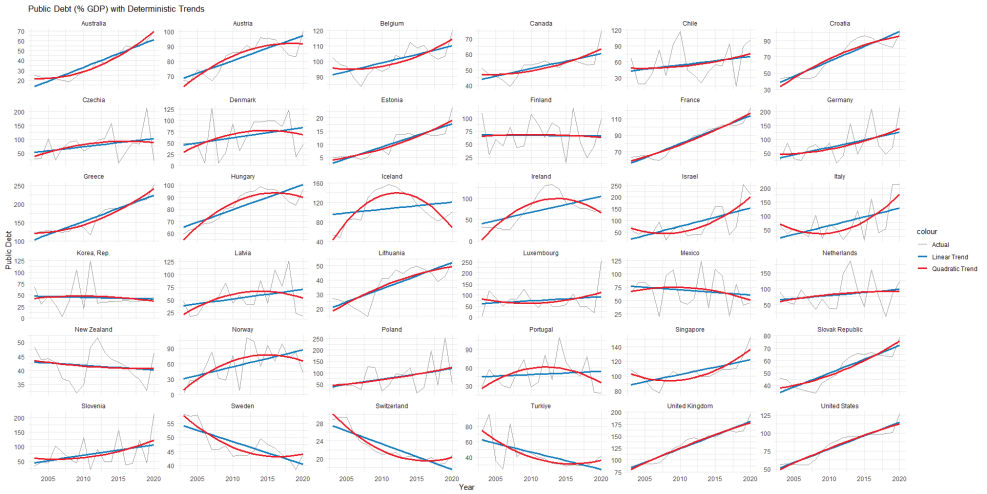

Figure A3: Inflation Trend

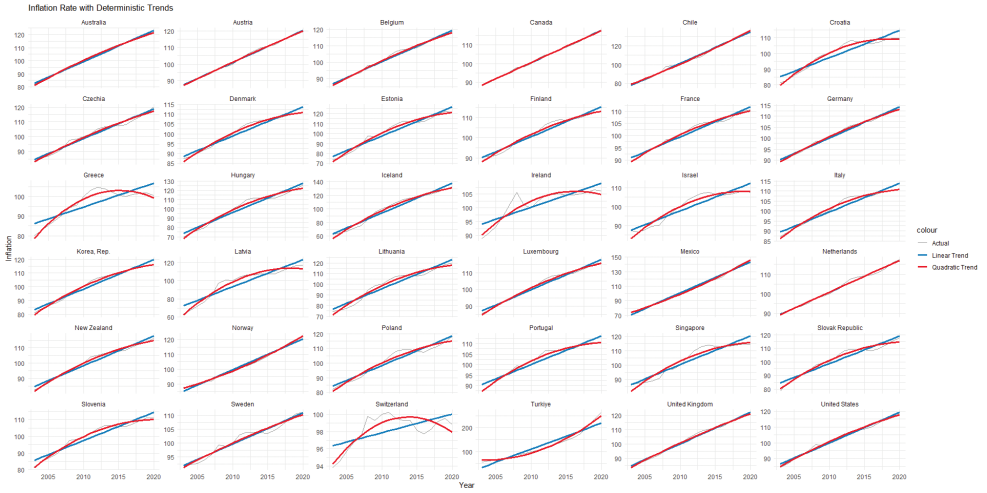

Figure A4: Real Interest Rate Trend

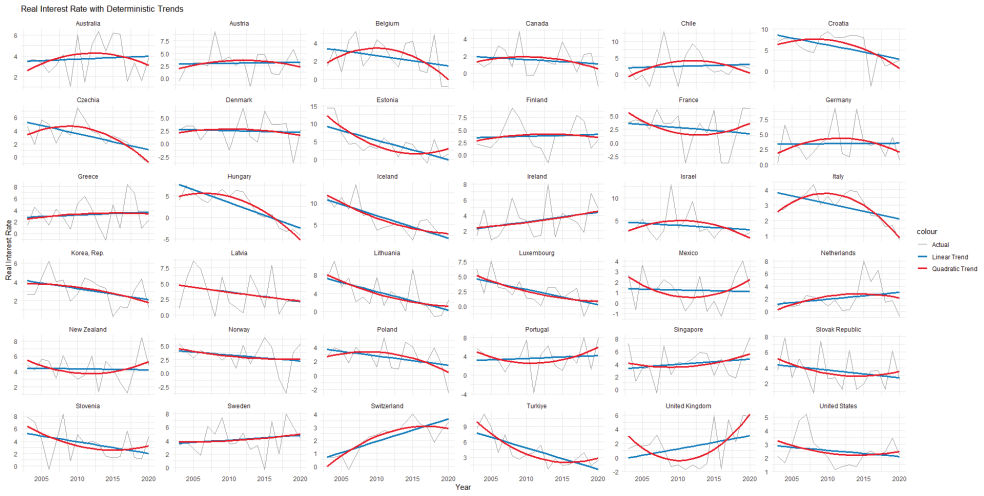

Figure A5: Roots of Companion Matrix – Panel VAR Model (Total Countries Dataset)

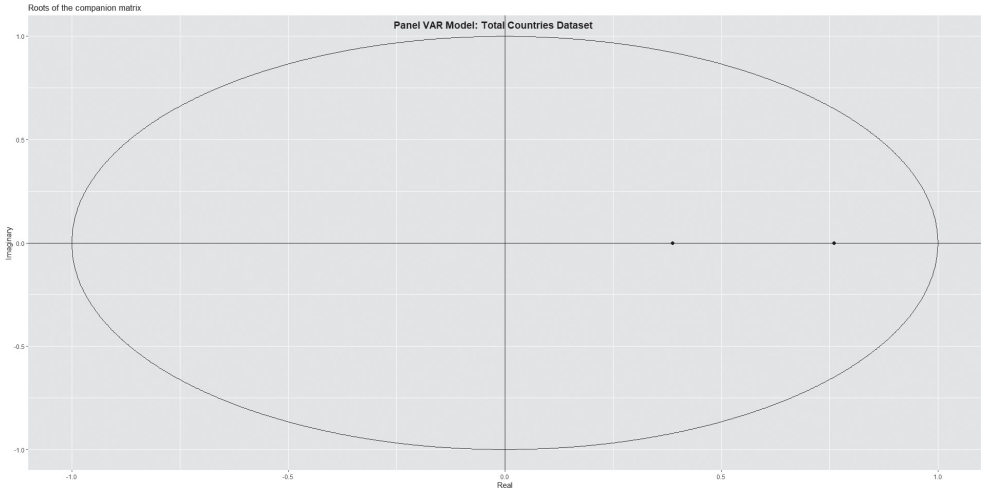

Figure A6: Roots of Companion Matrix – Panel VAR Model (Control Group)

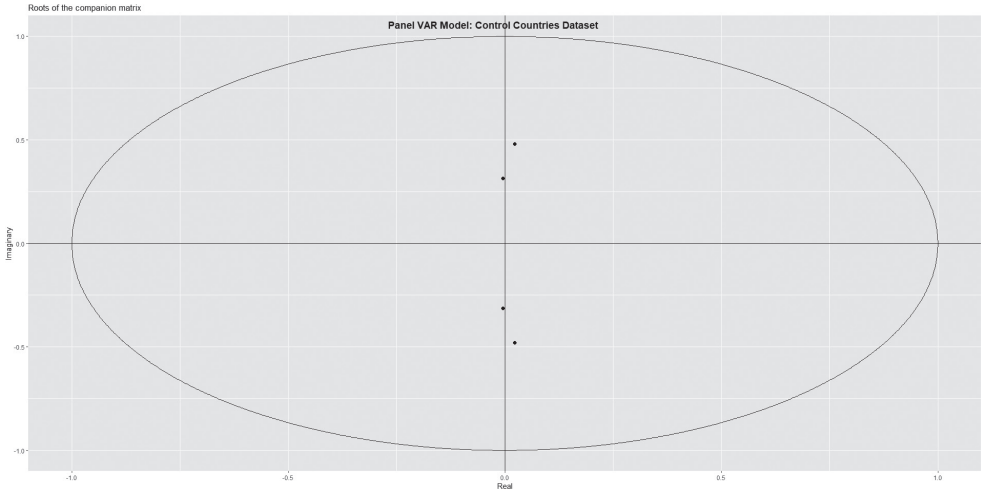

Figure A7: Roots of Companion Matrix – Panel VAR Model (Tourism Group)