

Faculty of Economics and Business

Current Account Imbalances and Indebtedness in Asia Countries

Soo Xin Lin

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Current Account Imbalances and Indebtedness in Asia Countries

Soo Xin Lin

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature	
Name	Soo Xin Lin
Matric No.	20010019
Faculty	Faculty of Economics and Business
Institution	Universiti Malaysia Sarawak
Date	19 October 2023

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ABSTRACT

The primary focus of international economics is external imbalances which act as a powerful impetus for historical changes in the economy. This study's objectives are to analyse the determinants of current account imbalance as well as to examine the relationship between current account balance and indebtedness. This study is on 48 Asia countries and spans a sampling period from 1990 to 2020. The fiscal balance, public debt, household debt, age dependency ratios for old and young, information and communications technology (ICT), real GDP, and real effective exchange rate are independent variables while the current account balance is a dependent variable. The primary methodologies are dynamic GMM panel estimation and panel threshold splitting model estimation. The empirical result indicates that the determinants of current account imbalance are the fiscal balance, public debt, age dependency ratio for old, and real GDP. However, the age dependency ratio for young, ICT, and real effective exchange rate are insignificant to the current account balance. Besides, debt levels have a positive and strong association with both the fiscal balance and current account balance. Next, the current account balance and the fiscal balance have a positive and significant association under both regimes when the threshold level of public debt-to-GDP is at 62.72%. Besides, the threshold level of household debt-to-GDP is achieved at 52.22%. Yet, both balances perform a negative relationship which is a twin divergence situation below the household debt threshold level and demonstrates positive significant nexus above the household debt threshold level. In the policy recommendation, fiscal consolidation is proposed for the Asia

countries. The application of fiscal rule can help to slow down deficit phenomenon and act as a stabilization mechanism in moderating the current account position of Asia countries. Moreover, the managing of the optimal debt threshold position of a country by policymakers is also crucial to overcome the economic uncertainties for sustaining economic growth in the Asia region.

Keywords: Current account imbalance, fiscal balance, public debt, household debt, threshold debt level

Ketidakseimbangan Akaun Semasa dan Keberhutangan di Negara-negara Asia

ABSTRAK

Tumpuan utama ekonomi antarabangsa ialah ketidakseimbangan luaran yang bertindak sebagai pendorong kuat untuk perubahan sejarah dalam ekonomi. Objektif kajian ini adalah untuk menganalisis faktor penentu ketidakseimbangan akaun semasa serta mengkaji hubungan antara baki akaun semasa dan keberhutangan. Kajian ini adalah ke atas 48 negara Asia dan merangkumi tempoh persampelan dari tahun 1990 hingga 2020. Imbangan fiskal, hutang awam, hutang isi rumah, nisbah kebergantungan umur untuk golongan tua dan muda, teknologi maklumat dan komunikasi, Keluaran Dalam Negara Kasar (KDNK) sebenar, dan kadar pertukaran berkesan sebenar adalah pembolehubah bebas manakala imbangan akaun semasa adalah pembolehubah bersedia. Metodologi utama ialah anggaran panel GMM dinamik dan model penganggaran pemisahan ambang panel. Keputusan empirikal menunjukkan bahawa penentu yang ketidakseimbangan akaun semasa ialah imbangan fiskal, hutang awam, nisbah kebergantungan umur untuk golongan tua, dan KDNK sebenar. Walau bagaimanapun, nisbah kebergantungan umur untuk golongan muda, teknologi maklumat dan komunukasi, dan kadar pertukaran berkesan sebenar adalah tidak penting kepada imbangan akaun semasa. Selain itu, paras hutang mempunyai perkaitan yang positif dan kukuh dengan kedua-dua imbangan fiskal dan imbangan akaun semasa. Seterusnya, imbangan akaun semasa dan imbangan fiskal mempunyai perkaitan yang positif dan signifikan di bawah kedua-dua rejim apabila tahap ambang hutang awam kepada KDNK adalah pada 62.72%. Di samping itu, paras ambang

hutang isi rumah kepada KDNK dicapai pada 52.22%. Namun, kedua-dua imbangan melakukan hubungan negatif yang merupakan situasi perbezaan berkembar di bawah paras ambang hutang isi rumah dan menunjukkan perhubungan signifikan yang positif melebihi paras ambang isi rumah. Dalam pengesyoran dasar, penyatuan fiskal dicadangkan kepada negara-negara Asia. Penggunaan peraturan fiskal boleh membantu memperlahankan fenomena defisit dan bertindak sebagai mekanisme penstabilan dalam menyederhanakan kedudukan akaun semasa negara-negara Asia. Selanjutnya, pengurusan kedudukan ambang hutang optimum sesebuah negara oleh penggubal dasar juga penting untuk mengatasi ketidaktentuan ekonomi unntuk mengekalkan pertumbuhan ekonomi di rantau Asia.

Kata kunci: *Ketidakseimbangan akaun semasa, imbangan fiskal, hutang awam, hutang isi rumah, tahap hutang ambang*

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ADRO	Age dependency ratio for old
ADRY	Age dependency ratio for young
APEC	Asia-Pacific Economic Cooperation
AR	Autoregressive
ARDL	Autoregressive distributed lag
ASEAN	Association of Southeast Asian Nations
BOP	Balance of payments
BRICS	Brazil, Russia, India, China, and South Africa
CAB	Current account balance
CEE	Central and Eastern Europe
CEEC	Central and Eastern Europe Countries
CEIC	Canada Employment Insurance Commission
CIS	The Commonwealth of Independent States
COVID-19	Coronavirus disease 2019
CPI	Consumer price index

DOLS	Dynamic ordinary least squares
DSGE	Dynamic stochastic general equilibrium
DTC	Debt trap country
ECM	Error correction model
EU	European Union
FB	Fiscal balance
FDI	Foreign direct investment
FGLS	Feasible generalized least squares
FMOLS	Fully modified ordinary least squares
GDP	Gross domestic product
GMM	Generalized method of moments
HD	Household debt
ICT	Information and communications technology
IDI	ICT development index
IMF	International Monetary Fund
IV	Instrument variable
IVQR	Instrumental variable quantile regression
JJ	Johansen and Juselius

LLC	Levin, Lin, and Chu
M	Import
MENA	Middle East and North Africa
MG	Mean group
NDTC	Non-debt trap country
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary least squares
OLS-PCSE	Ordinary least squares - panel corrected standard error
PCA	Principle component analysis
PD	Public debt
PLS	Partial least squares
PMG	Pooled mean group
QR	Quantile regression
QRPD	Quantile regression estimator for panel data
REER	Real effective exchange rate
RGDP	Real gross domestic product
RIR	Real interest rate
SEE	South-East European

SUR	Seemingly unrelated regression
SVAR	Structural Vector Autoregressions
U.A.E.	United Arab Emirates
U.K.	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
U.S.	United States
USD	U.S. Dollar
VAR	Vector autoregression
VECM	Vector error correction model
WDI	World Development Indicators
WEO	World Economic Outlook
X	Export
2SLS	Two-stage least squares

CHAPTER 1

INTRODUCTION

1.1 Introduction

In this era of globalisation, the fusion of financial and commercial activities will provide advantages like effective resource allocation for saving and investing. In the meantime, this integration will result in global current account imbalances (Altuzarra et al., 2010). Global imbalances are circumstances where certain countries have more assets than others. Practically, huge deficits and surpluses in the global economy's current account positions are also referred to as global imbalances (Sadiku et al., 2015). In theory, when the current account reaches equilibrium, its value is zero, and the inflow and outflow of capital cancel each other out, there is an external balance. In contrast, an imbalanced current account has deficits that have persisted for a predetermined amount of time.

The primary focus of international economics is external imbalances, which act as a powerful impetus for historical changes in the economy (Bracke et al., 2010). During the time of interwar, the growing imbalances led to the collapse of international trading and the currency arrangement, which later led to the Second World War. In the 1970s, the Bretton Woods system folded up because there was pressure across the external imbalances that resulted in a prime overhaul of the international monetary system. In 1980s,

the expansion of current account status led to in-depth international coordination with specific policy commitments. Due to a succession of financial crises that affected nearly all the major emerging economies in the 1990s, the external imbalance in these economies has grown to be a major source of worry.

Afonso and Opoku (2018) indicated that one of the main markers of external imbalances in the world economy is the current account. Today, the problems of global imbalances are rising, and the world is again exposed to large external imbalances. Das (2016) mentioned that global current account balances as a percentage of output are now twice as large as they were in the middle of the 1980s. Intentionally, the rest of the world has paid close attention to how the global current account imbalances are configured. The U.S. and other major advanced economies continue to run current account deficits, which they oppose some emerging market nations that have large surpluses. The U.S. trade balance is increasing deficits, which to raise the financing by borrowing from the central bank of emerging market economies that have continued to grow in trade surpluses (Vermeiren, 2017).

Moreover, Gruber and Kamin (2007) mentioned that the U.S. shows the most protruding situation on current account deficits. In 2007, the current account deficits of the U.S. have expanded to 6% of GDP from 2.4% of GDP in 1998 (Das, 2016). Other than the U.S., many other advanced economies also have long-term deficits, while there is a contrary takes place in the Asia region and emerging economies. There is consensus stating

that “in practice, private capital often flows from developing to advanced economies, such as the U.S. will run current account deficits, whereas developing countries and emerging market economies often run surpluses or near surpluses. However, very poor countries typically run large current account deficits, in proportion to their GDP, that are financed by official grants and loans” (Ghosh & Ramakrishnan, 2012, p.1).

An economy that has a current account surplus exports more products and services than it imports. Generally, a current account surplus is expected to have a great effect on a country, which includes job creation. A current account surplus [export (X) – import (M)], which is a sign of increased domestic demand, may theoretically be expected to increase employment. In conjunction, employment in the export sector rises when exports are high. Besides, a decrease in import spending could indicate that consumers are spending more on domestic items than foreign goods. This also can enhance domestic employment when there is more demand for domestic items.

Oppositely, Ghosh and Ramakrishnan (2012) pointed out that when a country has a current account deficit, it means that it imports more goods and services than it exports. The deficit can also be implied that a country is spending beyond its means. Additionally, various factors cause a current account deficit, which includes the overvalued exchange rate or currency. A currency that is overvalued makes imports less expensive and exports less competitive, which raises the current account deficit or narrows down the current account surplus. In consequences, there would be more imports due to more affordable and

hence, less in export volume. In such a situation, a country may utilise the external debts to finance the investments that will bring greater returns. When debt accumulation increases, it will affect the fiscal account and hence, have a huge influence on the current account. In contrarily, an undervalued currency has a negative impact.

Likewise, a nation incurs liabilities to the rest of the world when its current account is in deficit, and these liabilities are paid for by financial account flows. This is because solvency necessitates that the nation be ready and able to produce (eventually) enough current account surpluses to pay back the debt it has incurred to support the current account deficits. Because of this, whether a country should run a current account deficit (borrow more) depends on the size of its foreign liabilities (external debt) and whether the borrowing will finance investments with a higher marginal product than the interest rate (or rate of return) the country must pay on its foreign liabilities.

Furthermore, debt is inevitable and broadly used to narrow the negative impacts of economic shocks. To mitigate the negative impact of the buffer shock, a country may accept deficits, which will lead to debt accumulation during economic shocks. By comparing the debt level of the current year with that of previous years, debt can also better reflect the actual deficit. According to Forte and Magazzino (2013), they argued that government debt contrasts with the yearly budget deficit, which is defined as the difference between government income and expenditure over the course of a year. Soo and Kueh (2019) indicated that the annual increase in the public debt will devote the budget deficit to

rise. Every year, the fiscal deficit widens, which also raises the cost of borrowing of money and debt interest. The total amount of prior debt, debt interest, and current growth in new debt will increase the debt to a higher level with annual growth. As a result, large amounts of debt will influence fiscal deficits and cause the current account to deficit.

This study is conducted to investigate the determinants of current account imbalance and to examine the relationship between current account balance and indebtedness across 48 Asia countries from 1990 to 2020. Moreover, there is term “twin imbalances” has been frequently adopted in this study, which implicates the imbalances of current account balance and fiscal balance. The example situations of “twin imbalances” are current account surplus with fiscal deficit and current account deficit with fiscal surplus.

1.2 Background of the Study

The current account, capital account, and finance account are the specific components of the balance of payments, which is a statistical report that details a country's economic interactions with the rest of the world. Every country's economic health may be primarily determined by looking at its current account. The sum of the trade balances, net current transfers, and net foreign income is what is referred to as it (Soo & Kueh, 2019). A country's current account is balanced when its citizens have enough money to pay for all domestic purchases. The residents include the people, the businesses, and the governments;

funds are made up of earnings and savings; while purchases include all consumer spending as well as business growth and government infrastructure (Sharma, 2020).

Likewise, positive and negative current account balances are distinct categories. The instance shows the current account balance is positive when the nation is the world's net creditor. On the other hand, a negative current account balance implies net global borrowers. Besides, by quoting the country's total foreign net assets, there will also be current account surpluses and deficits. In another point of view, the target of most countries is to accumulate funds by exporting more goods and services than importing. This is the trade surplus. This means that a country's income will exceed its expenditure. Whereas, when a country's government, companies, and individuals export fewer goods and services than they import, a deficit will occur (Makrevska-Disovska & Trpkova-Nestorovska, 2016). Since they absorbed less capital from foreigners than they issued.

Globally, there is the existence of current account imbalances continuously for the past 20 years (Yang, 2011). Das (2016) mentioned that the global current account imbalances against some emerging market countries with large surpluses are increasing as major developed economies such as the U.S. and others still run a persistent current account deficit. In particular, the U.S. current account deficit widened to 6% in 2007 from 2.4% in 1998. Besides, Goodhart et al. (2019) also stated that the imbalances in the global current account have been largely concentrated on a small number of regions and countries, which until recently had shown an unusually high degree of persistence.

UNCTAD (2022) mentioned that the income of an economy is typically significantly different from the revenue paid in interactions with other economies. Most of the economies in the U.S., Africa, Eastern Europe, and Central Asia experienced current account deficits in 2019 because of payments being greater than received. High current account surpluses, however, are more common in countries that export oil. Additionally, the current accounts are generally more balanced in Central and Western Europe, South and East Asia, and Oceania. The emerging economies' current account surplus in 2019 increased by more than double its level from USD 118 billion in 2008 to USD 283 billion, although their trade surplus in goods and services only increased slightly. Yet, the current account surplus of advanced economies hit USD 114 billion in 2019, a decrease of nearly 20% from 2018.

There are five major geographical regions in the world, which are made up of Africa, the Americas, Asia, Europe, and Oceania. Figure 1.1 displays the world's current account balance by region from 1990 to 2021. By referring to Figure 1.1, Asia is the region that always shows a current account surplus among the others. In recent decades, Asia has achieved remarkable economic progress in the world, where the economies of Bangladesh, Cambodia, India, and Vietnam are expanding at the quickest rates in the globe. The economies of most Asia countries are characterized as developing too. The developing economies process has driven the Asia region to gain a current account surplus. Based on Figure 1.1, the current account surplus of Asia started to experience an acceleration after the Asian financial crisis and reached its peak situation in 2007.

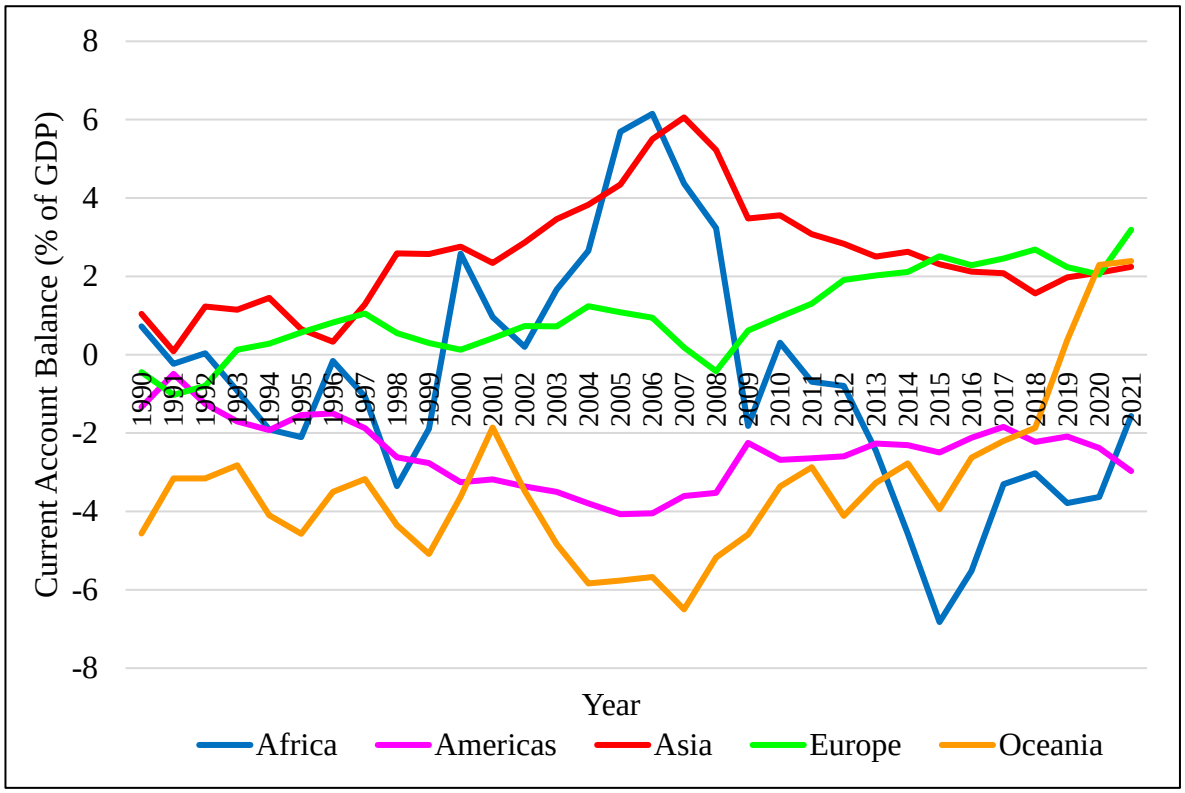


Figure 1.1: World Current Account Balance by Regions from 1990 to 2021
Source: UNCTAD (2022)

Furthermore, Table 1.1 to Table 1.3 are tabulated to provide a brief review of the world's current account. Table 1.1 shows the current account balance (CAB) by group of economies in the world. As shown in Table 1.1, the developing and developed economies demonstrate current account surplus no matter what is measured in the average from 2017 to 2021 or the years 2020 and 2021. Moreover, the ratio to GDP for the three economic groups also illustrates a current account surplus. Yet, developing economies are classified into three main groups, which are Africa, the Americas, and Asia and Oceania. The tabulated data in Table 1.1 exhibits that developing economies in Asia and Oceania are having current account surpluses from 2017 to 2021. The phenomena of current account surpluses occurred in developing economies of Asia and Oceania correspond to the

justification by Gruber and Kamin (2007). They argued that the developing countries in Asia started to move into aggregate current account surplus in 2000.

Table 1.1: World Current Account Balance (CAB) by Group of Economies

Group of economies	**Value (USD billions)**			**Ratio to GDP (%)**		
	2017-2021*	**2020**	**2021**	**2017-2021***	**2020**	**2021**
World	481	428	710	0.5	0.5	0.7
Developing economies	239	364	480	0.7	1.1	1.3
Developing economies: Africa	-72	-88	-41	-2.9	-3.6	-1.6
Developing economies: Americas	-82	-1	-77	-1.5	-0.0	-1.5
Developing economies: Asia and Oceania	393	452	598	1.5	1.7	2.0
Developed economies	243	64	230	0.5	0.1	0.4

*Annual average.
Notes: The total number of countries is 193. Current account deficits and surpluses do not add up to zero across groups of economies, due to imperfect geographic coverage and cross-country differences in compilation methods.
Source: Handbook of Statistics, UNCTAD (2022)

Additionally, the statistical work of UNCTAD (2022) has complied, validated, and extracted a wide range of data gathered from a total of 193 countries in the world. Table 1.2 presents the current account balance in the largest surplus economies among the 193 countries from 2017 to 2021. According to Table 1.2, in 2021, the top 5 current account

surplus economies in the world are China, Germany, Japan, Russian, and Taiwan. China ranked first for current account surplus with the highest value of economy at USD 249 billion and USD 317 billion in 2020 and 2021. Germany ranked 2nd in both 2020 and 2021 for current account surplus, which is USD 274 billion and USD 314 billion.

Table 1.2: Current Account Balance (CAB) with Largest Surplus in World Economies

Economy	**2017-2021***		**2020**		**2021**	
(Ranked by 2021 value)	**Value (USD Billions)**	**Ratio to GDP (%)**	**Value (USD Billions)**	**Ratio to GDP (%)**	**Value (USD Billions)**	**Ratio to GDP (%)**
China	176	1.2	249	1.7	317	1.8
Germany	298	7.6	274	7.1	314	7.4
Japan	169	3.4	147	2.9	142	2.9
Russian	74	4.4	36	2.4	122	6.9
Taiwan	86	13.0	95	14.2	115	14.6

*Annual average.
Note: The total number of countries is 193.
Source: Handbook of Statistics, UNCTAD (2022)

Oppositely, in 2021, the economy that ranked at the top of the current account deficit is the U.S. (refer to Table 1.3). From the data tabulated in Table 1.3, it is apparent that the U.S. is constantly scaled as the country with the highest current account deficits in the world. Table 1.3 demonstrates that from 2017 to 2021, the average current account deficit value for the U.S. is USD 542 billion or 2.5% of GDP. Besides, in the 2021, the U.S.

also undergoes current account deficits of USD 822 billion. Whereas there is a huge expansion in the current account deficit to a value of USD 616 billion in 2020. Moreover, the U.K. also experienced a huge current account deficit every year that was second to the U.S.

Table 1.3: Current Account Balance (CAB) with Largest Deficit in World Economies

Economy	**2017-2021***		**2020**		**2021**	
(Ranked by 2021 value)	Value (USD Billions)	Ratio to GDP (%)	Value (USD Billions)	Ratio to GDP (%)	Value (USD Billions)	Ratio to GDP (%)
Chile	-9	-3.0	3	1.3	-20	-6.4
Brazil	-38	-2.1	-24	-1.7	-28	-1.7
India	-27	-0.9	33	1.2	-35	-1.1
U.K.	-88	-3.1	-70	-2.5	-83	-2.6
U.S.	-542	-2.5	-616	-2.9	-822	-3.6

*Annual average.
Note: The total number of countries is 193.
Source: Handbook of Statistics, UNCTAD (2022)

Moreover, the current accounts of top exporters of commodities and services from Asia and Oceania in 2021 are illustrated in Table 1.4. According to UNCTAD (2022), the trade balance of developing economies in Asia and Oceania stands at USD 0.77 billion, China has surpassed the other 50 emerging economies in Asia and Oceania to become the region's largest exporter and importer. China’s exports are captured a 12.90% of total share

exports in world and 11.50% of total share imports. Furthermore, ranking the developing economies in Asia and Oceania by their export share, Hong Kong and Singapore come in 2nd and 3rd place, with an export share of roughly 2.7%. Then, is followed by India and Taiwan, respectively, with an export share of 2.30% and 1.80%.

Table 1.4: Current Accounts of Leading Exporters (Goods and Services) by Developing Economies in Asia and Oceania in 2021

Economy (Ranked by export share)	**Current account balance**		**Trade balance**	**Exports**	**Imports**
	Value (USD billions)	Ratio to GDP (%)	Value (USD billions)	Share in world (%)	Share in world (%)
China	317	1.80	514	12.90	11.50
Hong Kong	42	11.30	18	2.70	2.70
Singapore	72	18.70	125	2.60	2.30
India	-35	-1.10	-133	2.30	2.90
Taiwan	115	14.60	103	1.80	1.50
Developing Asia and Oceania	598	2.00	834	33.30	31.40

Note: The total number of countries are 50.
Source: Handbook of Statistics, UNCTAD (2022)

The current account imbalances in a nation can be impacted by several elements, including competitiveness, the inflation rate, trade policies, foreign exchange reserves, and

exchange rates. In addition, countries with trade surpluses have insufficient domestic demand, and deficits have reduced the country's competitiveness, whereby this requires the international community to coordinate an environment that promotes growth to achieve rebalancing also one of the influences on current account imbalances (Chinn et al., 2012). Current account imbalances are largely affected by a country's trade balance performance. For example, imports increase quickly while the economy is expanding strongly, but if exports are unable to rise at the same rate, current account imbalances will develop. In contrast, if imports decrease and exports expand to a stronger economy, the current account deficit will be lower. There will be two different phenomena.

Furthermore, the possibility of capital flight is one result of the current account imbalance (Hervey & Merkel, 2000). A high current account deficit will result in foreign investors losing confidence and withdrawing their investments, which may subsequently lead to a depreciation of the local currency. This may also lead to a lower standard of living and lower investment confidence. In addition, current account imbalances indicate a country's economic imbalances. This happens when the current account deficit is constant, which indicates that the country is dependent on consumer spending. Therefore, short-term consumption and long-term investment will encounter economic imbalances between different sectors. Additionally, the large current account deficit will also bring the risk of currency depreciation to take place, if there are not enough capital inflows to fund the shortfall. A drop in the exchange rate indicates an imbalance in foreign capital flows that will also expose consumers and companies that rely on imports to confront imported inflation. If the current account deficit leads to a severe currency collapse, then the

consequences will be the same for everyone, which will result in a lower standard of living for the residents of the country.

For many years, to retain macroeconomic stability and sustain economic growth, current account imbalances must be controlled. Therefore, current account imbalances need to be fully explored. The current account deficit will be impacted by the fiscal deficit's unsustainable growth. Following Anjum (2021) stated that fiscal imbalance is the difference between the overall government income (total taxes and non-debt capital receipts) and its entire expenses (material consumption of the public sector, the wages of government employees, the devaluation of the fixed state capital, and various transfers to the population.). The discrepancy between the two is either a positive or negative fiscal imbalance, which is also called budget surplus or deficit, respectively. When the fiscal imbalance is positive, it means that government revenue exceeds the cost of benefiting the economy, or vice versa. Ahmad (2021) stated that the increase in expenditure means that the government obtains loans from home and abroad. In this case, the fiscal deficit indicates that the government does not have enough revenue to advance its debts. Severe negative financial imbalances lead to an unpleasant situation in which the government provides more expenditures than the income obtained through loans (Ahmad, 2021).

Furthermore, Table 1.5 shows the fiscal deficit in 2022 based on 168 countries in the world. Ukraine is the country that experiences the highest fiscal deficit at 16.30% of GDP. Among the top 10 economies, there are 2 Asia’s countries is with the world’s highest

fiscal deficit, which are Maldives and Sri Lanka. Furthermore, in the Asia region, the country that gained the largest government budget deficit in 2022 is Maldives, valued at 14.30% of GDP (refer to Table 1.6). The sequence of the largest government budget deficit is followed by Sri Lanka (10.2% of GDP), Pakistan (7.90% of GDP), Bhutan (7.80% of GDP), and China (7.40% of GDP).

The Maldives' tourist industry has contributed significantly to the country's development and has since taken over as the main source of income (Gentile, 2023). Yet, the status of agriculture and manufacturing in the economy continues to decline, constrained by the limited supply of arable land and the shortage of household labour. Hence, tourism-related taxes and import duties have turned into the government's major tax revenue at over 90% of income. This results in Maldives' economies undergoing the situation of the total value on import of country experiencing the total export value. Thus, the circumstances of the current account deficit occurred.

Table 1.5: Top 10 World Countries with Highest Fiscal Deficit in 2022

Rank	Economy	Fiscal Deficit (% of GDP)
1	Ukraine	16.30
2	Maldives	14.30
3	Bahamas	13.60
4	Fiji	12.20
5	Ghana	11.80
6	Guyana	11.80
7	Cuba	11.70
8	Sri Lanka	10.20
9	Tunisia	10.00
10	Zambia	9.80

Note: The total number of countries is 168.
Source: Trading Economics (2023)

Table 1.6: Asia Countries with Largest Government Budget Deficit in 2022

Rank	Country	Government Budget Deficit (% of GDP)
1	Maldives	14.30
2	Sri Lanka	10.20
3	Pakistan	7.90
4	Bhutan	7.80
5	China	7.40

Note: The total number of Asia countries is 44.
Source: Trading Economics (2023)

In keeping with Saidam and Sarmidi (2017), they argued that there have been numerous developed and developing nations around the world experiencing simultaneous budget deficits and current account deficits for more than three decades. Besides, Baharumshah et al. (2009) also denoted that many developing countries ran into huge budget deficits in the late 1970s due to funding growth in government spending. This indicates that the government's current account balance and fiscal balance demonstrate a vigorous and strong linkage between each other (Trachanas & Katrakilidis, 2013). The relationship between twin imbalances is crucial. When a country with a severe fiscal deficit, the government has greater demand for borrowing from the credit market and even from foreign sources. Due to this, there is now a higher demand for local currencies on international markets.

Intentionally, exports will become costly because of the internal currency's appreciation, while imports will be inexpensive. Imports began to exceed total exports, causing the country’s huge trade deficit. Therefore, high fiscal deficits will lead to high trade deficits, which together become a double deficit phenomenon. On the other hand, the government borrowing from foreign banks or investors will result in the buildup of substantial public debt. The increase in public debt has also increased the probability of default, and the risk premium required by international creditors has exacerbated interest rate pressure (Makin, 2005). The real domestic exchange rate is boosted by capital inflows when interest rates rise, but the appreciation may reduce the company's competitiveness and widen the current account deficit (Kuncahyo, 2016).

Park and Shin (2009) revealed that the large current account surplus is a relatively new feature in Asia. The world's largest continent by both population and area is Asia. This Asia continent is almost north of the equator, except for some Southeast Asia islands. Asia can be divided into several regions, such as Central Asia, Eastern Asia, Southeast Asia, Southern Asia, and Western Asia. In fact, before the 1997 to 1998 Asian financial crisis, the region had a current account deficit. On the other hand, there is a brief overview of the current account balance and fiscal balance of 48 countries in the Asia region. When looking into 48 Asia countries individually, not all the countries are showing twin imbalances in an average of 31 years (1990-2020), yet some countries demonstrate twin surpluses or twin deficits. There are 12 countries that show twin surpluses (e.g., Hong Kong, Macau, Qatar, Singapore, U.A.E.). Besides, 20 countries denote the twin deficits (e.g., Cambodia, Indonesia, Lebanon, Pakistan, Vietnam) and 16 countries implies the twin imbalances (e.g., Bangladesh, China, Japan, Malaysia, Thailand). However, the whole Asia region indicates a phenomenon of current account surplus in an average of 31 years, which is tally with the argument by Park and Shin (2009).

Moreno (2007) mentioned that due to the substantial current account deficits that persisted throughout the 1990s, Southeast Asia has developed quickly. However, this situation persisted from 1990 until about 1996, when the Asian crisis erupted in between 1997 and 1998. As an example, the current account deficit in Malaysia was highest in 1995, reaching about 10% of GDP, whereas Thailand reached a peak of 8% of GDP in 1996, compared with Mexico which had 7% of GDP during the peso crisis that happened in 1994. The following is the Figure 1.2 expresses the current account balance of Asia by the region

(Central Asia, Eastern Asia, Southern Asia, Western Asia, & and South-eastern Asia). Almost all the nations in the region have current account surpluses due to the Asian financial crisis that happened in 1998. Among the five regions, Eastern Asia (China, Hong Kong, Macao, Taiwan, Japan, Korea, & and Mongolia) is the region that always keeps on track to perform current account surplus.

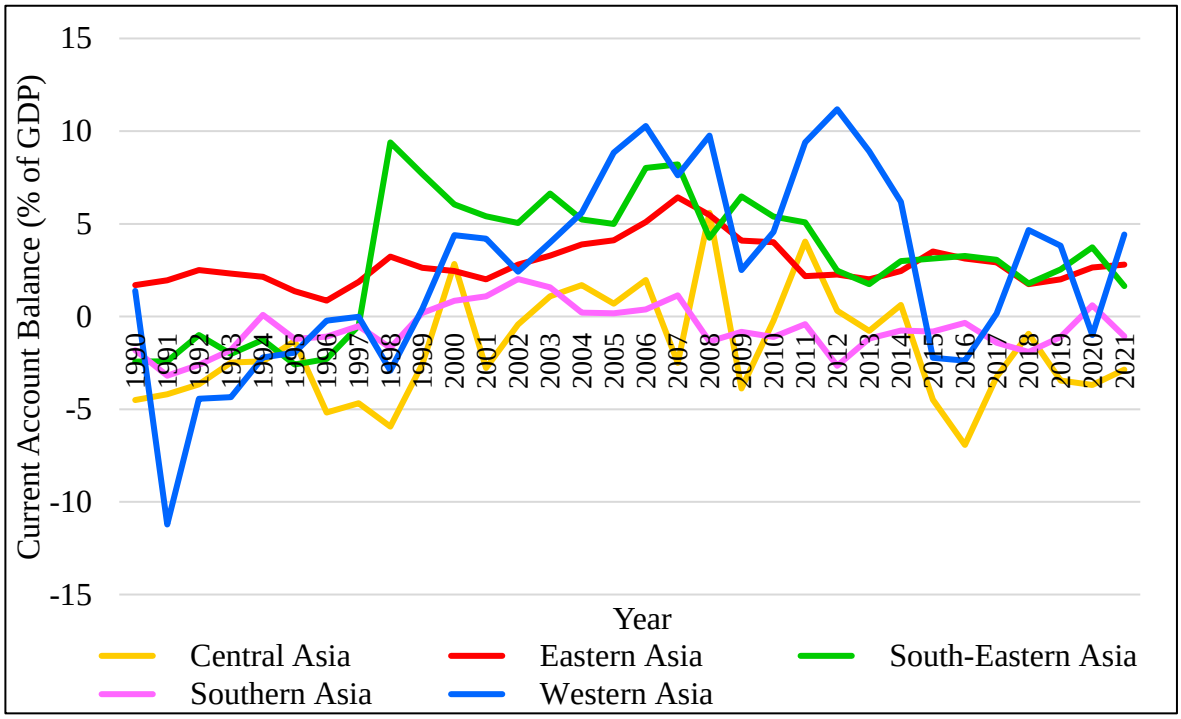


Figure 1.2: Asia Current Account Balance by Regions from 1990 to 2021
Source: UNCTAD (2022)

In Asia, compared with other countries in the world, these countries have historically enjoyed high savings rates. Although the current account balances between countries or regions with large surpluses or deficits are below the optimal level, this imbalanced pattern has not changed substantially during the time earlier on the Asian financial crisis. In the study by Gruber and Kamin (2007), they illustrated the emergence of

current account surpluses in developing Asia. Credit availability and demand are still being constrained by the financial crisis, which is also reducing domestic demand and raising external revenue and expenditure (Gruber & Kamin, 2007). The financial crisis that hit Asia's developing nations in the late 1990s played a critical role in boosting surpluses, either directly by limiting domestic spending, particularly investment, or indirectly by pressuring the government to take action to preserve exchange rate competitiveness.

Next, based on the tabulation in Table 1.7, Azerbaijan is the country with the highest current account surplus among the 46 Asia countries in 2022, with 30.50% of GDP. According to Valiyev (2023), the huge expansion in current account surplus is due to the earnings skyrocketing in higher hydrocarbon prices. The trade surplus of Azerbaijan has more than doubled from USD 11.2 billion a year earlier to an estimated USD 24.2 billion on higher oil and gas export earnings, increased transportation services, and higher income flow, with hydrocarbons accounting for 90% of exports. Furthermore, with the higher oil production and gas exports, the export total is expected to rise by 0.2% in 2023 and then narrow slightly by 2.9% in 2024 with a small decrease in oil production.

Table 1.7: Asia Countries with Highest Current Account Surplus in 2022

Rank	Country	CA Surplus (% of GDP)
1	Azerbaijan	30.50
2	Kuwait	28.50
3	Qatar	26.00
4	Singapore	19.30
5	Iraq	16.30

Note: The total number of Asia countries is 46.
Source: Trading Economics (2023)

On the other hand, Table 1.8 exhibits the country that experiences the highest current account deficit among 46 Asia countries in 2022 is Bhutan at 33.80% of GDP. The current account deficit of Bhutan is estimated to further widen in 2023 to an estimated 34.30%. The expansion in the current account deficit of Bhutan is due to the strong growth in imports by 35.2% from a year earlier. This is mainly due to the raising in fuel prices and steel and a dramatic increase in the imports of ICT equipment, while exports only increased by 2.4% (Lhendup, 2023). On the other hand, the current account deficit of Cambodia ranked 2nd among Asia countries in 2022 at 26.90% of GDP, which experienced a significant decline from 40.04% of GDP in 2021 (Doung & Nguyen, 2023). The higher current account deficit of Cambodia is caused by the gain in imported merchandise, such as fuel, construction materials and equipment, and consumer goods. Moreover, the recovery in tourism after the COVID-19 pandemic is expected to slow down the current account deficit in the future.

Table 1.8: Asia Countries with Highest Current Account Deficit in 2022

Rank	Country	CAD (% of GDP)
1	Bhutan	33.80
2	Cambodia	26.90
3	Kyrgyzstan	26.80
4	Afghanistan	17.30
5	Maldives	16.60

Note: The total number of Asia countries is 46.
Source: Trading Economics (2023)

Apart from that, indebtedness is a huge issue that is faced by all economies in the world. Soo and Kueh (2019) denote that the total sum that one party borrows from another is referred to as debt. There are many types of debt. Public debt, also known as government debt, contrasts with the annual of government fiscal deficit. A government debt quantity is representing how much the federal government is owed. According to Cecchetti et al. (2011a), high and increasing debt levels have become a concern, and public debt has become the core of the turmoil that began a few years ago. A budget deficit exists for a fiscal year when the government's spending is higher than its revenue.

To cover the funding shortfall, debt must be used to fill the gap. Because of this, there is a yearly deficit that will continue until the government's finances collapse due to the mounting debt. If a country’s consumption exceeds its income and it is unable to make productive investments, this will increase the fiscal deficit and may lead to high debt levels. As a result of the central governments borrowing more capitals at higher interest rates from

creditors, the debt-to-GDP ratio likewise keeps climbing (Soo & Kueh, 2019). Likewise, public debt data shows how much a government owes its creditors and provides insight into the future prosperity of a nation. If a country's national debt to GDP ratio keeps increasing, it indicates that its spending surpasses its income and productivity.

In the first quarter of 2020, global debt soared to a record high of USD 258 trillion, as the global economy was shut down worldwide to control the coronavirus epidemic and debt levels kept rising. Although the growth of debt levels is much lower than the average quarterly growth from 2015 to 2019, the global debt accumulation of governments, companies, financial institutions, and households has accelerated. Table 1.9, hence, shows the top 10 world most government indebtedness economy in 2022. According to the IMF, Japan has a debt-to-GDP ratio of 264, making it the most indebted nation in the world. Guillemette and Str*ásk*ý (2015) mentioned that the increase in Japan's debt during the past two decades is the result of a combination of large primary deficits and high real interest rates relative to real GDP growth, where Japan has maintained a significant deficit for 20 years.

Table 1.9: Top 10 World Most Government Indebtedness Economy in 2022

Rank	Economy	Debt-to-GDP ratio (%)
1	Japan	264
2	Venezuela	241
3	Sudan	182
4	Greece	171
5	Singapore	168
6	Eritrea	164
7	Lebanon	151
8	Italy	145
9	U.S.	129
10	Cape Verde	127

Note: The total number of countries is 171.
Source: Trading Economics (2023)

On the opposite, among the top 10 world least government indebtedness economies in 2022 (refer to Table 1.10), there are occupied by 5 Asia countries, which are Brunei, Kuwait, Afghanistan, Turkmenistan, and Azerbaijan. Brunei has the world's least government indebtedness with a 1.90% debt-to-GDP ratio. The net exports of Brunei in 2022 have become the most significant contributor to the trade growth which maintains the trade balance in surplus (Magtibay-Ramos & Ramayandi, 2023). Likewise, an expected rise in crude oil and natural gas production has supported the export growth and the consumption growth has also been sustained by the further recovery in tourism. The oil and gas industry of Brunei remains the most critical in the economy where exports highly exceed its imports. Hence, this can help to reduce Brunei’s government debt accumulation.

Table 1.10: Top 10 World Least Government Indebtedness Economy in 2022

Rank	Economy	Debt-to-GDP ratio (%)
1	Brunei	1.90
2	Cayman Islands	4.50
3	Kuwait	7.10
4	Afghanistan	7.40
5	Turkmenistan	8.00
6	Azerbaijan	11.70
7	Burundi	14.50
8	Congo	14.60
9	Russia	17.20
10	Estonia	18.40

Note: The total number of countries is 171.
Source: Trading Economics (2023)

Table 1.11 represents the largest holding of U.S. government debt as of January 2023. According to Table 1.11, Japan holds the most value of U.S. debt in the world at USD 1.1 trillion, then followed by China at USD 855 billion. Over the past 20 years, Japan and China have owned more US Treasurys than any other foreign nation. There is no other country except Japan and China alone dominates more than one-third of the foreign market of U.S. debt. Likewise, in mid-2019, China was the largest foreign holder of U.S. debt but overstepped by Japan in 2020. Between 2000 and 2022, Japan grew from owning USD 534 billion to over USD 1 trillion, while China's ownership grew from USD 101 billion to USD 855 billion. Besides, Wu et al. (2021) mentioned that there are many other interesting

nuggets about U.S. Treasury bondholders. Several EU countries possess a lot of debt. Perhaps this is because American investors hold assets overseas but are still looking for guarantees on government bonds (Wu et al., 2021).

Table 1.11: Top 5 Largest Holding Nations of U.S. Government Debt as of January 2023

Rank	Economy	Debt owned (USD billion)
1	Japan	1100
2	China	859
3	U.K.	668
4	Belgium	331
5	Luxembourg	318

Source: U.S Department of Treasury (2023)

Following Table 1.12, Japan is the country that gains the highest government debt among 48 Asia countries in 2022. Japan has a government debt at amount of 266.2% of GDP, while Singapore is the second highest government debt country with a 168% of GDP; Lebanon achieves 151% of GDP; Bhutan reaches 125% of GDP; and Bahrain is acquired 120% of GDP. The high indebtedness of Japan is mostly caused by the aging population (Popova, 2023). The population is stressing public finance, which requires further improvement in spending on healthcare, pensions, and social security. These rising expenditures have exacerbated the debt burden to a new high level. Moreover, the structure-related difficulties and the shortage of productivity developments have influenced

the Japanese economy. The nation has had a hard time adapting to the shifting of global scene, making it difficult to achieve sustainable growth and uphold fiscal stability.

In addition, Japan also experienced a prolonged period of deflation, which began in the 1990s and lasted for more than two decades. Likewise, Japan also has a history of using deficit spending as s tool for economic stimulus, which has contributed to its high level of public debt. This approach was used extensively in the 1990s and 200s to combat deflation and stimulate economic growth. On the other hand, Table 1.13 displays the Asia countries with the lowest government indebtedness in 2022. Again, Brunei is the country with the least accumulation of government debt at 1.90% of GDP. Lastly, Figure 1.3 displays the government debt to GDP of 48 Asia countries in 2022.

Table 1.12: Asia Countries with Highest Government Indebtedness in 2022

Rank	Country	Government Debt (% to GDP)
1	Japan	266.2
2	Singapore	168.0
3	Lebanon	151.0
4	Bhutan	125.0
5	Bahrain	120.0

Note: The total number of Asia countries is 48.
Source: Trading Economics (2023)

Table 1.13: Asia Countries with Lowest Government Indebtedness in 2022

Rank	Country	Government Debt (% to GDP)
1	Brunei	1.90
2	Kuwait	7.10
3	Afghanistan	7.40
4	Turkmenistan	8.00
5	Azerbaijan	11.70

Note: The total number of Asia countries is 48.
Source: Trading Economics (2023)

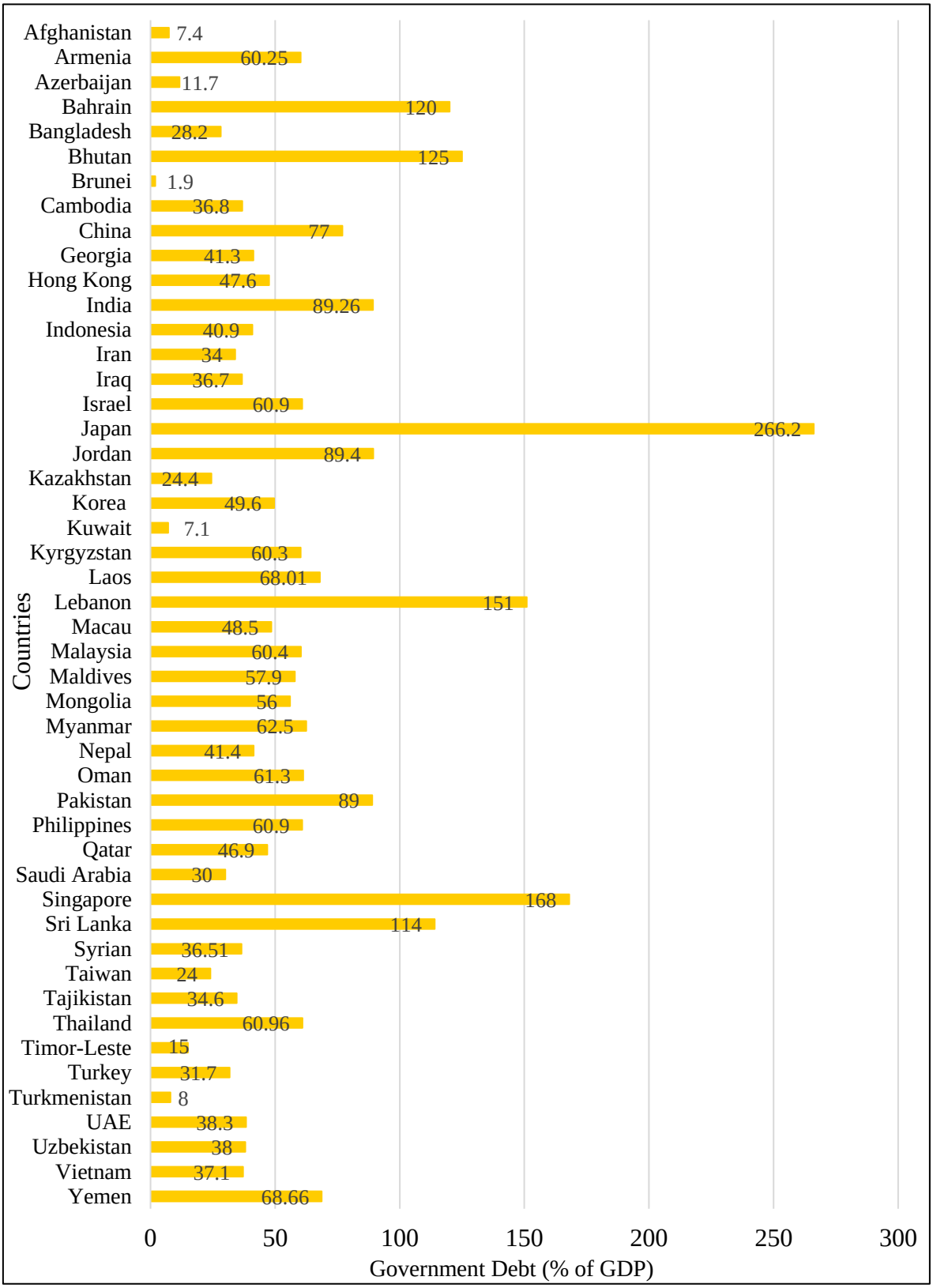


Figure 1.3: Government Debt of 48 Asia Countries in 2022
Source: Trading Economics (2023)

1.3 Problem Statement

Nowadays, as a percentage of global output, the total current account balances are double what they were in the middle of the 1980s (Das, 2016). Makrevska-Disovska and Trpkova-Nestorovska (2016) also stated that in recent years, there has been a growth in global external imbalances, and the current account deficit has significantly decreased since the start of the economic crisis. Moreover, Yang (2011) also denoted that since the global current account imbalance has continued for the past 20 years, economists and decision-makers have focused more on the issue. A large current account deficit usually means that some difference in the economy needs to be corrected. Hence, there is an important measure of competitiveness and the volume of imports and exports, which is the current account deficit.

In the Asia region, developing nations experience current account deficits, which are beneficial in the short term but detrimental in the long run for the health of the economy. To boost domestic productivity and exports in the future, emerging countries may temporarily run current account deficits, although this is not optimal for the domestic economy in the long run. Park and Shin (2009) stated that current account surplus is a new feature in the Asia developing economies after the Asian financial crisis, where countries tend to expand their savings abroad, making those countries as one of the greatest lenders in the world. Furthermore, Das (2016) also implies that between 2000 and 2009, the average current account surplus of China and the other Asia Tigers (South Korea, Malaysia,

Singapore, Indonesia, and Thailand) was 6.4% of GDP, making them one of the top lenders in the world. These economies are increasingly transferring most of their savings abroad despite strong growth and abundant domestic investment prospects. Besides, those countries also have strong export-oriented economies that produce goods and services that are in high demand globally.

Furthermore, the decline in surpluses caused by the COVID-19 pandemic is currently a key issue regarding Asia's current account balance. Nevertheless, the pandemic has significantly affected international trade and demand resulting in a decrease of surpluses across the region. The epidemic has disrupted supply chains around the world, reduced demand for goods and services, as well as a decrease in activity worldwide. This resulted in an impact on trade flows, leading to a fall in Asia's current account surplus. Moreover, economic activity is affected and revenue from exports and tourism has declined because of actions aimed at containing the outbreak, e.g., lockdowns and social distancing measures.

Secondly, the medium or high debt ratios can contribute to twin imbalances. The relationship between the double deficits of industrialized nations like the U.S. and European countries has been the subject of numerous empirical research. However, most people have also forgotten to assess debt issues where modern macroeconomics has evolved over the last 50 years (Cecchetti et al., 2011a). Debt is described as a two-edged sword. By using smartly, it can serve to improve welfares. In contrast, overuse can result to

a serious negative impact. Furthermore, the total amount of accumulated debt implies the level of risk. Debt and fiscal deficit have a significant relationship, where the fiscal deficit is yielded by the government to finance debt expenses. During a serious fiscal deficit, the government will borrow from the credit market. This will lead to a high demand for local currency in foreign markets where exports will become more expensive than imports, reducing import volume than exports. The situation of a huge deficit brings twin imbalances.

Likewise, Cecchetti et al. (2011a) also mentioned that the ability of borrowers to repay their debts is more sensitive to drops in income and sales as well as increases in interest rates as debt levels rise. The magnitude of the economic shock increases with the debt level. Therefore, to analyse the relationship between current account balance and fiscal balance on the threshold level of different type of debts in the Asia region, public debt and household debt are used in the study. The issue of the COVID-19 pandemic brought about a substantial increase in spending on government by many countries throughout the region, resulting in higher public debt levels. Before the pandemic, many Asia countries were relatively low in public debt levels, but economic downturns and increased government spending have led to a sharp increase. The sustainability of government debt and the ability of countries to repay their debts over time have been raised in this context. On the other hand, as an example, the household debt of South Korea is facing the most serious problem, which expanded by more than 10% annually in 2015 and 2016, triggered by the 2014 mortgage loan criteria that are being loosened and the low-interest rates. The higher household debt will result in larger share of the economic outputs

coming from the consumption, later bringing in a country running current account deficits as imports rise. Thus, the empirical gap in the study between twin imbalances and indebtedness in the Asia region should be filled.

Thirdly, the endogenous threshold plays a direct and significant role in influencing the relationship between debt and current account balance. The perspective of the debt threshold level is used to quantify the current account characteristic. A study by Kueh et al. (2017), indicated that when the country's domestic debt threshold is below the level, the current account deficit and the budget deficit will both show double deficit behaviour. Therefore, assessing the evidence of double deficits in countries with debt levels above or below the threshold is the main rationale in the study for using the threshold model. In fact, understanding the threshold effect can provide decision-makers with key instructions or signals. Immediately, the debt threshold may eventually serve as a crucial gauge of a nation's debt burden. A country's debt level may eventually run into obstacles that prevent it from financing its debt if it reaches the threshold level. On the other hand, if a country's debt level is below the threshold level, it indicates that it may not have problems in managing its debt. The debt threshold level affects the long-term sustainability of the twin imbalances relationship, which will also affect the economic growth of the country. Finally, assessing the relationship between current account balance and fiscal balance on different type of debts in the threshold model plays an important part, because it can provide more reflective information.

Consequently, there are three related research questions in this study. The research questions are shown below.

1. What are the determinants of current account imbalance?

2. What impacts do different type of debts have on twin imbalances?

3. How does the threshold level of different type of debts affect the relationship between the current account balance and the fiscal balance?

1.4 Objectives of the Study

1.4.1 General Objective

The general objectives of this study are to investigate the determinants of current account imbalance and to examine the relationship between current account balance and indebtedness in 48 Asia countries from 1990 to 2020.

1.4.2 Specific Objectives

To achieve the main objectives of this study, this study sets the specific objectives as the following:

i. To analyse the determinants of current account imbalance

ii. To examine the impacts of different type of debts on twin imbalances

iii. To assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts

1.5 Significance of the Study

Many different studies have been conducted to look at the possible causes of the current account balance. Since most studies only consider advanced and some emerging economies, for example, Khan and Knight (1983), Calderon et al. (2002), Chinn and Prasad (2003), Chinn and Ito (2007), Yang (2011), Brissimis et al. (2013), Lazar and Andreica (2013), Bollano and Ibrahimaj (2015), Das (2016), Sharma (2020), Okoli et al. (2021), and Su and Nguyen (2021), where these limitations are difficult to reflect determinants of current account imbalance in Asia. Das (2016) also argued that advanced technology and large samples must be used to identify important determinants, which are rarely described either in theory or in empirical studies.

Firstly, is to fill the literature gap between current account imbalance and determinants, and to extend how demographic structure and ICT will affect current account imbalance. Previous studies on the determinants of current account imbalance mainly focus on a single country, selected countries within a region, or a group of countries. The empirical studies on the causes of the Asia's current account imbalance are still ambiguous

in theoretical and empirical arguments. Intentionally, this study has conducted in-depth empirical research to analyse the determinants that contribute to Asia's current account imbalance, and these determinants cover a large heterogeneous group in 48 countries. Determining the relationship between variables can help to answer some of the stated questions surrounding the research topic.

By the demographic structure, Asia has the world's largest population and highest population growth rate. Hence, the age dependency ratios of young people and old people were included in the model. According to previous research surrounding the Euro countries, the age dependency ratio will affect the current account imbalance. Yet, the age dependency ratio is an interesting variable that has seldom been included in the model for analysis in the Asia region. Kim and Lee (2008) stated that the macroeconomic effects of demographic shifts are anticipated to be significant and rising dependency ratios will complicate government decision making due to their financial implications. Gudmundsson and Zoega (2014) mentioned that the current account deficits in various countries can be impacted by age dependency with varied age structures. Besides, people with varying levels of age reliance will have varying levels of purchasing power and savings ratio, which is according to the life-cycle hypothesis (Goodhart et al., 2019). Both the purchasing power and saving ratio will increase the current account surplus. On the other hand, the increase in the number of dependents will lead to a decrease in national savings and an incline in domestic spending, which will lead to a rise in debt levels, a fiscal deficit, and a significant current account deficit. This is because when there is an increase in the dependent population, the medical care services for the elderly and public pensions will

face pressure. Thus, policymakers in the Asia region may find it more useful to employ references that include the age dependency ratio in the study.

On the other hand, ICT is now the main driver of global economic integration and has a positive and major impact on global trade, with an export-led growth pattern. According to Juh*á*sz and Steinwender (2018), ICT is a disproportionate increase in the trade of codable intermediate inputs and has become an important factor in promoting the formation of global value chains. It is widely believed that significant improvements in ICT are the driving force behind the increasing complexity of global economic integration (Juh*á*sz & Steinwender, 2018). Nath and Liu (2017) also mentioned that the phenomenal expansion of global services trade and the unparalleled growth of ICT coexist. Besides, the studies by Lin (2015) and Nath and Liu (2017) concluded that international trade is positively impacted by ICT, and this impact is statistically significant, while export is more impacted than import. The application of ICT can also help to reduce the trading costs, enhance trade efficiency, and extend trading volume (Wang & Choi, 2019). Additionally, by implementing ICT techniques, developing nations can assist exporters in lowering trade costs and locating prospective customers globally, as opposed to driving up imports. (Wang & Choi, 2019). When exports in trade increase more than imports, which is influenced by ICT, it may cause the revenue of a country to exceed expenditure and indirectly influence the current account to move into surplus. The behaviour of the current account balance offers significant information about the performance of the economy and can help policymakers make useful macroeconomic policy recommendations (Yang, 2011).

Hence, ICT as a variable is included in the study to analyse the direct or indirect impact on the current account balance.

Secondly, is to enhance the literature gap between imbalances and debt, and to provide an answer to how fiscal guidelines influence current account balance. Debt is well-known as a crucial problem that is faced by all countries around the world, where the size and composition of debt are important aspects that will affect the fiscal deficit. A relatively high level of debt will lead to an increase in the fiscal deficit because the country will have to borrow huge funds to raise more debt. Thus, the service cost of debt may become the largest part of government expenditure. According to the twin deficits hypothesis, when a fiscal account moves towards a deficit, it will cause the current account to shift into a deficit, where both accounts are in parallel. Additionally, if the problem cannot be resolved, the risks faced by countries with current account deficits will become critical, as this will burden countries with increasing debt levels. Yet, a highly indebted country does not indicate that its economic situation is poor. In some cases, the government borrows money for national development. Development has strengthened a country with high competitiveness and influence in the global market.

Moreover, the current account deficit is usually financed by debt and is rarely resolved by raising taxes. The ineffective budget deficit not only failed to reach the current account balance but also further aggravated the country's debt levels. Consequently, the results and outcomes of this study will assist the policymakers in the budget plannings, and

the threshold level determined will serve as a guideline for policymakers to maintain fiscal deficits at a level that will not influence economic development. In addition, current account imbalance may lead to global financial turmoil, and may even lead to a world economic crisis. Therefore, major policy action should be taken.

Thirdly, this study contributes to offering an understanding based on the debt threshold level. A panel threshold sample splitting model is employed to show the threshold's significant impact on the current account balance either below or above the debt threshold level. Regardless of whether the interval is below or above the threshold level, the interval of debt is purposefully analyse using a threshold sample segmentation model. Finally, it is possible to determine a panel data threshold model that quantifies the threshold amount of debt in the attributes of the current account balance. This model has current account balance features that are both lower and greater than the usual debt threshold level. Fiscal balance considerably positively affects the current account when it is below the debt threshold level and strongly affects the current account negatively when it is beyond the debt threshold. Hence, an understanding of the threshold level is crucial for policymakers, as it provides important guidance on the best debt levels that can be managed in a country.

In addition, to improve the budget balance and the extent of the current account balance in these sample nations, policymakers can use the threshold debt level as a guideline when designing the budgets. Nowadays, Asia has the world's quickest economics

growth rate. In accordance with Yendamuri and Ingilizian (2019), argued that the GDP of Asia will equal or exceed the GDP of the rest of the globe when summed together. The area is anticipated to provide over 60% of worldwide growth by 2030. In addition, the Asia-Pacific area will account for 90% of the 2.4 billion new middle-class individuals joining the global economy too (Yendamuri & Ingilizian, 2019). Hence, it is important to have a regional threshold as a guideline rather than applying the threshold individually to each country. If the threshold is based on each country, it may affect regional integration work, because each policy may not be applicable or suitable for regional policies. In other words, panel data estimates are more applicable to elections in these countries than time series estimates.

Lastly, along with this study, the determinants of current account imbalance can be analysed. Besides, the impacts of different type of debts on twin imbalances can be examined. Moreover, the relationship between current account balance and fiscal balance on threshold levels of different type of debts can be assessed too. This study is essential to support decision makers in implementing wise policies and strategies. Therefore, through investment and promotion of ideas, it is hoped that this empirical research study can bring benefits to a country's current account.

1.6 Scope of the Study

The current account imbalances and indebtedness in Asia countries is the main topic of this study. This study includes 48 different Asia countries in total and the time frame is from 1990 to 2020, total is 31 years of coverage. The total number of observations is 1488. Moreover, the data obtained show that it is a balanced data set, where the data is recorded annually. Those data are obtained from the CEIC Global Database, UNCTADstat, World Development Indicators (WDI) of the World Bank, and World Economic Outlook (WEO) of IMF.

Additionally, this study employs a panel data analysis. The endogenous variable is the current account balance (CAB), whereas the exogenous variables are the fiscal balance (FB), public debt (PD), household debt (HD), age dependency ratio for old (ADRO), and age dependency ratio for young (ADRY), ICT component (ICT), real GDP (RGDP), and real effective exchange rate (REER). Likewise, this study intends to analyse determinants of current account imbalance, to examine the effect of different type of debts on twin imbalances, as well as developing panel splitting threshold model to assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts in the 48 Asia countries.

Park and Shin (2009) revealed that the large current account surplus is a relatively new feature in Asia. The world's largest continent by both population and area is Asia. Asia nations have historically higher savings rates than other nations around the world. Although the current account balances between countries or regions with large surpluses or deficits are below the optimal level, this imbalanced pattern has not changed substantially during the time before the Asian financial crisis. Furthermore, according to the IMF, among the top 10 largest economies in the world in 2023, there are 3 Asia countries, which are China, Japan, and India. India is the fifth-largest economy in the world behind the second and third largest economies, China and Japan.

In accordance with Wang et al. (2023), Japan's economy is one of the most developed free markets in the world, which attained a first position on the economic complexity index, and its foreign exchange reserves are among the second biggest in the world. In addition, by nominal GDP, Japan is the third largest in the world, and by purchasing power parity, the world is fourth. Besides, Japan is also well-known for having the lowest unemployment rates in the world and the world's largest manufacturing sector, On the other hand, China is the largest country for international trade and exports goods, agricultural products, and manufactured goods. Besides, India is one of the greatest exporters of crude oil and natural gas, as well as one of the top providers of agricultural and food-related commodities. India has also made economic contributions to the globe in the manufacture of textiles, natural resources, coal, cement, and vehicles. The strong economic background of those countries had brought Asia countries towards rapid growth and emerging market economies. The experiences of these emerging market economies are

contrary to those of large, industrialized nations with larger and more highly developed capital markets (Baharumshah et al., 2009).

In addition, every Asia country has a series of favourable domestic and foreign conditions. They are still the major engine of economic growth because of their strong capacity to climb the development ladder swiftly to accomplish their economic vision. The key to their success lies in their ability to formulate and implement comprehensive skills development plans, especially their ability to meet important skill requirements in the growth industry. Especially for Indonesia and the Philippines, if they can cope with the skills challenges they faced, then they have great potential to become major contributors to growth. China and Japan may make their efforts to develop and maintain good contacts through various diplomatic efforts and channels. As a result, this will have a bigger impact on fostering economic growth in the Asia region and ensuring the stability of global trade. Hence, these are the reasons that inspire and drive my study to focus on the whole Asia region.

1.7 Organization of the Study

There are five chapters in this study. Introduction, Literature Review, Data and Methodology, Empirical Results and Analysis, and Conclusion and Recommendations are the chapters that make up this list.

The organization of the study provides an overall view of the research study. Chapter 1 is the Introduction, which complies with an introduction, the background of the study, the problem statement, the objectives (both general and specific), the significance of the study, the scope of the study, and the organization of the study. The following is Chapter 2. It figures the literature review of former research, which has been analysed to support this research study. For those previous studies, the different authors have discussed different perspectives regarding the same research subject. Moreover, there is a remark on research gaps in the last section of Chapter 2.

Next, is Chapter 3 on data and methodology. This chapter comprises an introduction, a description of the empirical research model, data descriptions, the methodology applied, and a conclusion. Chapter 4, tabulates the empirical results, makes results analysis, and discusses the analysis outcome. Then, this chapter ends with a summary of the chapter's conclusion.

Finally, Chapter 5. It embodies the conclusion of the study and recommendations to policymakers. This chapter summarizes the entire study. In addition, some suggestions are made to improve and strengthen the current account balances of the Asia region. Additionally, some recommendations for additional research areas are given along with a brief explanation of the study's acknowledged limitations.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The recent worsening of trade disputes between the U.S., China, and other nations is a result of global current account imbalances (Gu et al., 2020). Bracke et al. (2010) emphasized that today's global current account balance is more than twice as large as the level of output in the middle of the 1980s. Besides, the foreign net assets have also tripled. Furthermore, Das (2016) also stated that the U.S. and other major advanced economies are both experiencing growing global current account imbalances at the same time, and these countries have current account deficits in some lucrative emerging market countries too. In terms of its causality, this economic imbalance has long been a controversial global issue (Gu et al., 2020).

Moreover, Caballero et al. (2008) and Keys et al. (2010) mentioned that the serious global imbalances and other factors led to the 2007 to 2009 global financial crisis (such as low interest rates, loose monetary policies, extensive financial deregulation, etc.). These problems have therefore piqued my interest in studying potential determinants of current account balance and the relationship between current account balance and fiscal balance on different thresholds with varied levels of debt over the entire Asia region.

This chapter is designed to analyse earlier research on the independent variables that contribute to current account balance, to examine the impacts of different types of debts on twin imbalances, and to assess the relationship between current account balance and fiscal balance on the threshold levels of different types of debts. The relevant literature and findings can be used as references for this study. Likewise, the current account balance performs as the dependent variable, whereas the exogenous variables are represented by fiscal balance, public debt, household debt, age dependency ratio for old, age dependency ratio for young, ICT, real GDP, and real effective exchange rate.

Additionally, this chapter contains two major topics. First, is the Section 2.1. This section gives a brief overview intro to Chapter 2. Then, followed by Section 2.2. Section 2.2 outlines the theoretical approaches related to the study. Furthermore, is coming to Section 2.3, is utilises to focus on outlining the review related to the existing literature on determinants of the current account balance. Section 2.4 reviews the literature on trade and ICT. Next, Section 2.5 concentrates on literature reviews concerning different indebtedness affecting the fiscal balance and current account balance. Afterward, Section 2.6 discusses economic growth and debt with threshold analysis. Furthermore, Chapter 2.7 displays the literature reviews in table forms on the summary of each article which involves dependent variable and independent variables. Lastly, a remark on research gaps is discussed in Section 2.7.

2.2 Theoretical Approaches

2.2.1 Keynesian Theory of Deficits

The Keynesian deficit theory is an economic expression of total expenditure in an economy, which has consequences for output. Besides, Yusuf and Mohd (2023) mentioned that Keynesian theory also supports the idea that a budget deficit will lead to a growth in macroeconomic performance variables and a corresponding rise in inflation. This Keynesian theory was proposed by John Maynard Keynes in 1930 (King, 2021). In Keynesian economics, the interference of government is to maintain the economic cycle by applying expansionary fiscal policy to reduce taxes and raise spending, which later can enhance economic recovery. Additionally, the government can also directly affect the demand for goods and services by changing the tax policy and public spending.

Furthermore, *Šulikovά* and Tykhonenko (2017) stated that in tradition, the double relationship between the current account balance and the fiscal balance is illustrated by Keynesian absorption theory. The theory states that when the fiscal deficit has increased, the current account deficit expands too. Besides, Keynes also believes that total consumer spending mainly depends on the current real national income. According to Keynes's income and expenditure model, the equilibrium level of profit equals expenses. However, during economic recessions, taxable income experiences a fall due to unemployment or falling profits that occur.

Moreover, Keynes’s income model also compares the pricing effect to the elasticity method while comparing the income effect of devaluation. According to the theory, a deficit in a nation's balance of payments indicates that people are 'consuming' more than they are producing. This will bring the domestic budget for investment and consumption to exceed the GDP. On the other hand, people will consume less if their balance of payments is in surplus, which results in the national income being lesser than the expenditure on consumption and investment.

In addition, according to the argument, a country's balance of payments imbalance indicates that people are consuming more than they are producing. Saleh and Harvie (2005) argued that the Keynesian absorption theory raises an expansion in the fiscal deficit that will drive domestic absorption, and therefore imports will grow, resulting in a current account deficit, where the situation of imports is greater than exports appear. Therefore, the domestic consumption and investment expenses will exceed the national revenues. When the fiscal deficit rises, the government's revenue may shrink more than the government's expenditure. In conclusion, Keynesians focus on the importance of government interventions to stabilise the economy during a recession and low demand. To foster demand and stabilise economies, the government should apply expanded fiscal policies.

In this study, to analyse the determinants of current account imbalances in 48 Asia countries, the fiscal balance is expected to affect the current account balance positively with a significant relationship which is according to the theory of Keynesian.

2.2.2 Ricardian Equivalence

The Ricardian equivalence theory says that there is an equal impact on the overall economy of financing public spending through existing taxes or future taxes, and current deficits. When the government attempts to stimulate the economy by increasing debt financing from government expenditures but the demand by individuals and households remains the same (Yamin et al., 2023), the Ricardian equivalence principle is a useful concept. This is because people are saving more money now to cover upcoming tax hikes that will be used to pay off debt.

The concept of Ricardian theory was presented by David Ricardo in the 19th century (Stigler, 1952). The Ricardian equivalence formula is based on household consumption. In addition, Ricard's theory also conceives rational expectations for household consumption optimization. Therefore, the Ricardian equivalence relationship denotes that the government cannot incentivize consumer spending when people know its future benefits. The reason is that the increase in government spending will induce people to keep more savings as people know their responsibility to pay future taxes. The macroeconomic effects of increased government spending will, in turn, be compensated. Likewise, when government debt rises, people's behaviour will also become wiser, where people are inclined to save more rather than spend more.

In the context of this study, household debt plays a crucial relationship in examining the effect of indebtedness on current account balance and fiscal balance in 48 Asia countries. According to the Ricardian Equivalence, when the government raises spending, people look forward to rational expectations by optimizing their consumption to increase savings by setting a precautionary cushion for future tax payments. Hence, the household debt will be lower in accordance with the people's rationality. In other words, household debt in this study on 48 Asia countries will contribute a negative significant relationship between fiscal balance and current account balance with the application of Ricardian Equivalence.

2.2.3 Debt and Deficits – Vicious Cycle

Public debt and fiscal deficit are correlated to each other. The size and composition of public debt will lead to a fiscal deficit. The step up of public debt claims a large amount of government expenditure to finance the debt. This may cause a country to increase its borrowing, thereby further raising its deficit. The cyclical relationship between these two estimates may lead to serious economic turbulence and even trigger a national financial crisis. Besides, a huge and excessive fiscal deficit will certainly harm the economy and even enhance the cost of living of citizens. In addition, the increase in debt burden, including foreign and domestic borrowing, has become a cumulative fiscal deficit. Therefore, increasing the fiscal deficit will eventually lead to a current account deficit. Likewise, the service cost of public debt is the major element that induces and proposes the

deficit and public debt. In other words, debt service cost is the greatest component of government expenses.

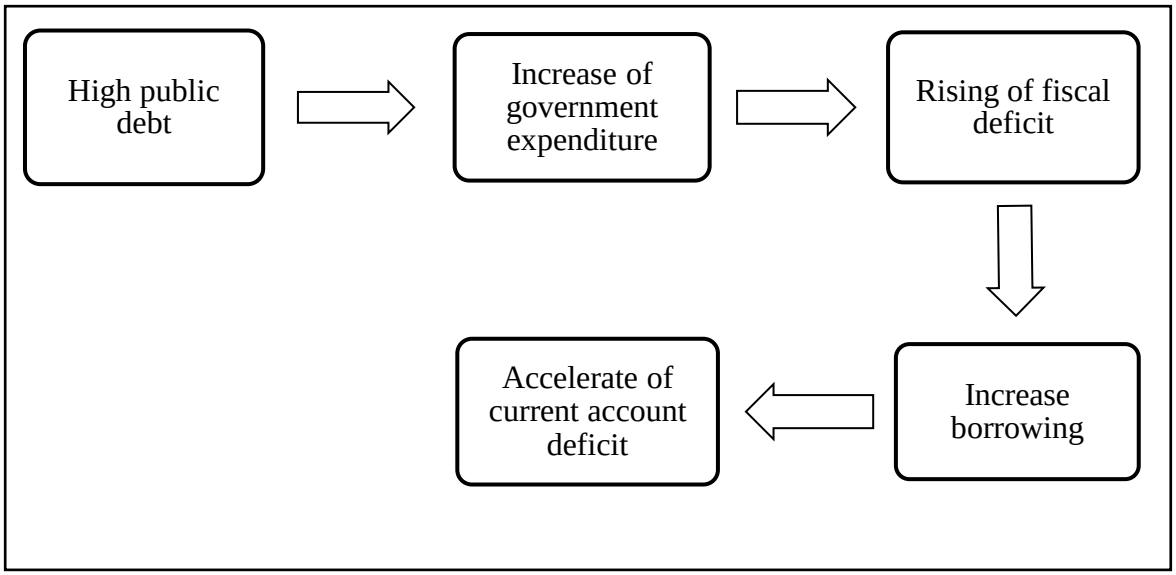


Figure 2.1: Debt and Deficit: A Vicious Cycle

2.2.4 Life-Cycle Hypothesis

In accordance with Ganic and Mamuti (2020), the concept of the life-cycle hypothesis is proposed and presented by Modigliani and Brumberg (1954) and Modigliani and Ando (1957), which originates from the microeconomic principle of consumer choice. This life-cycle hypothesis is an economic principle where the consumption and saving patterns of people are described over their lifetime. Subsequently, the model of the life-cycle hypothesis is further developed by Modigliani to determine how the altering in saving rates are caused by demographic structure. Referring to the model, saving should be

positive for the family's work range and negative for retired families, and hence the welfare should be presented in hump-shaped (Modigliani, 1986). This life-cycle hypothesis supposes that individuals consider their future income to plan their lifetime expenditures. Accordingly, people take on debt when they are young because they believe that their future income will allow them to repay it. Then, they intend to save in their working age to maintain their consumption levels at retirement (Jappelli & Modigliani, 1998).

Based on Figure 2.2, shows that young and old age dependents tend to consume more rather than save, while only the working age population tends to have saved. Therefore, later in the day, the country's expenditure will exceed its income, due to the low contribution on government finance in terms of taxation. The rise in the dependency ratio brings a situation where the reduction in national savings is greater than domestic expenditure. Afterward, this phenomenon will drive the expansion in debt levels, which will cause the current account deficits to undergo further development.

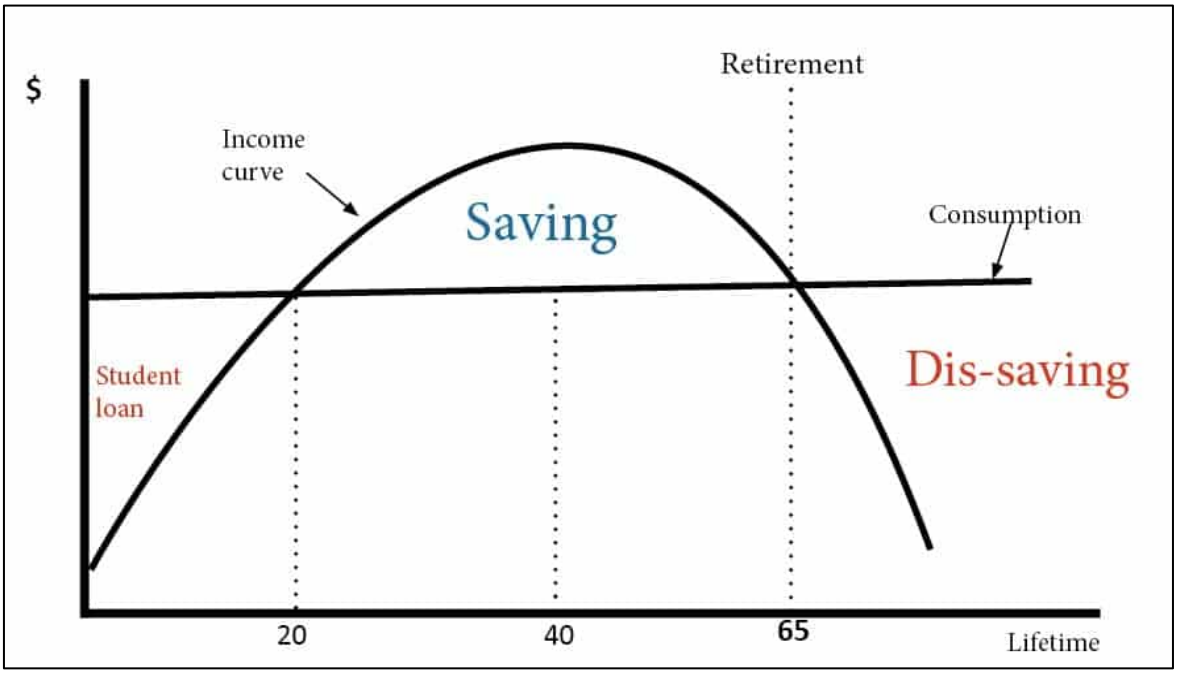


Figure 2.2: Life-cycle Hypothesis

2.3 Literature Review on the Current Account Imbalance and Independent Variables

2.3.1 Fiscal Balance

How closely do the economies' fiscal and current account deficits relate to one another? The twin deficits hypothesis has been the subject of polarized opinions between economic theory and empirical research throughout the years. Empirical research has paid a lot of attention to the connection between these balances and macroeconomic policies (Su & Nguyen, 2021). Okoli et al. (2021) stated that according to economic theory, a budget deficit will inevitably result in a current account deficit and vice versa. In addition, Ganchev et al. (2012) also pointed out that according to the double deficits hypothesis, the fiscal deficit is strongly associated with the current account and serves as its main pillar too.

However, the experience of this issue among countries is found to be inconsistent. Although this assumption makes theoretical sense, empirical evidence demonstrates that outcomes vary depending on the country studied and when different econometric approaches and model specifications are applied to the same country's data (Okoli et al., 2021). Thus, the twin deficit theory may be both subjective and time-limited because the theoretical plausibility of the concept does not ensure the veracity of its experience.

According to an investigation by Bagnai (2010) based on CEEC countries that covered from year 1995 to 2006 with a fixed effect model, the result indicated that current account deficit and fiscal deficit are tied by a statistically significant relation. In another study, Bussière et al. (2010) proposed that budget balance is important in explaining current accounts, however, it only demonstrated a small effect in lowering the current account deficit. Moreover, a study on 12 CIS countries by employing OLS-PCSE from 1989 to 2008 in carried out by Gevorkyan (2010). The results are in line with those of a prior study by Bagnai (2010), which suggested a positive and statistically significant association between the current account and the fiscal account. Besides, Lau et al. (2010) also researched the same topic in India, Korea, Malaysia, the Philippines, and Thailand. They asserted that in Malaysia, the Philippines, and Thailand, there is a causal link between the budget deficit and the current account deficit. However, Indonesia and Korea showed a divergent causal relationship between the current account deficit and the budget deficit.

Furthermore, Bose and Jha (2011) have studied India about the current account deficit and fiscal deficit. They adopted quarterly data frequency by using the VECM approach. They reported both deficits to have bidirectional causal relations, where the current account deficit will not worsen by the budget deficit in the short run. In addition, Holmes (2011) also utilised quarterly data in his research study. Holmes (2011) analysed that both balances posed a positive cointegration nexus. Another study by Nieminen (2011) surrounded 30 advanced countries and 49 developing countries that adopted the panel fixed effect model. However, interestingly, Nieminen (2011) suggested a contrasting result where the budget balance is against the Ricardian view, where for emerging economies there is no correlation between the budget balance and the current account balance.

Azgun (2012), in contrast, concluded that from 1980 to 2009, there was no correlation between Turkey's budget deficit and current account deficit. This result is contradicted by the research of Ganchev et al. (2012) who considered a study on CEE countries by using annual data from 1998 to 2009. Ganchev et al. (2012) described that there is a positive nexus between both balances in the basic regression. Moreover, according to Kalou and Paleologou (2012), the fiscal deficit and current account deficit are both found to have a causal relationship that flows from the current account balance to the budget deficit. Furthermore, Lam (2012) demonstrated that the Keynesian method has strong short run and long run support in Vietnam, where the causality is shifted from budget deficit to current account deficit.

In addition to that, a study using a fixed effect model and 17 Euro countries from 1980 to 2008 by Brissimis et al. (2013) shows the association between the current account balance and the fiscal balance. All variables are identified as having a statistically significant relationship to the current account balance throughout the estimation. Moreover, Forte and Magazzino (2013) and Gehringer (2013) summarized their studies on European countries, where government budget influences the current account balance statistically and positively significant. A different study by Saysombath and Kyophilavong (2013), highlighted both deficits are stationary and proposed bidirectional causality in the long run. Additionally, Trachanas and Katrakilidis (2013) investigated Portugal, Spain, Ireland, Italy, and Greece from 1971 to 2009 with a conclusion that the reduction in fiscal deficit demonstrated a greater effect on the current account deficit. Additionally, Tsen (2013) found that from 1974 to 2011, Malaysia's current account balance and fiscal balance displayed a long run relationship.

In the additional work of Tsen (2013), Gossé and Serranito (2014) also presented a comprehensive review of the current account balance and fiscal balance. According to the report, when there is a long-term relationship between each other, the fiscal balance is positive significant in determining the current account balance. In the same year, Mwangi studied Kenya which covered research years from 1970 to 2010 by utilizing the SVAR approach. Mwangi (2014) found that the current account balance is positively impacted by the budget deficit, with the current account balance being the source of 14.74% of the deficit's influence on the shock to the current account balance. In addition, Van Bon (2014)

indicated that by applying GMM estimation, both deficits have a statistically negative relation, where twin divergence occurs.

On the other hand, Bollano and Ibrahimaj (2015) reported their study based on 11 central and East European countries employed quarterly period from 2005:Q1 to 2014:Q4 by applying the panel VAR model. The result proposed a positive nexus relationship between both balances. In contrast, Kurt and Ozkiper (2015) suggested a different outcome that there is no proof to support the twin deficits hypothesis in developing countries at a specific period. Besides, Neaime (2015) mentioned in the long run, both deficits have no relation, whereas, in the short run, there is a unidirectional causal relationship in Lebanon from 1970 to 2013. On the other hand, there are different studies carried out by Coban and Balikcioglu (2016) and Makrevska-Disovska and Trpkova-Nestorovska (2016) on 24 transition economies and Macedonia respectively. The conclusions of both studies are the same, namely that there is a positive relationship between the current account deficit and the budget deficit. Mumtaz and Munir (2016) provided a contrasting outcome with the same goal, arguing that the twin deficits hypothesis does not hold in South Asia nations and that there is no causal relationship between twin deficits as well.

According to Saidam and Sarmidi (2017), in Malaysia, the coefficient of fiscal deficit is negative and insignificant in the long run, indicating rise in the fiscal deficit does not drive to detrition of the current account by adopting the ARDL approach. In contrast to the former study by Saidam and Sarmidi (2017), Afonso and Opoku (2018) identified there

is positive long run nexus among fiscal balance and current account balance in 18 OECD countries. In the same year, Bucevska (2018) observed the twin balances in Albania, Croatia, Macedonia, Serbia, and Turkey. They indicated that twin deficits hypothesis is valid with significant and positive effects with the use of the FGLS approach. Girma (2018) investigated Ethiopia with annual data from 1980 to 2015 by employing an inter-temporal approach and ARDL model. In both the short run and long run, there is now a negative and statistically significant link between the fiscal and current account balances.

Likewise, there is research concerning China from 1985 to 2016 using the ARDL model raised by Banday and Aneja (2019). As a result, the current account deficit has a considerable impact on the budget deficit, and there is a bidirectional negative causal relationship between the two deficits. Furthermore, in a different study, According to Behera and Yadav (2019), the current account deficit is significantly impacted by the budget deficit, where increasing by 1% causes the current account deficit to rise by 28%. Additionally, Mohanty (2019) also revealed that fiscal deficit has a positive significant effect on current account deficit in both the short run and long run.

In the following year, Abu and Gamal (2020) with the same objective also concluded that budget deficit and current account deficit demonstrated positive nexus in the short run and long run from 1981 to 2017 in Nigeria by employing ARDL and DOLS estimation. Likewise, the study by Ahmad et al. (2020) concluded that in Pakistan, Nepal, India, Bangladesh, and Sri Lanka from 1990 to 2018, there are strong evidences among the

both deficits. When there is a 1% growth in fiscal balance, CAB will rise by 0.33%. Besides, Handoyo et al. (2020) discovered there is positive long run nexus among both deficits in Indonesia with quarterly data from 2004:Q1 to 2017:Q4 by ARDL model. On the other hand, Karras (2020) discussed a study in 7 OECD countries from 1870 to 2013. The outcome showed when there is a rise in government spending by 1% of GDP, will then deteriorate the current account by a maximum of 0.2% of GDP. Additionally, the above findings are consistent with the study by Magoti et al. (2020). Magoti et al. (2020) showed that budget balance has a positive effect on CAB, where a 1 unit increase in fiscal balance brings to 0.969 units of growth in CAB.

Furthermore, Magazzino (2021) revealed a study that the CAB of ASEAN-10 has a positive linkage with budget balance. On the other hand, Okoli et al. (2021) estimate the relationship between the current account deficit and the fiscal deficit using a panel ARDL model. Okoli et al. (2021) studied based on BRICS countries with quarterly data from 2000:Q1 to 2019:Q4. They concluded that a twin divergence was held because the long-term impact of the fiscal deficit on the current account deficit is notably negative. Additionally, two deficits are significantly positively correlated after a threshold point (Okoli et al., 2021). In addition, Su and Nguyen (2021) employed 31 OECD countries to carry out a numerical study with annual frequency from 2002 to 2017 by applying the panel quantile regression with fixed effect. The result indicated that fiscal balance and trade balance are moving together, suggesting the existence of twin deficits.

Furthermore, a study on Bangladesh from 1980 to 2018 to investigate the conventional twin deficit hypothesis by applying ARDL emphasized that budget deficit has a significant positive influence on the current account deficit in the short run and long run (Dey & Tareque, 2022). Apart from that, Sahoo et al. (2022) conducted a study in India that also provided a consistent outcome with findings of past studies by most researchers, in which FB significantly positively impacted CAB. Most recently, there is a study executed by Hailemareiam (2023) on Ethiopia concluded that there is a positive linkage between the current account deficit and fiscal deficit in the long run by utilizing the ARDL model from 1987 to 2021. Likewise, Soo et al. (2023a) also confirmed the positive significant nexus between twin balances in Asia countries from 1990 to 2021 by utilising the PMG estimation approach.

2.3.2 Debt

Debt poses the value that a country owes to lenders that make use of it to finance the fiscal deficit or improve the infrastructure development. Neaime (2015) believes that a heavy debt burden, insufficient taxation, and excessive government spending on infrastructure will lead to regular budget deficits. If the domestic consumption exceeds its income and is not able to generate productive investment, this will also result in a fiscal shortfall which leads to the rise of national debt levels as well as increasing the current account deficit (Soo et al., 2023a). As a result of the debts impact on the CAB, the scholars,

and policymakers have recently become interested in the relationship between current account deficits and debt (Neaime, 2015).

Aristovnik (2008) provided a thorough analysis of the current account balance and indebtedness. The analysis is based on data from 26 newly developing Eastern European and former Soviet Union nations, including 8 CEE, 6 SEE, and 12 CIS. The panel fixed effect model is used to cover the years 1992 to 2003. Aristovnik (2008) is suggested that a considerable positive relationship between external debt and current account balance. Moreover, Alam and Taib (2013) investigated 6 DTC and 8 NDTC in yearly data basic from 1971 to 2000. In the study, they attempted the use of a panel random effect model. According to Alam and Taib's (2013) analysis, there is a positive relationship between external debt, budget deficits, and current account deficits. In the DTC, a larger correlation between the budget deficit and external debt signals a demand for external debt, whereas the correlation between the current account deficit and external debt signals is weaker in the NDTC.

In accordance with Lazar and Andreica (2013), they reported the analysis of the North and South Euro area. They also adopted yearly data frequency, which is covered from 2000 to 2111 by employing a fixed effect model. In their analysis, they mentioned that for the South Euro area, the current account deficit has a great and positive effect on government debt, whereas, for the North Euro area, the current account balance and private debt indicated a positive but lower influence. Additionally, the previous study suggested by

Neaime (2015) that in Lebanon, the external debt and internal debt are not sustainable. Nevertheless, in the long run, both deficits have no relation, but there is a unidirectional causal relation in the short run.

On the other hand, Samsu and Ismail (2020) presented a comprehensive review of 13 middle-income countries from 1990 to 2015. They observed that budget balance and CAB have a short-term favourable relationship but a negative long term, where a 1% improvement in the budget balance will result in a decrease of 0.45% in CAB. Most recently, Soo et al. (2023a) conducted a study on 48 Asia countries by applying PMG estimation from 1990 to 2021. They found that public debt has a positive and significant relationship with CAB.

2.3.3 Age Dependency Ratio for Old and Young

An essential variable in determining the current account balance is the age-dependent ratio (Chinn & Prasad, 2003). Besides, Debelle and Faruqee (1996) contended that the rate of population age rise also has an impact on how a country's current account is perceived. In other words, The savings rate will decline as the age dependence ratio rises. This is a reference to the life cycle hypothesis, which states that while some people (such as employees) are classified as net savers, the young and old are net consumers. However, in accordance with the legacy of aging, the life expectancy after retirement is uncertain, financial support is needed, and only public pension income forces the elderly to save more

instead of spending (Brissimis et al., 2012). Therefore, the dependency ratio is more important in explaining the medium-term difference in current account balances rather than the short-term difference (Chinn & Prasad, 2003).

In accordance with the investigation by Brissimis et al. (2012), they discovered that the dependency ratios do not suggest a role in supporting the development of Greece's current account. Brissimis et al. (2012) examined the model by using a regime-switching model that included the years from 1960 to 2007. Moreover, a similar subject is examined by Kumhof et al. (2012) using current account balance and age dependency ratio. By using the DSGE model, it is determined that the old dependency ratio is negatively affecting the U.K.'s current account balance over the long term from 1970 to 2007. However, Lane and Pels (2012) discovered disparities that suggested demographics have a large and significant impact on the current account balance, even though demographics are generally unimportant to the current account.

Furthermore, Brissimis et al. (2013) extended their work to examine 17 Euro countries with annual data basic from 1980 to 2008. In this study, a fixed effect model and seemingly unrelated regression (SUR) is applied. In the fixed effect, the dependency ratio demonstrated a statistically significant relation with the current account balance. While in SUR estimation, the life-cycle hypothesis is not supported. Likewise, according to Gehringer (2013), the resulting outcome proposed that the old age dependency ratio is reveals significant with the pooled OLS in 20 EU member states. Moreover, the significant

association between the dependency ratio and current account balance was also discussed by Gossé and Serranito (2014), however, it has a negative coefficient and is significant at a 10% level in 22 developing countries from 1974 to 2009. In a different study, Girma (2018) examined Ethiopia from 1980 to 2015 and found that in the long run, there is a positive correlation between CAB and age dependence ratio, although there is a statistically significant negative correlation in the short run.

On the other hand, Behera and Yadav (2019) found in another analysis that increasing age dependency will greatly increase the current account deficit in India. The investigation carried out by Behera and Yadav (2019) uses yearly frequency from 1980 to 2012 on time series regression. In addition, Šima (2020), who published his findings more recently, examined the impact of demographics on the current account balances of 173 nations between 1995 and 2016. The aging of the population has the greatest effect on the government's current account balance (Šima, 2020).

On the contrary, Sahoo et al. (2022) indicated that the age dependency ratio in India has a negatively significant impact on CAB. Most recently, Soo et al. (2023a) conducted a study on 48 Asia countries by applying PMG estimation from 1990 to 2021. They found that both the age dependency ratio for old and the age dependency ratio for young also have a positive and statistically significant relationship with CAB.

2.3.4 Real GDP

In keeping with Brissimis et al. (2013), the development level or standard of a country is reflected by the real GDP. According to another statement, real GDP is used to assess a nation's economic health. Real GDP, according to Cavdar and Aydin (2015), also demonstrates how vulnerable the economy is to financial crises, particularly when the GDP growth rate is low. Likewise, when the country's real GDP is low, this will result in capital input to meet its investment needs when the domestic savings rate is low and will therefore drive a current account deficit in the early stages of the country's development (Brissimis et al., 2013).

Brissimis et al. (2012) presented a comprehensive review of the study on Greece from 1960 to 2007 and found that real GDP has a positive nexus to the current account deficit. However, Gehringer (2013) analysed a study on 20 EU member states from 1995 to 2009 by employing a fixed effect model. Gehringer (2013) posited that with a fixed effect model, real GDP growth has a significant impact on the current account. Moreover, Gossé and Serranito (2014) also discovered that there real GDP and the current account balance are correlated throughout time in 22 developed countries by using a panel VECM model. According to an early study conducted by Mwangi (2014) on Kenya from 1970 to 2010 using the structural vector autoregressive technique, there is a positive correlation between GDP growth rate and current account balance.

Besides, Bollano and Ibrahimaj (2015) conducted a thorough analysis of the factors that influence current account balance. In their panel VAR model, one of the independent variables was the domestic GDP. The result shows that the current account balance is negatively impacted by rising domestic GDP. Moreover, a study on 16 developed and developing OECD countries is attempted by Cavdar and Aydin (2015). The binary panel logit model is employed by referring to annual data frequency from 2005 to 2014. They found that when real GDP rises by 1%, the estimated current account deficit will increase by 0.01 too. Despite prior evidence, Kurt and Ozkiper (2015) highlighted that a 1% rise in the GDP growth rate will bring the current account deficit to fall by 0.07%. Their research study referred to 20 developing countries with a fixed effect model from 1995 to 2013.

Furthermore, research findings by Das (2016) also pointed toward the same outcome as Kurt and Ozkiper (2015). According to Das (2016), real GDP growth has a large negative influence on CAB, which means that higher real GDP growth will amplify the higher income of developed nations and cause them to spend more on consumption. In 2018, Bucevska (2018) discussed the potential factors affecting the current account balance in Albania, Croatia, Macedonia, Serbia, and Turkey with quarterly data from 2005:Q1 to 2017:Q4 by utilizing the FGLS approach. They posited that the real GDP growth rate has a negative and high statistical effect on CAB, where a 1% rise in GDP growth leads to a 0.13-0.29% rise in the current account deficit. Moreover, an investigation of Ethiopia from 1980 to 2015 was conducted by Girma (2018). A negative substantial relationship between the CAB and real GDP growth rate was shown to exist both in the short run and long run.

In addition, Mohanty (2019) concluded the same result in his study where there is a positive effect between the current account deficit and GDP growth in India by adopting the ARDL model. Besides, the outcomes of the study by Ahmad et al. (2020) are also in line with the results of this study. Ahmad et al. (2020) examined that higher GDP growth can attract capital flows and make current accounts worse, where a 1% rise in RGDP growth will negatively impact the mean value of CAB by 0.24%. However, it was later shown by Feriyanto (2020) that the finding of the study is contradictory, while in the short run and long run, real GDP had an insignificant effect on the current account in Indonesia from 2000 to 2017 by applying the ECM approach. Recently, Hailemareiam (2023) carried out a study on Ethiopia and found that there is a positive linkage between the current account deficit and fiscal deficit in the long run by utilizing the ARDL model from 1987 to 2021.

2.3.5 Real Effective Exchange Rate

In accordance with the IMF, the REER is a weighted average assessment of a currency's value with a certain cost to a specific external currency. In addition, the weight is determined by comparing the currency of a country with the trade balance of each country in the index. The current account balance is significantly impacted by the appreciation or depreciation of REER (Feriyanto, 2020). The value of accumulated currency and resource assets, as well as the purchasing power of domestic agents for present and upcoming revenue imports, can all gain benefit from the appreciation of REER.

Nevertheless, a growth in purchases will raise consumption while decreasing the propensity to save. The economy's current account balance will shrink as current account savings rise and the savings rate declines (Girma, 2018). As a result, it is anticipated that REER and current account balances will have a strong link.

In accordance with the research by Aristovnik (2008), REER has a positive and significantly relationship with current account balance in 26 emerging countries from 1992 to 2003 by adopting the fixed effect model. However, in contrast, Brissimis et al. (2012) investigated that the appreciation of REER in Greece harmed the current account from 1960 to 2007. The previous finding is consistent with the study by Forte and Magazzino (2013). Forte and Magazzino (2013) examined 33 European countries from 1970 to 2010 on panel GLS and found that REER also has an adverse impact on CAB.

According to an investigation by Mwangi (2014), the study was done in Kenya with yearly frequency from 1970 to 2010. Mwangi used the SVAR approach to conduct the investigation. The outcome emphasized that REER has long lasting impact on the current account and has with positive influence. In contrast, Bollano and Ibrahimaj (2015) analysed that the depreciation of REER will not perform immediately influence the current account balance in 11 central and East European countries with quarterly data basic from 2005:Q1 to 2014:Q4 by employing the panel VAR model.

In a different study, using a panel GMM estimate method, Das (2016) measured 47 developing countries, 32 emerging nations, and 27 high-income industrial nations during the period 1980 to 2011. Das (2016) expressed concern over the statistical significance of REER and its detrimental effects on the current account balance. Furthermore, research findings by Saidam and Sarmidi (2017) on Malaysia also pointed towards a consistent outcome with the study by Das (2016). They concluded that REER is statistically significant in the long run, where a 1-unit rise in REER will narrow the current account surplus by 0.108%.

However, interestingly, Afonso and Opoku (2018) proposed research that contradicts some previous studies. Using a panel VAR model with quarterly data frequency, they argued that the impact of REER on the current account balance in 18 OECD nations is not statistically significant. Apart from that, Girma (2018) is another author who also investigated the relationship between current account balance and REER. A study by Girma (2018) pointed to Ethiopia on annual data from 1980 to 2015 with an inter-temporal approach. The outcome showed that REER is statistically significant and positive in the long run for CAB, but statistically negative significant in the short term for CAB. Oppositely, a study carried out by Mohanty in 2019 on India showed that the exchange rate has an insignificant effect on the current account deficit in both the short run and long run.

In addition, Sri Lanka as the research country is adopted by Udayanga (2019) in determining the nexus between REER and current accounts from 1990 to 2017. The outcome of the study discovered that the exchange rate is the highest and negatively affects the current account balance. According to recent research by Feriyanto (2020), based on annual data for Indonesia from 2000 to 2017, there is a negative significant association between the exchange rate and the current account in the short run, but no significant impact in the long run. Lately, there is a study on Ethiopia performed by Hailemareiam (2023) disclosed that there is a positive linkage between the current account deficit and fiscal deficit in the long run by utilizing the ARDL model from 1987 to 2021.

In conclusion for the literature reviews on current account imbalances and those independent variables, the hypothesis assumes that fiscal balance, age dependency ratio for old, age dependency ratio for young, real GDP, and REER have a positive significant relationship to current account balance in 48 Asia countries.

2.4 Literature Review on Trade and ICT

In keeping with Chung et al. (2013), brought up the fact that, since the end of the 19th century, the decline in transportation costs and the current development of ICT and its cost reduction have had a significant impact on globalisation. The importance of using technology in our daily lives has increased with the present wave of globalisation (Ozcan, 2018). Additionally, Lin (2015) observed that the Internet has developed into the enormous

market in the world, operating around-the-clock, seven days a week, and offering limitless chances to everyone. In other words, everyone is now in the era of the internet driven economy. The globe has undergone several substantial changes because of the ICT industrial revolution, including greater economic activity, increased productivity, and expanded global trade (Ozcan, 2018). Moreover, Wang and Choi (2019) also implied that the usage of ICT can support improving the situation of insufficient trade information and serves to reduce trade barriers and shorten spatial distances. Hence, the use of ICT has greatly reduced transaction costs, improved trading efficiency, and developed trading volume (Terzi, 2011).

The relationship between ICT and trade has been the subject of numerous studies in the literature. Freund and Weinhold (2004) examined 56 countries from 1995 to 1999. To examine the impact of the growth of web host variables on commerce, they used panel data estimation with a gravity model and an augmented baseline model. The results indicated that the rapid growth of the internet means a significant contribution to trade growth, where a 10% rise in the growth of web hosts brings an increase of export growth by 0.2%. Furthermore, Clarke and Wallsten (2006) also showed that developing countries intend to have higher internet access rates, thereby improving export performance. There are involving of 52 high-income countries and 46 developing countries in 2001 by using two-stage least squares estimation. They found that when a 1% increase in the number of internet hosts, the total exports will grow by 0.05% as a percent of GDP (Clarke & Wallsten, 2006).

Additionally, the finding of the past study by Demirkan et al. (2009) is coherent with the findings mentioned above. Demirkan et al. (2009) examined 175 countries from 1962 to 2005 by utilising OLS estimation. They found that rather than between smaller economies, the adoption and use of ICT have a higher favourable influence on bilateral commerce between large economies. In other words, when the application of the internet has increased, so enhancing the trade flows too. Moreover, Chung et al. (2013) revealed in their study that penetrating fixed telephone lines had the greatest influence on exports among 20 APEC countries from 1997 to 2006. By employing the gravity model in their work, they disclosed that the penetration rate of fixed-line telephones increased by 1%, the export trade increased by 0.36%; while a 1% rise in internet users will facilitate a 0.17% increase in export trade.

In addition, Yushkova (2014) noted that a study conducted in 2011 using data from 40 OECD nations found a positive and statistically significant relationship between trade and internet use. The result indicated the use of the Internet rose by 1-unit, total exports will grow by about 27%. In another study, Bankole et al. (2015) discussed the impact of ICT on 28 countries on the intra-African trade with a PLS-base structural equation model by applying annual data from 1998 to 2007. They proposed that telecommunications infrastructure reflects a significant and statistically positive relation on intra-African trade. To investigate the connection between trade and ICT, Lin (2015) reportedly used a gravity model on a GMM estimation. Lin (2015) summarized that the Internet effect is stronger in stimulating the export.

Apart from that, Ozcan and Nath (2016) extended their work to investigate Turkey's trade and ICT by utilizing annual data frequency from 1948 to 2014. The fixed effect model traced that ICT has a significant positive influence on exports, where it has the largest impact. According to Nath and Liu (2017), they used the gravity model to carry out the research based on 49 countries. The period is covered from 2000 to 2013. They referred to the important link between ICT and trade volume, whereby ICT used is growing and is helping to boost exports. Similarly, Ozcan (2018) presented a comprehensive analysis of 35 export countries and 34 import countries from 2000 to 2014. A gravity model with GMM estimation and sensitivity analysis is adopted. The result highlighted that the ICT development index (IDI) has a positive significant effect on exports, where a 1% growth in IDI, will lead to a 0.4% rise in exports. Ozcan (2018) also concluded that a high scale of ICT accessibility is decisive in boosting export volume.

Toader et al. (2018) conducted a study in which they investigated the effect of technology on economic growth in EU nations between 2000 and 2017. They emphasized that ICT infrastructure has a significant positive impact on economic growth throughout EU member states. Besides, when 1% rise in the adoption of ICT infrastructure will denote the GDP per capita growth between 0.0767% (fixed-broadband subscriptions) and 0.396% (mobile cell subscriptions). Furthermore, a study by Wang and Choi (2019) inspected the nexus between trade and ICT in BRICS, where the yearly data covered from 2000 to 2016 is utilised. The research finding revealed that fixed broadband subscriptions have a positive and significant relation on the exports, while a 1% rise in the subscription rate will enhance

exports to grow by 0.22%. Additionally, Wang and Choi (2019) found that the impact of ICT on exports is both more positive and grows over time.

More recently, in an analysis of 12 high-income and 13 middle-income Asia nations from the years 2000 to 2018, Kurniawati (2022) identified the relationship between ICT and economic growth in the region. Kurniawati (2022) concluded that ICT has a statistically significant impact on the economic expansion of Asia nations. In those high-income countries, the penetration of internet users is greatly significant to economic growth. On the contrary, in those middle-income countries, telephone line and mobile phone penetration became the significant ICT variables that bring impact to economic growth. Lastly, to analyse the determinants of current account imbalance in 48 Asia countries, the hypothesis is ICT has an indirect relationship to current account balance.

2.5 Literature Review on Twin Deficits and Debt

The question of whether there is a connection between twin imbalances and debt has traditionally been the focus of empirical investigations on twin deficits and debt. Soo and Kueh (2019) mentioned that debt is highly correlated with fiscal deficits, where the magnitude of debt will lead to the occurrence of fiscal deficits. The rapidly growing debts require huge government expenditures to repay the debts. This may cause a country to raise its borrowing level, thereby further expanding its deficit. Hence, the cyclical relations

of these two variables may lead to serious economic instability or even drive a national financial crisis, i.e., a current account deficit.

In keeping with Gevorkyan (2010), the study was conducted on 12 CIS countries with annual data from 1989 to 2008. The research is carried out with the OLS-PCSE approach. Gevorkyan (2010) summarized that debt service suggested a positive relation between the current account and fiscal balance. Besides, with the presence of debt in the main model, the current account and fiscal budget produce a statistically more significant positive relationship. Moreover, Nickel and Tudyka (2014) investigated 17 European countries with annual data from 1970 to 2010 by utilizing the panel VAR model. They found that twin deficits occurred at a low level of debt, while twin divergence happened at a high level of debt.

In a different study, *Šulikovά* and Tykhonenko (2017) looked at the correlation between public debt and twin deficits in 14 different European countries. They adopted a panel threshold regression model with yearly frequency from 1995 to 2012. They suggested that there is a strong negative association when public debt is smaller than the 40.2% debt level. Besides, double deficits exist between 40.2% and 96.6% of threshold debt levels with a positive relationship, while twin divergence occurs when exceeding 96.6% of threshold debt. Furthermore, Soo and Kueh (2019) also attempted a study with the same objective. The study uses a panel regression model on PMG estimation and covers six randomly chosen ASEAN nations from 1990 to 2016 every year. They said that both

balances, which exhibit a positive and statistically significant link, are affected by public debt.

Apart from the above previous studies, more recently, Furceri and Zdzienicka (2020) measured 114 developing countries in the world. They used annual data from 1990 to 2015 by adopting the ARDL model. They reported that the influence of fiscal shock on current account balance is weaker with high public debt. Nevertheless, the research by Okombi (2020) is based on the impact of three different types of debt on the CAB in 30 African nations by using a yearly methodology from 2004 to 2017. The study is examined by employing the panel threshold regression. The three different indebtedness involved are public debt, external debt, and domestic debt. The result findings demonstrated the debt threshold levels for public debt, external debt, and domestic debt are 78.4%, 65.25%, and 13.5% respectively. Fiscal balance also has a considerable positive impact on the current account when it is below the debt threshold of those three types of debt, but it has little impact when it is beyond the debt threshold.

In a similar vein, Rajakaruna et al. (2021) have conducted research on the effect of a nation's public debt on its twin deficits. This study is focused on the South Asia region, mainly including Bhutan, Sri Lanka, Maldives, Pakistan, and India from 1980 to 2018. They adopted a panel threshold model and discovered that the twin deficits link is nonlinear. Besides, the threshold effect test indicates the model is a double threshold effect model with the public debt-to-GDP threshold levels are at 46.21% and 65.80% respectively.

The threshold estimation result shows that there is a positive significant relation between twin imbalances when below the debt threshold of 46.21%; there is a negative significant nexus between threshold debt level of 46.21% and 65.80%; when greater than 65.80% debt threshold level, twin imbalances display positive statistically significant relationship.

In a most recent study by Bousnina and Gabsi (2023), they conducted a panel threshold estimation on public debt, budget balance, and current account balance on 15 countries in MENA from 2003 to 2019. They revealed that the outcomes show there is not a single debt threshold model, where it is a double threshold model with a public debt-to-GDP threshold is at 36.71% and 72.99%. When the public threshold debt is below 32.71%, the model determines a negative nexus between the budget balance and the current account. Apart from that, twin deficits are found in the regime between 36.71% and 72.99%. Besides, a twin divergence situation is confirmed when public debt-to-GDP threshold debt is beyond 72.99%.

Furthermore, Soo et al. (2023b) also carried out a study with the same goal as Bousnina and Gabsi (2023). The study is on 6 ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, Thailand, & Vietnam) which cover the period from 1990 to 2021 by adopting a panel threshold sample splitting model. They discovered that the study is a panel threshold single splitting model with a public debt-to-GDP threshold at 63.36%. When lower or equal to the threshold level, CAB and FB have a negative significant nexus,

while when above the threshold level, CAB and FB demonstrate a positive and statistically significant relationship.

As concluded in those literature reviews, in line with the 2nd objective to examine the impacts of different type of debts on twin imbalances, the hypotheses point out that twin imbalances have a significant positive relation with the occurrence of debts. In addition, to meet the 3rd objective to assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts, the hypothesis is when below the threshold debt level, fiscal balance will demonstrate a positive significant relationship with current account balance; while above the threshold debt level, fiscal balance will have negative significant nexus with the current account balance.

2.6 Literature Review on Economic Growth and Debt

Inevitably, debt is used to lessen the negative effects of economic shocks. The rise in governmental debt has been a top issue for most nations worldwide during the last few decades. According to Law et al. (2021), advanced economies are experiencing significant debt accumulation because of stimulus spending and the expensive cost of stabilizing the financial system, particularly in the wake of the global financial crisis that lasted from 2007 to 2008, the European sovereign debt crisis that started in 2008, and the most recent COVID-19 outbreak. Moreover, Law et al. (2021) also emphasized that the crisis had resulted unprecedented expands in PD, which had triggered severe concerns about how this

debt may affect economic growth. Debt issues related to the fiscal sustainability of developed economies may also spread and with major impacts on developing countries. Besides, Caner et al. (2010) mentioned that due to the current global situation, the public debt of all countries at income levels has increased significantly too.

Caner et al. (2010) studied the threshold effect on public debt and the different influences of GDP growth on 75 developing countries and 26 developed countries. Their analysis is based on the Hansen threshold regression model that covered an annual data frequency from 1980 to 2008. Their analysis revealed that the public debt threshold is predicted at 77% for developed nations, where a 1% rise in debt level, leads to a 0.017% decrease in annual growth; whereas the debt ceiling for emerging markets is set at 64%, which 1% grow in public debt, drives the annual real growth to shrink by 0.02%.

Furthermore, with the same objectives, Reinhart and Rogoff (2010) also conducted research on debt threshold and economic growth. They observed 20 advanced nations and 24 emerging markets from 1946 to 2009 by using mean comparison. They discovered that the threshold value for both advanced and emerging markets is 90%. Debt and economic growth have a weak association when the threshold level is lower than 90%, while the threshold that is above 90%, leads the economic growth to experience a fall. In a different study, Cecchetti et al. (2011b) claimed that high debt levels are bad for economic growth. The public debt-to-GDP threshold currently stands at 85%, and any further increase would have a significant negative impact on the growth. Moreover, their study discovered that the

corporate debt threshold is noticed at 90% and household debt is at 85% threshold level of debt. Using a growth regression model, Cecchetti et al. (2011b) examined the association between various debts and economic development in 18 OECD nations from 1980 to 2010.

On the other hand, an analysis of 12 Euro countries with a panel fixed effect model is performed by Checherita-Westphal and Rother (2012). The nonlinear influence of debt on growth with a turning point of 90% to 100% is underlined in the study's findings, while the negative influence of high debt is estimated to start from the levels at around 70% to 80%. Apart from those, Égert (2015) attempted a study built on 20 advanced countries and 24 emerging countries by utilizing a nonlinear Hansen threshold model from 1946 to 2010. The result is in accordance with earlier research by Checherita-Westphal and Rother (2012), which shows a negative nonlinear association between public debt and growth above a threshold debt level. This negative correlation occurred at a lower threshold debt level, which is between 20% and 60% of GDP.

In 2016, Kueh et al. published a paper in which they described the nexus between public debt and economic growth in Malaysia employing quarterly data frequency from 1991:Q1 to 2014:Q4. The findings show that public debt and economic growth will be positively correlated in the absence of the threshold effect (Kueh et al., 2016). Besides, they proposed that the existing threshold effect will denote a double threshold level at 41% and 53%. The situation takes place when the public debt threshold is below 41%, which indicates a positive influence on economic growth. In contrast, when the threshold

surpasses 53%, debt, and economic growth will perform an inverse relation. However, between 41% and 53% of threshold levels, the effect of debt on growth is diminished.

Moreover, Kueh et al. (2017) extended further research with the same aims in Malaysia. The study included the period from 1980 to 2005 by adopting domestic debt and external debt. When the debt-to-GDP ratio is under 37%, Kueh et al. (2017) found that domestic debt has a favourable impact on growth, whereas it revealed a negative impact beyond the threshold level. Yet, external debt implied a negative influence on growth below the 4% threshold and acted positive relation above the threshold. Likewise, Bentour (2020) chose to investigate 20 individual developed countries by applying the Hansen link regression model from 1880 to 2010 on the association between threshold debt and economic growth. The finding identified the threshold effect of Japan is statistically significant negative below the threshold level at 22.9%; where UK threshold is at 50.3% with positive debt towards economic growth when lower than the threshold level; and France gained a negative impact for debt ratios below the threshold level of 44%.

More recently, using a dynamic panel threshold approach, Law et al. (2021) examined the impact of public debt on economic development in 71 emerging economies between 1980 and 2015. They concluded that when there is a large level of public debt, debt has a statistically significant adverse influence on economic growth. However, at lower debt threshold levels, the debt coefficient had an insignificant positive effect on growth. Additionally, as robustness check, they used a panel quantile regression estimation.

They concluded that the outcomes of quantile estimation are robust to the result of dynamic threshold estimation. On the other hand, Awadzie et al. (2022) indicated that the public debt threshold in Ghana from 1990 to 2020 is at 57.09%. When lower than the threshold level, public debt and economic growth show a positive nexus, while beyond the threshold level, economic growth is discovered to be insignificant to public debt. Recently, a study by Obiero and Topuz (2023) found that the public debt-to-GDP threshold in Kenya from 1970 to 2018 is at 33.29%. The economic growth of Kenya is positively influenced by public debt when above the debt threshold level, while economic growth will have a negative effect when below the threshold level of public debt.

2.7 Summary of Literature Review

In this sub-section, the literature reviews are displayed in table forms on the summaries of each article which involves between the dependent variable and those independent variables.

Table 2.1 is on the summaries of literature reviews on the current account balance and fiscal balance; Table 2.2 tabulates the summaries of literature reviews on the current account balance and debt; Table 2.3 displays the summaries of literature reviews on the current account balance and age dependency ratios; Table 2.4 performs the summaries of literature reviews on the current account balance and real GDP; Table 2.5 presents the summaries of literature reviews on the current account balance and REER; while Table 2.6

shows the summaries of literature reviews on trade and ICT; Table 2.7 demonstrates the summaries of literature reviews on twin deficits and debt; and Table 2.8 reveals the summaries of literature reviews on economic growth and debt.

Table 2.1: Summaries of Literature Reviews on Current Account Balance and Fiscal Balance

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Bagnai (2010)	• CEEC countries • Annual data: 1995-2006 • Fixed effect model • Current account balance, government balance, gross fixed investment	• Two deficits appear to be tied by a statistically significant relationship.
Bussière et al. (2010)	• 21 OECD countries • Annual data: 1960-2003 • Baseline specification • Current account, consumption, government budget balance	• Budget balance is an important determinant of the current account, but it has a small effect on the current account. • A reduction in US government deficit is not sufficient to lower its current account deficit. • The response of the current account to reduce the budget deficit will become higher due to some specific factors.
Gevorkyan (2010)	• 12 CIS countries • Annual data: 1989-2008 • OLS regression with panel-corrected standard errors (OLS-PCSE) • Current account balance, fiscal budget, investment, debt	• The fiscal budget has positive and statistically significant suggesting a positive relationship between current account and fiscal balance, where the coefficient values are between 0.4 and 0.6.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Lau et al. (2010)	• India, Korea, Malaysia, Philippines, Thailand • Quarterly data: 1976:Q1-1997:Q2 (pre-crisis), 1997:Q3-2008: Q1 • Time series model • Current account deficit, budget deficit	• There is causal relation run from budget deficit to current account deficit in Malaysia, Philippines, and Thailand. • Indonesia and Korea show an opposite causality, where is run from current account deficit to budget deficit. • In post-crisis of Philippines, there is bidirectional causal between both deficits.
Bose and Jha (2011)	• India • Quarterly data: 1998:Q1-2011:Q1 • VECM approach • Fiscal deficit, current account deficit, exchange rate, interest rate	• Both deficits have a bidirectional causal relationship. • The budget deficit does not worsen the current account deficit in the short run. • The reverse relation between both deficits is much stronger.
Holmes (2011)	• U.S. • Quarterly data: 1947:Q1-2009:Q4 • Time series model • Current account balance, budget balance	• CAB and budget balance have a positive cointegration relationship.
Nieminen (2011)	• 30 advanced countries, 49 developing countries • Annual data: 1993-2007 • Panel fixed effect model • Current account balance, budget balance, age dependency ratio, openness, GDP per capita	• For developing economies, budget balance is against the Ricardian view, where there is no causation from budget balance to current account deficit.
Azgun (2012)	• Turkey • Annual data: 1980-2009 • Time series model • Current account deficit, budget deficit	• There is no relation between budget deficit and current account deficit.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Ganchev et al. (2012)	• CEE countries • Annual data: 1998-2009 • Panel regression model • Fiscal deficit, current account balance	• There is positive connection between CAB and fiscal balance. However, Bulgaria and Estonia have negative relation. • Positive relation between both balances is only on basic regression.
Kalou and Paleologou (2012)	• Greece • Annual data: 1960-2007 • VECM model • Current account balance, budget deficit, interest rate, exchange rate	• Both deficits are found to be positively linked and the direction of causality is run from CAB to the budget deficit.
Lam (2012)	• Vietnam • Annual data: 1990-2011 • VECM model • Current account balance, budget deficit, investment	• In the short run and long run, there is strong support for the Keynesian approach where causality runs from budget deficit to current account deficit.
Brissimis et al. (2013)	• 17 Euro countries • Annual data: 1980-2008 • Fixed effects model, seemingly unrelated regression (SUR), FMOLS • CAB, real GDP, REER, fiscal balance, dependency ratio	• In fixed effects, all variables show a statistically significant relation to CAB.
Forte and Magazzino (2013)	• 33 European countries • Annual data: 1970-2010 • Panel GLS • Current account balance, government budget, REER, real GDP growth	• In low deficits and high deficits countries, government budget affects CAB with positive and statistically significant relation at 1% level.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Gehringer (2013)	• 20 EU member states • Annual data: 1995-2009 • Fixed effect model • Current account, dependency ratios, GDP growth	• Government balance is positive significant influence current account by using pooled OLS method and have stringer effect on fixed effect model.
Saysombath and Kyophilavong (2013)	• Laos • Annual data: 1980-2010 • ARDL approach • Budget deficit, current account deficit	• Budget deficit and current account deficit are stationary in different forms. • In long run, both have bidirectional causality.
Trachanas and Katrakilidis (2013)	• Portugal, Spain, Ireland, Italy, Greece • Annual data: 1971-2009 • Time series model • Current account balance, government deficit	• Decrease in fiscal deficit has greater impact on current account deficit.
Tsen (2013)	• Malaysia • Annual data: 1974-2011 • Times series model • Balance of trade, current account balance	• CAB and budget balance has long run relationship.
Gossé and Serranito (2014)	• 21OECD countries • Annual data: 1974-2009 • Panel VECM model • Current account balance, fiscal balance, REER, real GDP, interest rate, age dependency ratio, trade, oil balance	• In long run, fiscal balance plays an important role in affecting CAB.
Mwangi (2014)	• Kenya • Annual data: 1970-2010 • Structural vector autoregressive approach (SVAR) • Current account balance, GDP, REER, budget deficit, inflation, trade	• Impact of budget deficit are positive on CAB. • The shock of current account is highly affected by budget deficit, where the 14.74% of CAB is caused by budget deficit.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Van Bon (2014)	• Bangladesh, Cambodia, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam • Annual data: 1985-2012 • Panel regression model • Fiscal deficit, current account deficit, interest rate, inflation,	• By applying GMM estimation, both deficits have statistically negative relationship. • Twin divergence occurs between both deficits.
Bollano and Ibrahimaj (2015)	• 11 Central and East European countries outside Euro area • Quarterly data: 2005:Q1-2014:Q4 • Panel VAR model • CAB, FB, REER, domestic GDP, interest rate	• Fiscal balance worsening is accompanied by CAB, where there is positive relationship with among both.
Kurt and Ozkiper (2015)	• 20 developing countries • Annual data: 1995-2013 • Fixed effect model • Budget deficit, current account balance, GDP growth rate, RIR, openness, inflation	• There is no proof to support twin deficits hypothesis in developing countries at specific time span. • Budget balance and current account deficit have negative correlation with each other, where 1% rise in budget balance causes a drop of 0.09% in CAB.
Neaime (2015)	• Lebanon • Annual data: 1970-2013 • Time series model • Current account, budget deficit, public debt, exchange rate policies	• In long run, both deficits have no relation, whereas in short run there is unidirectional causal relation.
Coban and Balikcioglu (2016)	• 24 transition economies • Annual data: 2002-2013 • Fixed effect model • Current account deficit, budget deficit, private saving	• There is positive relation between both deficits. • There is inverse relationship between both deficits that caused by high share of indirect taxes.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Makrevska-Disovska and Trpkova-Nestorovska (2016)	• Macedonia • Monthly data: Jan 2013-Sept 2012 • Time series model • Current account, economic growth, budget balance, FDI, demographic	• Budget balance is significant to current account with positive relation, 1% rise in budget balance brings to increase in 0.28% of current account.
Mumtaz and Munir (2016)	• South Asia countries • Annual data: 1980-2014 • Panel ARDL model • Current account deficit, fiscal deficit, investment	• Twin deficits hypothesis does not exist in South Asia countries. • In Granger causal test, there is no causal link between both deficits, except Bangladesh has bidirectional causal in short run.
Saidam and Sarmidi (2017)	• Malaysia • Quarterly data: 1988:Q1-2015:Q4 • ARDL approach • Current account, fiscal deficit, REER, RIR	• In long run, coefficient of fiscal deficit is negative insignificant, indicates increasing fiscal deficit does not lead to detrition of current account.
Afonso and Opoku (2018)	• 18 OECD countries • Quarterly data: 1995:Q1-2018:Q1 • Panel VAR model, fixed effect • Current account balance, fiscal balance, REER, government consumption	• There is long run relation between fiscal balance and CAB.
Bucevska (2018)	• Albania, Croatia, Macedonia, Serbia, Turkey • Quarterly data: 2005:Q1-2017:Q4 • Feasible Generalized Least Squares (FGLS) • CAB, fiscal balance, domestic investment, real GDP growth rate	• Government budget balance has a positive and significant effect on CAB, supports “twin deficits” hypothesis about the co-movement.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Girma (2018)	• Ethiopia • Annual data: 1980-2015 • Inter-temporal approach, ARDL model • CAB, budget balance, REER, dependency ratio	• The short run and long run relation of CAB and fiscal balance is negative and statistically significant.
Banday and Aneja (2019)	• China • Annual data: 1985-2016 • ARDL model • Current account deficit, budget deficit, deposit interest rate, inflation, broad money, REER	• Small change in budget deficit has a significant impact on current account deficit. • Both deficits have strong inverse causal relation and bidirectional causality happens. • The negative shock to budget deficit reduces CAB, where positive shock is vice versa.
Behera and Yadav (2019)	• India • Annual data: 1980-2012 • Time series model • Current account balance, exports, imports, deposit rate, CPI, real GDP, REER, fiscal deficit, GDP, age dependency, inflation	• Fiscal deficit has significant impact on current account deficit, 1% rise in fiscal deficit leads to rise current account deficit by 28%.
Mohanty (2019)	• India • Annual data: 1970-1971 to 2013-2014, 1980-1981 to 2013-2014 • ARDL • Current account deficit, fiscal deficit, GDP growth, exchange rate	• Fiscal deficit has significant positive impact on CAD in short run and long run.
Abu and Gamal (2020)	• Nigeria • Annual data: 1981-2017 • ARDL, DOLS • Budget deficit, current account deficit	• There is positive relation between current account deficit and budget deficit in short run and long run.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Ahmad et al. (2020)	• Pakistan, Nepal, India, Bangladesh, Sri Lanka • Annual data: 1990-2018 • External balance assessment regression, macroeconomic-balance approach • Current account balance, net foreign assets, fiscal balance, population growth, trade, real GDP growth	• There is strong relationship among fiscal deficit and current account deficit, where 1% rise in fiscal balance significantly leads to 0.33% increase of CAB.
Handoyo et al. (2020)	• Indonesia • Quarterly data: 2004:Q1-2017:Q4 • ARDL model • Current account deficit, budget deficit, real GDP growth, inflation, debt	• In long run, there is positive relation among both deficits. • In short run, both deficits show negative association, twin divergence.
Karras (2020)	• 7 OECD countries • Annual data: 1870-2013 • Fixed effects model • Government budget, current account balance	• The current account effect declines in size but remains statistically significant negative. • An increase in government spending by 1% of GDP, deteriorate current account by a maximum of 0.2% of GDP.
Magoti et al. (2020)	• Tanzania, Kenya, Uganda, Burundi, Rwanda (East African countries) • Annual data: 2004-2018 • Panel ARDL model • Saving gap, fiscal balance, current account balance	• In long run, fiscal balance is positively significant to CAB, where 1 unit rise in fiscal balance leads to 0.969 units increases for CAB. • In short run, both balances have no significant impact.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Magazzino (2021)	• ASEAN-10 countries • Annual data: 1980-2012 • Panel data regression • Current account balance, GDP	• ASEAN-6 countries show a CAB higher than ASEAN-10 group, with a positive budget balance, while ASEAN-10 countries exhibit mean deficit.
Okoli et al. (2021)	• BRICS countries • Quarterly data: 2000:Q1-2019:Q4 • Panel ARDL model, threshold estimation • Current account balance, fiscal deficit	• The effect of fiscal deficit on current account deficit is significantly negative in long run, hence a twin divergence hold.
Su and Nguyen (2021)	• 31 OECD countries • Annual data: 2002-2017 • Panel quantile regression with fixed effect • Trade balance, fiscal balance, private investment, saving, GDP per capita	• Fiscal balance and trade balance ae moving together, suggesting the existence of twin deficits.
Dey and Tareque (2022)	• Bangladesh • Annual data: 1980 to 2018 • ARDL • Current account deficit, fiscal deficit	• Budget deficit has a significant positive effect on current account deficit in short run and long run.
Sahoo et al. (2022)	• India • Annual data: 1980-1981, 2014-2015 • VECM • CAB, REER, FB, age dependency ratio, trade	• Fiscal balance is significantly and positively linked with CAB.
Hailemareiam (2023)	• Ethiopia • Annual data: 1987-2021 • ARDL • Current account deficit, fiscal balance, real GDP, REER	• Current account deficit has a positive relationship with fiscal balance in the long run.

Table 2.1 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Soo et al. (2023a)	• 48 Asia countries • Annual data: 1990-2021 • PMG • CAB, FB, public debt, age dependency ratio for old, age dependency ratio for young, ICT, real GDP	• CAB has positive significant relationship with FB.

Table 2.2: Summaries of Literature Reviews on Current Account Balance and Debt

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Aristovnik (2008)	• 26 emerging countries of Eastern Euro, former Soviet Union countries (8 CEE, 6 SEE, 12 CIS) • Annual data: 1992-2003 • Panel fixed effect model • CAB, budget balance, openness, external debt, age dependency ratio, REER, GDP growth rate	• External debt and REER indicate positive significant relation with CAB. • Shock in public budget rates is coming with current account deterioration, which verifying twin deficit hypothesis.
Alam and Taib (2013)	• 6 debt trap countries, 8 non-debt trap countries • Annual data: 1971-2000 • Panel random effect model • Current account deficit, budget deficit, external debt	• Positive relation between external debt with budget deficit and current account deficit. • In DTC, stronger coefficient of external debt and budget deficit indicates demand of external debt and a weaker coefficient of current account deficit signals, whereas for NDTC is vice versa.

Table 2.2 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Lazar and Andreica (2013)	• North Euro, South Euro • Annual data: 2000-2011 • Fixed effect model • Current account deficit, government debt, private sector debt	• For South Euro, current account deficit has strong and positive influence on government debt. • For North Euro, CAB and private debt has positive but lower influence.
Neaime (2015)	• Lebanon • Annual data: 1970-2013 • Time series model • Current account, budget deficit, public debt, exchange rate policies	• External and internal debt are not sustainable. • In long run, both deficits have no relation, whereas in short run there is unidirectional causal relation.
Samsu and Ismail (2020)	• 13 middle-income countries • Annual data: 1990-2015 • Panel ARDL model • Current account balance, fiscal balance, GDP per capita growth, openness, shirt term debt, external debt	• External debt shows insignificance with CAB in high public debt countries. • Short term debt is positively and significantly linked to current account position in long run.
Soo et al. (2023a)	• 48 Asia countries • Annual data: 1990-2021 • PMG • CAB, FB, public debt, age dependency ratio for old, age dependency ratio for young, ICT, real GDP	• CAB has positive significant relationship with public debt.

Table 2.3: Summaries of Literature Reviews on Current Account Balance and Age Dependency Ratios

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Brissimis et al. (2012)	• Greece • Annual data: 1960-2007 • Regime-switching model • Current account, fiscal account, REER, real GDP, age dependency ratio, interest rate	• Dependency ratios do not play a role in explaining evolution of current account.
Kumhof et al. (2012)	• UK • Annual data: 1970-2007 • DSGE model • Government budget, current account , age old and young dependency ratios, real GDP growth	• Old dependency ratio is negatively affecting the CAB in long run.
Lane and Pels (2012)	• 30 EU countries • Annual data: 1995-2007 • OLS with robust standard errors • Current account balance, age dependency ratio for old and young	• Demographic has strong effect on saving and investment behaviour. • The overall effect of both dependency ratios is insignificant to current account.
Brissimis et al. (2013)	• 17 Euro countries • Annual data: 1980-2008 • Fixed effects model, seemingly unrelated regression (SUR), FMOLS • Current account balance, real GDP, REER, fiscal balance, dependency ratio	• In fixed effects, all variables show a statistically significant relation to CAB. • In SUR estimation, life-cycle hypothesis does not find support.

Table 2.3 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Gehringer (2013)	• 20 EU member states • Annual data: 1995-2009 • Fixed effect model • Current account, dependency ratios, GDP growth	• Old age dependency ratio is significant with pooled OLS.
Gossé and Serranito (2014)	• 21 OECD countries • Annual data: 1974-2009 • Panel VECM model • Current account balance, fiscal balance, REER, real GDP, interest rate, age dependency ratio, trade, oil balance	• Dependency ratio is significant when fixed effect included in regression, with negative coefficient and significant at 10% level.
Girma (2018)	• Ethiopia • Annual data: 1980-2015 • Inter-temporal approach, ARDL model • CAB, budget balance, REER, dependency ratio	• There is positive relationship between CAB and age dependency ratio in long run, whereas in short run there is negative statistically significant relationship.
Behera and Yadav (2019)	• India • Annual data: 1980-2012 • Time series model • Current account balance, age dependency	• Rise in age dependency increases current account deficit significantly.
Šima (2020)	• 173 countries • Annual data: 1995-2016 • Panel fixed effects regression • Current account balance, age dependency ratio for old and young, total population	• Population ageing has greatest impact on the government current account balance.

Table 2.3 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Sahoo et al. (2022)	• India • Annual data: 1980-1981, 2014-2015 • VECM • Current account balance, real effective exchange rate, fiscal balance, age dependency ratio, trade	• Age dependency ratio is significantly negative affect the CAB.
Soo et al. (2023a)	• 48 Asia countries • Annual data: 1990-2021 • PMG • CAB, FB, public debt, age dependency ratio for old, age dependency ratio for young, ICT, real GDP	• CAB has positive significant relationship with age dependency ratio for old and age dependency ratio for young.

Table 2.4: Summaries of Literature Reviews on Current Account Balance and Real GDP

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Brissimis et al. (2012)	• Greece • Annual data: 1960-2007 • Regime-switching model • Current account, fiscal account, private investment rate, REER, real GDP, age dependency ratio	• Real GDP shows positive coefficient to current account deficit.
Gehringer (2013)	• 20 EU member states • Annual data: 1995-2009 • Fixed effect model • Current account, dependency ratios, GDP growth	• Growth of real GDP has a strong impact on current account with fixed effect model.

Table 2.4 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Gossé and Serranito (2014)	• 21 OECD countries • Annual data: 1974-2009 • Panel VECM model • Current account balance, fiscal balance, REER, real GDP, interest rate, age dependency ratio	• There is long run relationship between current account and real GDP.
Mwangi (2014)	• Kenya • Annual data: 1970-2010 • Structural vector autoregressive approach (SVAR) • Current account balance, GDP, REER, budget deficit, inflation	• Impact of GDP growth rate, REER, and budget deficit are positive on CAB.
Bollano and Ibrahimaj (2015)	• 11 Central and East European countries outside Euro area • Quarterly data: 2005:Q1-2014:Q4 • Panel VAR model • CAB, FB, REER, domestic GDP	• Increase in domestic GDP has negative effect on CAB.
Cavdar and Aydin (2015)	• 16 developed and developing OECD countries • Annual data: 2005-2014 • Binary panel logit model • Current account deficit, real GDP, CPI, public expenditure	• When real GDP rises by 1%, the estimated current account deficit will increase by 0.01.
Kurt and Ozkiper (2015)	• 20 developing countries • Annual data: 1995-2013 • Fixed effect model • Budget deficit, current account balance, GDP growth rate, RIR	• 1% rise in GDP growth rate leads to current account deficit falling 0.07%.

Table 2.4 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Bucevska (2018)	• Albania, Croatia, Macedonia, Serbia, Turkey • Quarterly data: 2005:Q1-2017:Q4 • Feasible Generalized Least Squares (FGLS) • CAB, fiscal balance, domestic investment, real GDP growth rate	• Real GDP growth rate has negative and high statistically effect on CAB, where 1% raise in GDP growth leads to 0.13-0.29% rise in current account deficit.
Girma (2018)	• Ethiopia • Annual data: 1980-2015 • Inter-temporal approach, ARDL model • CAB, budget balance, REER, dependency ratio	• The short run and long run response of CAB and real GDP growth rate is negative significant.
Mohanty (2019)	• India • Annual data: 1970-1971 to 2013-2014, 1980-1981 to 2013-2014 • ARDL • Current account deficit, fiscal deficit, GDP growth, exchange rate	• There is positive effect of GDP growth on CAD in long run.
Ahmad et al. (2020)	• Pakistan, Nepal, India, Bangladesh, Sri Lanka • Annual data: 1990-2018 • External balance assessment regression, macroeconomic-balance approach • Current account balance, net foreign assets, fiscal balance, population growth, trade, real GDP growth	• Higher GDP growth can attract capital flows and make current account worsen, where 1% rise in RGDP growth will negatively impact mean value of CAB by 0.24%.

Table 2.4 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Feriyanto (2020)	• Indonesia • Annual data: 2000-2017 • ECM model • Current account balance, exchange rate, real GDP, FDI	• In short run and long run, real GDP has not significant effect on the current account.
Hailemareiam (2023)	• Ethiopia • Annual data: 1987-2021 • ARDL • Current account deficit, fiscal balance, real GDP, REER	• Current account deficit has positive relationship with real GDP in the long run.

Table 2.5: Summaries of Literature Reviews on Current Account Balance and REER

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Aristovnik (2008)	• 26 emerging countries of Eastern Euro, former Soviet Union countries (8 CEE, 6SEE, 12 CIS) • Annual data: 1992-2003 • Panel fixed effect model • CAB, budget balance, external debt, age dependency ratio, REER, GDP growth rate	• REER indicates positive significant relation with CAB.
Brissimis et al. (2012)	• Greece • Annual data: 1960-2007 • Regime-switching model • Current account, fiscal account, private investment rate, REER, real GDP, age dependency ratio	• Appreciation of REER will adversely affect current account.

Table 2.5 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Forte and Magazzino (2013)	• 33 European countries • Annual data: 1970-2010 • Panel GLS • Current account balance, government budget, REER, real GDP growth	• REER has adverse effects on CAB.
Mwangi (2014)	• Kenya • Annual data: 1970-2010 • Structural vector autoregressive approach (SVAR) • Current account balance, GDP, REER, budget deficit, inflation	• REER has long lasting influence on current account with positive impact.
Bollano and Ibrahimaj (2015)	• 11 Central and East European countries outside Euro area • Quarterly data: 2005:Q1-2014:Q4 • Panel VAR model • CAB, FB, REER, domestic GDP	• Depreciation of REER does not have immediate effect on CAB.
Das (2016)	• 27 high-income industrial, 32 emerging countries, 47 developing countries • Annual data: 1980-2011 • Panel GMM • Current account balance, real GDP, REER, openness	• REER is statistically significant and negative impact to current account balance.
Saidam and Sarmidi (2017)	• Malaysia • Quarterly data: 1988:Q1-2015:Q4 • ARDL approach • Current account, fiscal deficit, REER, RIR	• REER is statistically significant in long run, where 1 unit rises of REER will decrease current account surplus by 0.108%.

Table 2.5 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Afonso and Opoku (2018)	• 18 OECD countries • Quarterly data: 1995:Q1-2018:Q1 • Panel VAR model, fixed effect • Current account balance, fiscal balance, REER	• The impact of REER is not statistically significant to CAB.
Girma (2018)	• Ethiopia • Annual data: 1980-2015 • Inter-temporal approach, ARDL model • CAB, budget balance, REER, dependency ratio	• REER is positive and statistically significant to CAB in long run, while negative significant in short run.
Mohanty (2019)	• India • Annual data: 1970-1971 to 2013-2014, 1980-1981 to 2013-2014 • ARDL • Current account deficit, fiscal deficit, GDP growth, exchange rate	• Exchange rate has insignificant impact on CAD in short run and long run.
Udayanga (2019)	• Sri Lanka • Annual data: 1990-2017 • Multiple regression model • BOP balance, inflation rate, exchange rate	• Exchange rate is highest negatively influence BOP balance.
Feriyanto (2020)	• Indonesia • Annual data: 2000-2017 • ECM model • Current account balance, exchange rate, real GDP, FDI	• In short run, exchange rate has negative significant effect to current account, while in long run it has not significant affect.
Hailemareiam (2023)	• Ethiopia • Annual data: 1987-2021 • ARDL • Current account deficit, fiscal balance, real GDP, REER	• Current account deficit has positive relationship with REER in the long run.

Table 2.6: Summaries of Literature Reviews on Trade and ICT

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Freund and Weinhold (2004)	• 56 countries • Annual data: 1995-1999 • Panel data estimation, augmented baseline model, gravity model estimation • Trade, GDP, population, geographic distances, web hosts attribution	• 10% increase in growth of web hosts, leads to 0.2% increase in export growth. • Rapid growth in internet implies a notable contribution to trade growth.
Clarke and Wallsten (2006)	• 52 high-income countries, 46 developing countries • Annual data: 2001 • OLS, two-stage least squares (2SLS), robustness check • Export, internet, GDP per capita, population	• Developing countries tend to have higher rates of internet access and thus improve export performance. • 1% increase in number of internet hosts per 100 people will increase total exports as percent of GDP by 0.05%.
Dermikan et al. (2009)	• 175 countries • Annual data: 1962-2005 • OLS estimation • Internet users per 100 population, trade, GDP, distance between cities, language	• ICT use has a more positive impact on bilateral trade between large economies than between smaller economies. As internet use increases, trade flows also increase.
Chung et al. (2013)	• 20 APEC countries • Annual data: 1997-2006 • Gravity model • Trade, access to internet, access to mobile telephony, access to fixed-line telephony	• The penetration of fixed-telephone lines has largest impact on export. • 1% increase in fixed telephone penetration, increase export trade by 0.36%. • 1% increase in internet users will stimulate 0.17% trade increase in export. • In the export sector, growth in some ICT products has "+" effects on trade. • Increasing the use of ICT has significant positive effect on exports, but no effect on imports.

Table 2.6 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Yushkova (2014)	• 40 OECD countries • 2011 • Intuitive gravity model • Total export of goods, geographical distance between countries, internet use	• The coefficient linking internet use and trade is positive and statistically significant. • The internet use in the exporting and importing country increase by 1unit, total exports raise by approximately 27%.
Bankole et al. (2015)	• 28 African countries • Annual data: 1998-2007 • PLS-based structural equation model • Trade, telecommunications, institutional quality, education attainment	• Telecommunications infrastructure has a positive and statistically significant influence on intra-African trade.
Lin (2015)	• 200 countries • Annual data: 1990-2006 • Gravity model, GMM estimation • Export, population, distance between two countries, internet users per 100 people	• The internet effect is higher in promoting export.
Ozcan and Nath (2016)	• Turkey • Annual data: 1948-2014 • Pooled OLS, fixed effect model • Export, import, fixed-telephone subscriptions, mobile-cellular subscriptions, households with computer, households with internet, ICT indices (individuals using internet, fixed broadband subscriptions, mobile-broadband subscriptions)	• ICT indices have significant positive impacts on exports. • ICT has the largest impact on exports.

Table 2.6 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Nath and Liu (2017)	• 49 countries • Annual data: 2000-2013 • Gravity model • GDP, exports, imports, population, ICT access (fixed-telephone lines, mobile-cellular subscriptions, international internet bandwidth), ICT use (percentage of individuals using internet, fixed-broadband subscriptions)	• ICT is statistically significant in relation to trade volume. • ICT development has significant positive contributions to growth of service trade. • The increasing use of ICT has positive impact on exports.
Ozcan (2018)	• Turkey • Annual data: 2000-2014 • Gravity model, pooled OLS, GMM estimation, sensitivity analyse, GMM estimation • GDP, population, binary dummy, export, import, ICT development index	• ICT development index (IDI) has a positive and significant impact on exports. • 1% increase in IDI rises 0.4% in export. • ICT has a positive and significant impact on export of Turkey to its developing trading partners. • High levels of ICT access and skills are crucial to boost export volume.
Toader et al. (2018)	• EU countries • Annual data: 2000-2017 • GMM estimation • ICT infrastructure, GDP per capita, inflation rate, gross fixed capital, unemployment rate, trade openness, inflows of FDI, government expenditure	• A positive and highly significant impact of ICT infrastructure on economic growth. • 1% increase in use of ICT infrastructure will contribute GDP per capita growth between 0.0767% on fixed-broadband subscriptions and 0.396% on mobile cell subscriptions.

Table 2.6 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Wang and Choi (2019)	• BRICS • Annual data: 2000-2016 • Fixed effect model • GDP, population, unemployment, fixed-broadband subscriptions, fixed-telephone subscriptions, percentage of individuals using the internet, mobile-cellular telephone subscriptions	• Fixed-broadband subscriptions has significant and positive coefficient with export, 1% increase in fixed-broadband subscriptions rate will lead to 0.22% increase in exports. • The effect of ICT is more positive on exports than on imports. • The higher the ICT levels in value chain, the smaller the effect of distance on exports and imports. • The effect of ICT levels on trade is greater over time.
Kurniawati (2022)	• 12 high-income and 13 middle-income Asia countries • Annual data: 2000-2018 • FMOLS estimation • Economic growth, labour, fixed telephone lines, mobile phone subscribers, internet users, trade openness, financial development	• ICT has a statistically significant influence on Asia's economic growth. • In high-income Asia countries, penetration of internet users is highly significant. • In middle-income Asia countries, telephone line and mobile phone penetration is highly significant.

Table 2.7: Summaries of Literature Reviews on Twin Deficits and Debt

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Gevorkyan (2010)	• 12 CIS countries • Annual data: 1989-2008 • OLS regression with panel corrected standard errors (OLS-PCSE) • Current account balance, fiscal budget, investment, debt	• Debt service suggests the same positive relation between current account and fiscal budget.
Nickel and Tudyka (2014)	• 17 European countries • Annual data: 1970-2010 • Panel VAR approach • Real GDP, government debt, trade balance	• Twin deficits occur at low level of debt. • Twin divergence appears at high level of debt.
Šulikovᡠ and Tykhonenko (2017)	• 14 European countries • Annual data: 1995-2012 • Panel threshold model • Current account balance, budget balance, public debt, openness, real GDP, interest rate	• Public debt is less than 40.2% threshold, there is significant negative relation. • Twin deficits exist between 40.2% and 96.6% of threshold debt level, which is positive relationship. • Twin divergence occurs when exceed 96.6% of threshold debt.
Soo and Kueh (2019)	• 6 ASEAN countries • Annual data: 1990-2016 • Panel regression model • Current account balance, fiscal balance, public debt	• Public debt is affecting relation of both balances, where both show a positive and statistically significant relationship.
Furceri and Zdzienicka (2020)	• 114 developing countries • Annual data: 1990-2015 • ARDL model • Current account balance, government spending shock, exchange rate, public debt, openness	• The impact of fiscal shock to CAB is weaker with high public debt. • 1% of GDP fiscal contraction improves the CAB by 0.8% point of GDP.

Table 2.7 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Okombi (2020)	• 30 African countries • Annual data: 2004-2017 • Panel threshold model • Current account balance, fiscal balance, public debt, external debt, domestic debt, investment, real GDP growth, interest rate, trade	• For public debt, external debt, and domestic debt, debt threshold level is at 78.4%, 65.25% and 13.5% respectively. • When below debt thresholds, fiscal balance has significantly positive effect on current account, while beyond debt threshold, fiscal balance has insignificant effect.
Rajakaruna et al. (2021)	• Bhutan, Sri Lanka, Maldives, Pakistan, India • Panel threshold model • Annual data: 1980-2018 • Public debt, budget balance, CPI, current account, openness, savings and investments	• Double threshold model with threshold debt levels at 46.21% and 65.80%. • When below debt threshold of 46.21%, there is positive significant relationship between twin imbalances. • In between threshold debt level of 46.21% and 65.80%, it is a negative significant relationship. • Above 65.80% debt threshold level, twin imbalances relationship is positive significant.
Bousnina and Gabsi (2023)	• 15 countries in MENA (Middle East and North Africa) • Panel threshold model • Annual data: 2003-2019 • Public debt, budget balance, current account balance	• Double threshold model with threshold debt levels at 36.71% and 72.99%. • Below threshold debt level of 36.71%, there is negative relationship between budget balance and current account. • In between threshold debt levels, twin deficits occurred. • When beyond 72.99% debt threshold, twin divergence is confirmed.

Table 2.7 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Soo et al. (2023b)	• 6 ASEAN countries • Panel threshold model • Annual data: 1990 to 2021 • Public debt, current account balance, fiscal balance	• Single threshold model with public debt-to-GDP threshold at 63.36%. • When below threshold level, negative significant relation between current account balance and fiscal balance. • When above threshold, current account balance and fiscal balance shows positive significant nexus.

Table 2.8: Summaries of Literature Reviews on Economic Growth and Debt

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Caner et al. (2010)	• 75 developing countries, 26 developed countries • Annual data: 1980-2008 • Hansen threshold regression • Initial GDP, inflation, trade openness, public debt, GDP growth	• The public debt threshold is 77% for developed countries and when debt is above this level, 1% increase in public debt, leads to 0.017% decrease in annual real growth. • The debt threshold is 64% for emerging economies, where 1% increase in public debt, leads to 0.02% shrink in annual real growth.
Reinhart and Rogoff (2010)	• 20 advanced countries, 24 emerging countries • Annual data: 1946-2009 • Mean comparison • External debt, GDP growth	• When threshold level is below 90%, the relation of debt and economic growth is weak, while above 90%, the economic growth falls. • Advanced and emerging countries both have similar threshold value.

Table 2.8 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Cecchetti et al. (2011b)	• 18 OECD countries • Annual data: 1980-2010 • Growth regression model • Public debt, corporate debt, household debt, gross saving, population growth, human capital, dependency ratio	• High debt level is bad for growth. • The public debt threshold is at 85%, where further raise in debt will have significant impact on growth. • The corporate debt threshold is at 90%; and the household debt threshold is at 85%.
Checherita-Westphal and Rother (2012)	• 12 Euro countries • Annual data: 1970-2008 • Panel fixed effect • GDP per capita growth rate, government debt, fiscal indicators, real interest rate, saving, population growth	• There is a nonlinear impact of debt on growth with a turning point of 90-100%. • The negative influence of high debt estimates to start from levels around 70-80%.
Égert (2015)	• 20 advanced countries, 24 emerging countries • Annual data: 1946-2010 • Non-linear Hansen threshold model • Public debt, real GDP growth rate	• There is a negative nonlinear relation between public debt and growth above threshold debt, while positive relationship is identified below threshold debt. • The negative correlation is at a very lower level of public debt, between 20% and 60% of GDP.
Kueh et al. (2016)	• Malaysia • Quarterly data: 1991:Q1-2014:Q4 • Unit root test, JJ cointegration test, threshold regression model • GDP, public debt	• There are double public debt threshold levels at 41% and 53%. • When debt threshold is below 41%, it shows positive impact towards economic growth. • The influence of debt on economic growth is reduced between 41% and 53% of public debt threshold levels. • When public debt threshold exceeds 53%, public debt and economic growth perform an inverse relation.

Table 2.8 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Kueh et al. (2017)	• Malaysia • Annual data; 1980-2015 • Unit root test, JJ cointegration test, threshold regression model • GDP, domestics debt, external debt, export, nominal exchange rate	• Domestic debt has positive effect on growth when debt threshold is less than 37% of GDP, whereas it shows negative impact with growth when beyond threshold level. • External debt demonstrates negative impact on growth when below 4% of threshold level; when above 4% of threshold, it implies a positive relationship.
Bentour (2020)	• 20 developed countries • Annual data: 1880-2010 • Hansen kink regression model • Public debt growth, GDP	• Ireland has statistically significant threshold of 27.3%, where debt value reduces above threshold. • The effect is negative for debt ratios below threshold level, of France, New Zealand, Italy, Spain, Sweden, and Switzerland. • UK, US, and Norway have positive debt effect towards growth when below threshold level. • The threshold effect of Japan is statistically significant negative below threshold level at 22.9%.
Law et al. (2021)	• 71 developing countries • Annual data: 1984-2015 • Dynamic panel threshold, panel quantile regression • Public debt, real GDP per capita, initial income, population growth, inflation	• Debt has a negative and statistically significant impact on economic growth at high level of public debt. • The coefficient of debt is a positive but insignificant effect on economic growth at low level of public debt.

Table 2.8 continued

Authors (Year)	Sample / Data / Methodology / Variables	Findings
Awadzie et al. (2022)	• Ghana • Annual data: 1990-2020 • Threshold autoregressive model • GDP per capita, public debt, inflation rate	• The public debt-to-GDP threshold is at 57.09%. • When above the threshold level, the economic growth is insignificant to public debt. • When below threshold level, there is a positive relationship between public debt and economic growth.
Obiero and Topuz (2023)	• Kenya • Annual data: 1970-2018 • Smooth transition regression model • Public debt, internal debt, economic growth	• Public debt-to-GDP threshold is at 33.29%. • Above public debt threshold, growth is positively affected by public debt. • Below the threshold, public debt has negative impact on economic growth.

Table 2.9: Empirical Papers on Asia Countries/Region

Variables	Authors (Year)	
Fiscal balance	Lau et al. (2010) Bose and Jha (2011) Nieminen (2011) Azgun (2012) Lam (2012) Saysombath and Kyophilavong (2013) Tsen (2013) Van Bon (2014) Kurt and Ozkiper (2015) Neaime (2015)	Mumtaz and Munir (2016) Saidam and Sarmidi (2017) Banday and Aneja (2019) Behera and Yadav (2019) Mohanty (2019) Ahmad et al. (2020) Handoyo et al. (2020) Magazzino (2021) Dey and Tareque (2022) Sahoo et al. (2022) Soo et al. (2023a)
Debt	Alam and Tain (2013) Neaime (2015)	Samsu and Ismail (2020) Soo et al. (2023a)
Age dependency ratio	Behera and Yadav (2019) *Š*ima (2020)	Sahoo et al. (2022) Soo et al. (2023a)
Real GDP	Kurt and Ozkiper (2015) Mohanty (2019)	Ahmad et al. (2020) Feriyanto (2020)
REER	Das (2016) Saidam and Sarmidi (2017) Mohanty (2019)	Udayanga (2019) Feriyanto (2020)
Trade and ICT	Freund and Weinhold (2004) Clarke and Wallsten (2006) Dermikan et al. (2009) Chung et al. (2013) Lin (2015)	Ozcan and Nath (2016) Nath and Liu (2017) Ozcan (2018) Kurniawati (2022)
Twin deficits and debt	Soo and Kueh (2019) Furceri and Zdzienicka (2020)	Rajakaruna et al. (2021) Soo et al. (2023b)
Economic growth and debt	Caner et al. (2010) Reinhart and Rogoff (2010) *É*gert (2015)	Kueh et al. (2016) Kueh et al. (2017)

2.8 A Remark on Research Gaps

Most of the previous studies aimed to test the twin deficit hypothesis and concentrated on developed countries, such as European countries, where little consideration is given to the association between current account imbalance, fiscal balance, and debts. Additionally, the current account imbalances and debt problems in the Asia region have not been the subject of consistent investigation. As a result, there is a research gap that must be filled regarding the analysis of current account imbalances and debt throughout the entire Asia region. Moreover, pooling Asia countries in the study can help to identify the common trends and patterns across the region, helps to improve the accuracy and reliability of the estimates, facilitate cross-country comparisons and benchmarking, and provides a more comprehensive and nuanced understanding of the economic dynamics and challenges facing the region.

Likewise, although researchers tend to use the same variables in various previous studies, the experience of the same issue among countries is found to be inconsistent. The results of one country differ from those of another when various econometric approaches and model assumptions are applied to the data from the same country, even though this assumption is theoretically reasonable (Mukhtar et al., 2007; Shastri et al., 2017). As an example, there is limited research on the role of household debt. However, given the frequent inclusion of household debt as a variable in the studies regarding the current account imbalances and indebtedness, further research is necessary into how the HD has an

impact on the current account of Asia countries. In addition, each country will show unique social, political, and economic characteristics. Furthermore, the time frame used may also have an impact on the outcomes of the study. Hence, theoretical rationality does not guarantee its empirical reality. Even if similar research objectives and variables are adopted, there are still many factors that may affect the empirical results of the research. In other words, the outcome of the results is subjective and time bound.

Apart from that, by reviewing all the available literature by different researchers, the statistically significant relationship between the current account balance and independent variables is supported. Additionally, under the panel threshold model, with different indebtedness, current account imbalances will perform different characteristics with debts. The threshold level of debt as a percentage of GDP may vary depending on the country/region and type of indebtedness involved. Previous empirical studies have analysed the existence of double deficits and twin divergence characteristics based on the different degrees or levels of debt and different indebtedness.

CHAPTER 3

DATA AND METHODOLOGY

3.1 Introduction

The purpose of this study is to analyse the determinants of current account imbalance, to examine the impacts of different type of debts on current account balance and fiscal balance, and to assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts. This research involves 48 countries in the whole Asia region (refer to Appendix A). The research covered the time from the year 1990 to 2020. Additionally, the empirical model in this study is a balanced panel regression model. Hence, this study is implemented with panel analysis. In accordance with González et al. (2017), the regression models for panel data often assume that heterogeneity in the data can be fully captured by individual effects and time effects.

Firstly, in this study, the determinants of current account imbalance will be analysed, and the independent variables include fiscal balance, public debt, age dependence ratios for the young and elderly, ICT, real GDP, and real effective exchange rate. Second, with household debt included as a new independent variable, the impact of different type of debts on twin imbalances will be examined. Thirdly, the relationship between the CAB and FB on threshold level of different types of debts are assessed. Hence,

to achieve the stated goals, many important steps must be taken. The procedures of identifying the endogenous and exogenous variables, justifying the methods and estimations that will be employed, analysing the empirical research, and drawing conclusions.

In this chapter, the development of empirical models will be discussed in the first part. At the same time, the empirical model is the methodological approach utilised in this research. In addition, it can also be used to express equation models related to this research. The next section contains a discussion about data description. In this section, the variables used, data period, data frequency, and data source are stated. Additionally, in the following section, tests, and methods for investigating variables will be discussed. The last part of this chapter contains a summary of this chapter.

3.2 Empirical Model

This research intends to analyse the determinants of current account imbalance, to examine the impacts of different type of debts on twin imbalances, as well as assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts in 48 Asia countries. Anwar and Nguyen (2010) stated that the panel data model including time series factors and cross-sectional conditions is suitable for this research. In this study, there are four main models to be adopted. FB, ADRO, ADRY, ICT, real GDP, and REER are independent variables in the first model. Additionally, for the 2nd

model (Model 2), the HD acts as another exogenous variable is added to Model 1 to examine the impacts of different type of debts on twin imbalances. Panel splitting threshold regression is used in Model 3 and Model 4, to assess the relationship between current account balance and fiscal balance on the threshold level of different types of debts.

The primary basic panel analysis model specification for this research study is labelled as Model 1, and expressed as Equation 3.1 as shown in the following:

$$CAB_{it} = \alpha + \beta_1 FB_{it} + \beta_2 PD_{it} + \beta_3 ADRO_{it} + \beta_4 ADRY_{it} + \beta_5 ICT_{it} + \beta_6 RGDP_{it} + \beta_7 REER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.1)}$$

where

CAB_{it} = Current account balance of country i at time t;

FB_{it} = Fiscal balance of country i at time t;

PD_{it} = Public debt of country i at time t;

$ADRO_{it}$ = Age dependency ratio for old of country i at time t;

$ADRY_{it}$ = Age dependency ratio for young of country i at time t;

ICT_{it} = ICT of country i at time t;

$RGDP_{it}$ = Real GDP of country i at time t;

$REER_{it}$ = Real effective exchange rate of country i at time t;

α = Constant term; and

ε_{it} = Error term or stochastic term.

The balanced panel Model 1 is a linear function, on the other hand, it has a set number of variables and coefficients, all of which are exactly equal to one. The variables in the equation model are applied in logarithmic form to generate the equation model with the best fitting model. As a result, the following Equation 3.2 represents the equation using the logarithm.

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD_{it} + \beta_3 LADRO_{it} + \beta_4 LADRY_{it} + \beta_5 LICT_{it} + \beta_6 LRGDP_{it} + \beta_7 LREER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.2)}$$

Furthermore, to meet the aim of examining the impact of different type of debts on twin imbalances, household debt acts as another debt independent variable are added into Model 1. Hereafter, a new model with household debt variable is created as Model 2. The equation for Model 2 is demonstrated as Equation 3.3 at below:

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD_{it} + \beta_3 LHD_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 LREER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.3)}$$

where

HD_{it} = Household debt of country i at time t;

In addition, the 3rd objective is to assess the relationship between current account balance and fiscal balance on threshold level of different types of debts. Thus, estimation strategies and model specifications are also used in this study. In previous studies, researchers attached great importance to the threshold model, as examples, Hansen (1996, 1999, 2000), Caner (2002), Cordella et al. (2005), Caner et al. (2010), Wang (2015), *Šulikovά* and Tykhonenko (2017), and Law et al. (2021).

Hansen (2000) stated that the threshold model has a broad introduction in economics. Hansen (2000) took the lead in studying the likelihood ratio test of threshold variables and introduced reasoning behaviour into this method. Likewise, an empirical sample segmentation or splitting method based on sustainable distribution variables is used in this study. The sample is consequently divided into two regimes using the threshold variable.

The ordinary structural equations that comply with the view of Hansen (2000) are tabulated as the following.

$$y_i = \theta'_1 x_i + e_i, \qquad q_i \leq \gamma \qquad \text{(Eqn. 3.4)}$$

$$y_i = \theta'_2 x_i + e_i, \qquad q_i > \gamma \qquad \text{(Eqn. 3.5)}$$

The Equation 3.4 and Equation 3.5 both can be integrated and written in a single equation as shown below:

$$y_i = \theta'_1 x_i 1(q_i \leq \gamma) + \theta'_2 x_i 1(q_i > \gamma) + e_i \qquad \text{(Eqn. 3.6)}$$

where y_i is the dependent variables, x_i is set of exploratory variables, q_i represents the threshold variable, 1(.) is the function of $q(x_i)$ that has continuous distribution, γ is denoting the threshold level, θ'_1 implies the coefficients of parameter interest if threshold variable below estimated threshold level, and the θ'_2 indicates coefficients of parameter interest if threshold variable more significant than the predicted threshold level.

In addition, the interaction between the current account balance (which is initially the endogenous variable in this study) and the debts (demonstrate as exogenous variable) is the primary motivating factor for conducting this research, to assess the relationship between the current account balance and fiscal balance on threshold level of different type of debts that are perhaps below or above the threshold level. In this study, the debt threshold is fixed at 50% of the GDP. Furthermore, moving to the third model, it is a splitting model, which is utilised in this study. Splitting model is a model specification that considers the different debt levels in this study. In this study, there are two different types

of debts that are being adopted, which are public debt (PD) and household debt (HD). Below indicates the splitting model for two different debts.

First, the splitting model for public debt (PD) is:

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD1_{it} + \beta_3 LADRO_{it} + \beta_4 LADRY_{it} + \beta_5 LICT_{it} + \beta_6 LRGDP_{it} + \beta_7 REER_{it} + \varepsilon_{it}; \quad PD1 \leq \gamma \quad \text{(Eqn. 3.7)}$$

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD2_{it} + \beta_3 LADRO_{it} + \beta_4 LADRY_{it} + \beta_5 LICT_{it} + \beta_6 LRGDP_{it} + \beta_7 REER_{it} + \varepsilon_{it}; \quad PD2 > \gamma \quad \text{(Eqn. 3.8)}$$

For the Equation 3.7 and Equation 3.8 in the single splitting model, both can be combined and displayed in the form as:

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD1_{it} + \beta_3 LPD2_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 REER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.9)}$$

where $PD1_{it}$ implies to debt below threshold level of country i at time t and $PD2_{it}$ refers to debt above threshold level of country i at time t.

Next, the splitting model for household debt (HD) is:

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LHD1_{it} + \beta_3 LADRO_{it} + \beta_4 LADRY_{it} + \beta_5 LICT_{it} + \beta_6 LRGDP_{it} + \beta_7 REER_{it} + \varepsilon_{it}; \quad \text{HD1} \leq \gamma \quad \text{(Eqn. 3.10)}$$

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LHD2_{it} + \beta_3 LADRO_{it} + \beta_4 LADRY_{it} + \beta_5 LICT_{it} + \beta_6 LRGDP_{it} + \beta_7 REER_{it} + \varepsilon_{it}; \quad \text{HD2} > \gamma \quad \text{(Eqn. 3.11)}$$

For the Equation 3.10 and Equation 3.11 in the single splitting model, both can be combined and displayed in the form as:

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LHD1_{it} + \beta_3 LHD2_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 REER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.12)}$$

where $HD1_{it}$ implies to debt below threshold level of country i at time t and $HD2_{it}$ refers to debt above threshold level of country i at time t.

As an overall conclusion, there are four research models applied in this study, which are included the Model 1 (basic panel model), Model 2 (basic model add with HD as

independent variable), Model 3 (threshold splitting model for PD), and Model 4 (threshold splitting model for HD).

Model 1 (basic panel model):

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD_{it} + \beta_3 LADRO_{it} + \beta_4 LADRY_{it} + \beta_5 LICT_{it} + \beta_6 LRGDP_{it} + \beta_7 LREER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.13)}$$

Model 2 (basic model add with household debt as independent variable):

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD_{it} + \beta_3 LHD_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 LREER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.14)}$$

Model 3 (threshold splitting model for public debt):

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LPD1_{it} + \beta_3 LPD2_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 REER_{it} + \varepsilon_{it} \quad \text{(Eqn. 3.15)}$$

Model 4 (threshold splitting model for household debt):

$$LCAB_{it} = \alpha + \beta_1 LFB_{it} + \beta_2 LHD1_{it} + \beta_3 LHD2_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 REER_{it} + \varepsilon_{it}; \quad \text{(Eqn. 3.16)}$$

3.3 Data Description

In this study, the panel data model approach is performed. The time frames are covered from 1990 to 2020 and the number of countries is 48 Asia countries (refer to Appendix A). Hence, in sum, there are comprising of 1488 observations. All data used in this study are collected annually. The research data is retrieved from UNCTADstat (2021), CEIC Global Database (2022), World Development Indicators (2022), World Bank, and World Economic Outlook Database (2022), IMF. The current account balances for 48 individual countries make up the dependent (endogenous) variable. In conjunction, the explanatory (exogenous/independent) variables implicated are fiscal balance, public debt, household debt, age dependency ratio for old, age dependency ratio for young, ICT, real GDP, and the real effective exchange rate.

Moreover, the expected findings or results of the estimated variables are described below (refer to Table 3.1). First, according to the conventional basic model, a positive and statistically significant relationship between the FB and the CAB is anticipated. In addition,

the current account balance and public debt are likely to have a significant negative relationship. Real GDP is anticipated to show a positive association with the current account balance, and it is forecasting that the age dependence ratio and REER have a statistically significant nexus and are positively correlated with current account positions. Furthermore, ICT is implied to have positive and statistical relationship with trade, hence, ICT is supposed to have an indirect positive impact with current account balance.

When proceeding to Model 2, household debt is added into the model. Current account balance and fiscal balances, commonly known as double balances, are predicted to be positive significantly from both public debt and household debt. Additionally, the current account balance is forecasted to display a positive sign in the threshold model when the debt level is below the estimated threshold level. Conversely, the current account balance should show a negative nexus if the debt amount is higher than the predicted threshold level. Moreover, to make the research clearer, the following subsections contain explanations for all dependent and independent variables.

Table 3.1: Summaries of Expected Results

Objectives	Independent Variables	Expected Sign
To analyse the determinants of current account imbalance	FB	+ve
	PD	-ve
	ADRO	+ve
	ADRY	+ve
	ICT	+ve
	RGDP	+ve
	REER	+ve
To examine the impacts of different type of debts on twin imbalances	PD	+ve
	HD	+ve
To assess the relationship between current account balance and fiscal balance on threshold level of different type of debts	PD & HD	Below threshold is +ve Above threshold is -ve

Notes: FB is fiscal balance; PD is public debt; ADRO is age dependency ratio for old; ADRY is age dependency ratio for young; ICT is information of communications of technology; RGDP is real GDP; REER is real effective exchange rate; HD is household debt; and GMM is a generalized method of moments. Moreover, "+ve" signifies a positive significant relationship and "-ve" implies a negative significant relationship.

3.3.1 Current Account Balance (CAB)

In this study, the primary dependent variable is current account balance. The current account, which can be summed as the trade balance, net current transfers, and total foreign net income, is the primary measure of economic health, according to Aristovnik

(2008) and Soo and Kueh (2019). One of the two key methods for calculating the balance of payments is the current account. In accordance with Sharma (2020), the current account is a significant component of the balance of payments. It comprises of trade in commodities, services, primary income, and secondary income between a nation and the rest of the globe. Even if the "goods and services account" makes up most of the current account, the basic income account replicates payables and receivables for the exchange of goods, services, or non-productive non-financial assets (natural resources). In addition, the second income account illustrates the income redistribution between residents and non-residents. While the current account balance refers to the total impact of the transactions (Sharma, 2020). Current account balances play many roles in the analysis of economic development by decision makers. The economics and growth of a country are also impacted by the current account balance (Aristovnik, 2008). The available data is retrieved from the UNCTADstat (2021) and the current account balance for every country is expressed as a percentage of GDP.

3.3.2 Fiscal Balance (FB)

Fiscal balance is a financial statement that shows government revenue and expenditure (Soo & Kueh, 2019). The country's long-term economic development is implied, which makes it significant as well (Baharumshah et al., 2009). It is suggested that the fiscal deficit and the current account balance are causally related. Consumption and investment constants have a direct impact on the fiscal balance and current account balance.

Nevertheless, the consumption and investment may be different, and sometimes households may increase their savings by paying more taxes. There are two statuses of fiscal balance, namely surplus or deficit. When the fiscal balance is positive, the government gets a fiscal surplus, while if the fiscal balance is negative, the government will get a fiscal deficit. The indicator used to assess the fiscal balance is used to measure the difference between taxation and government expenditure. The tax and government expenditure data are collected from World Economic Outlook Database (2022), IMF. Both the revenues and expenses are measured as a percentage of GDP.

$$Fiscal\ balance = Government\ revenues - Government\ expenditure$$

3.3.3 Public Debt (PD)

According to Aslam and Jaafar (2020), the debts of the federal government are related to the debts owed by a country, and the debts owed by the central government are the debts of the country. Public debt is one type of debt that is owned by local government, where it also known as the national debt, sovereign debt and public interest. Public debt is calculated as the initial debt level plus the present value of all governmental spending. In other words, it explains what a country owes to external lenders, which may include individuals, companies or even governments.

Likewise, the government can initially raise additional money by raising taxes, printing money, borrowing money from domestic or foreign sources, and exploiting previous budget surpluses (Chukwu et al., 2021). When the government chooses to borrow fund rather than take other tax measures to cover its budget deficit, it generates itself a type of debt called public debt. Furthermore, the accumulation of annual budget deficits is another way to quantify governmental debt. These annual deficits are the result of government spending exceeding tax revenue.

Furthermore, Neaime (2015) mentioned that the association between current account deficits, budget deficits and public debt has attracted great attention from scholars and policymakers. Chukwu et al. (2021) agreed that the global economy has a crucial component called public debt. Debts bring an important effect on economic growth, where it will have a positive short-term impact, while in the long run, this impact may become negative due to the risk premium induced by high debt (Bentour, 2020). Cecchetti et al. (2011b) also raised that debt is a two-edged sword, where if used properly it can improve welfare, but if used carelessly it can also cause devastating consequences. The World Economic Outlook Database (2022), IMF, which measures public debt as a percentage of GDP, is where the information on public debt is taken from.

3.3.4 Household debt (HD)

The entire debt owed by everyone living in a family is referred to as household debt. Depending on the type of debt covered, different methods can be used to calculate household debt. Home mortgages, automobile loans, school loans, and credit card debt are examples of common debts. Moreover, estimation of household debt can be made for the entire economy to measure the degree of household indebted relative to the various income indicators or economic scale. In keeping with Belabed et al. (2018), they argued that the raise in household debt and the decline in current account can be illustrated by the interaction between the household income inequality and system.

In addition, Gu et al. (2020) also justified that rise in consumer credit is indicating an increase in household debt, subsequently causing a current account deficit. Simultaneously, The current account deficit is associated with rising income inequality because of the rise in household debt. In other words, the rising level of household debt and the income-to-consumption inequality ratio enhances the current account deficit (Gu et al., 2020). The household debt data is acquired from CEIC Global Database (2022), with unit to percentage of GDP.

3.3.5 Age Dependency Ratios for the Old and Young (ADRO/ADRY)

In keeping with Kim and Lee (2008), Barnes et al. (2010), Jaumotte and Sodsriwiboon (2010), Graff et al. (2012), Morsy (2012), Mainka (2020), and Emara and Kasa (2021), They concluded that the current account balance in the Euro area is affected by the age dependency ratio. The estimate frequently includes the dependency ratios for people of different ages (old & young) as separate variables (Mainka, 2020). The age dependency ratio is population except 15 to 64 years old, whereby those dependent age of people is younger than 15, but older than 64 (Morsy, 2012). The ratio of people that are under aged of 15 is categorized as age dependency ratio for young, while ratio of people older than 64 is considered as age dependency for the old, which are comparing with percentage of people in their working age (Gruber & Kamin, 2007).

Likewise, no matter whether the issues are direct care or pension contributions, Mainka (2020) indicates that the statistic is with the intention of illuminating the working population's burden on the young and old. In other words, it is employed to discuss the financial load of the production population (Emara & Kasa, 2021). Hence, young individuals and older people, relative to other demographic groups, are more likely to contribute to current account deficits in a nation (Gruber & Kamin, 2007). The increase in the number of dependents will lead to a decrease in national savings and an incline in domestic spending, which will lead to a raise in debt levels, a fiscal deficit, and a significant current account deficit. The relevant data of the two groups are from the World

Development Indicators (2022), World Bank, with unit as the percentage of the working age population.

3.3.6 Information and Communications Technology (ICT)

Juh*á*sz and Steinwender (2018) denoted that due to a disproportionate rise in the trading of codable intermediate inputs, ICT has emerged as a key component in fostering the development of global value chains. Since the 1990s, ICT has grown quickly. According to Wang and Choi (2019), they stated that ICT uses in aiding to improve the situation of insufficient trading information, lower the trade barriers, and lessen geographic distances. Besides, the use of ICT has greatly reduced transaction costs, improved transaction efficiency, and expanded transaction volume (Terzi, 2011). Nath and Liu (2017) also mentioned ICT has been developing at an unprecedented rate, paralleling the amazing growth of global services trade. Hence, Future trade will continue to evolve in a way that takes advantage of ICT due to the clear advantages that come with it (Wang & Choi, 2019).

On the other hand, the studies by Lin (2015) and Nath and Liu (2017) concluded that international trade is positively impacted by ICT where this impact is statistically significant, and export is more impacted than import. Additionally, By implementing ICT techniques, developing nations can assist exporters in lowering trade costs and locating potential customers globally, as opposed to driving up imports (Wang & Choi, 2019). When exports in trade increase more than imports which is influenced by ICT, it may bring

the revenue of a country to exceed expenditure, and indirectly influence the current account to move into surplus. Likewise, the proxy for ICT variable is percentage of individuals using the internet, which is determined by applying principle component analysis (PCA). The data on individuals using the internet with unit of percentage of population is obtained from World Development Indicators (2022), World Bank.

3.3.7 Real GDP (RGDP)

The value of all commodities and services that a country's economy produces each year is reflected in its real GDP. According to Emehelu (2021), The total market value of a nation's exports of goods and services is its GDP, while within a certain period, these goods and services are exchanged in currency or trade in the market system. Moreover, since price changes have no impact on actual GDP, it is used to gauge the condition of the economy, whereas it only represents changes in total amount of production. Das (2016) also stated that a grow in real GDP will indicate a higher income, which will subsequently lead to more consumer spending. Thus, this will expand the current account deficit. The data of real GDP for all Asia countries are collected from UNCTADstat (2021), in the unit of USD at constant prices 2015 in millions.

3.3.8 Real Effective Exchange Rate (REER)

According to the IMF, the real exchange rate, as opposed to the weighted average of specific foreign currencies in relation to a cost index, is a gauge of a currency's value. In addition, the weight is established by comparing each country's trade balance to its respective currency. The REER implies a loss in trade competitiveness when it rises since it predicts that exports will cost more while imports will cost less. In addition, REER is also used to assess the monetary value of a currency relative to other major currencies. The data of REER is obtained from World Development Indicators (2022), World Bank, with units of constant 2010 US dollar.

3.4 Methodology

In accordance with this study, there are three specific objectives. To fulfil the aim set for this study, there are several estimations serve as main methodology are decided to be applied, which are dynamic GMM panel estimation, panel threshold quantile estimation, and robustness checks. Firstly, before carrying out those tests and estimations, descriptive statistics is conducted. Descriptive statistics is related to the summary and organization of easy-to-understand data. Besides, it also prosecutes to provide insights that can easily simplify large amounts of data too.

Under this section, the methods employed will be discussed in depth. Before starting to keep on with all tests and estimations, the study is continuing with principle component analysis (PCA). A multivariate technique called PCA is first proposed by Pearson (1901) and then modernized by Hotelling (1933). PCA is employed to determine the most suitable variable that can be adopted as the proxy for ICT variable. Next, in accordance with the main methodology, the dynamic GMM panel estimation is acquired to grab the dynamic view of interaction between CAB and independent variables, and to avoid instrument proliferation. For the threshold debt examination, panel single threshold regression estimation is performed. The robustness checks applied on dynamic GMM panel estimation are GMM estimation (with a 3-year average), PMG estimation, and DOLS estimation. Moreover, the robustness check for panel threshold estimation is panel quantile regression analysis.

Furthermore, in this study, the size of the time dimension (*T*) is 31, while the number of individuals (*N*) is 48. This study is set to be a micro panel dataset with a total number of observations are 1488. The implicated countries are 48 Asia countries. Due to the micro panel dataset, dynamic GMM panel estimation becomes the primary methodology in this study to meet the 1st and 2nd objectives.

3.4.1 Descriptive Statistics

Descriptive statistics are descriptive coefficients that involve the aggregation and organization of easy-to-understand data. Here it can be a representative sample of the overall population or a selected part of the population. In addition, descriptive statistics offer a perspective that can quickly and easily simplify enormous volumes of data. Descriptive statistics is different from inferential statistics. In inferential statistics, it does not try to make inferences from samples. Descriptive statistics only focus on depicting the data in the sample by giving a brief outline.

Likewise, measure of central tendency and measure of variability make up the two different categories of descriptive statistics. First, the concept of describing the centre location of the data set distribution is implied by the measure of central tendency. There are three main methods for estimating central tendency are mean (average), median, and mode. The average mean is the most general technique used to describe central tendency. To calculate the average of a sample, simply sum up the values and distinguish it from the total number of values. Secondly, the value at the centre of the data collection is known as the median. The median can be judged by listing all the values in numerical order, and later discovering the most central value among the listed samples. Additionally, the term representing the longest period in a data set is called the mode. The mode is found by computing the number of occurrences of each value, and the value that shows up most often in the data set is then defined as the mode.

Moreover, the measure of variability is the other type, which is also known as the measure of spread. It refers to the concept of data variability or value expansion around a central trend. Variance and standard deviation are the two most widely used metrics of variability. Average separation between each quantity and the average value is estimated via standard deviation. When there is a smaller value of the standard deviation, it indicates that the data point is used to approximate the average of the data set, while A larger standard deviation value denotes a more widely scattered distribution of the data point's values. However, it is the average square of the difference between each quantity and the average that is used to calculate variance. Nevertheless, the square of the standard deviation is also the variance.

Furthermore, the standard deviation of the complete population as well as a sample of the population can be calculated in a variety of ways. The formula used to determine the sample's and the population's standard deviations for this study is displayed below.

$$\text{S. D.} = \sqrt{\frac{1}{n-1}\sum_{i=0}^{n}(x-\bar{x})^2} \qquad \text{(Standard deviation for sample)}$$

$$\text{S. D.} = \sqrt{\frac{1}{n}\sum_{i=0}^{n}(x-\mu)^2} \qquad \text{(Standard deviation for population)}$$

where $\bar{x}$ and μ are mean for the sample and the population.

3.4.2 Principle Component Analysis (PCA)

In accordance with Abdi and Williams (2010), principal component analysis is perhaps to be the oldest and most broadly applied multivariate technique. As a matter of fact, Wold et al. (1987) stated that PCA is first formulated in statistics by Pearson (1901), where the analysis as finding that the “line and plane closest to the point system in space”. Later, Hotelling (1933), who also came up with the phrase "primary component," is the one who formally proposes its modern instantiation.

A multivariate analysis method known as PCA is used to examine data tables where observations are represented by several interconnected quantitative dependent variables (Abdi & Williams, 2010). PCA is also utilised to reduce the dimensionality of such data sets and increase interpretability while minimizing information loss. It accomplishes this by adding new uncorrelated factors that increase the volatility (Jolliffe & Cadima, 2016). Furthermore, Principle component analysis (PCA) is a statistical technique that seeks to extract significant information from tables and express it as a set of new orthogonal variables known as principal components, where it also uses dots on a map to show how closely related observations and variables are grouped (Abdi & Williams, 2010). In other words, Jolliffe and Cadima (2016) denoted that PCA is with a simple idea to reduce the dimension of a dataset while holding as much as possible the “variability” (e.g., the statistical information).

Abdi and Williams (2010) stated that the standard context for PCA involves some essential concepts and notation, for instance, matrices, vectors and elements. The matrix is expressed in uppercase boldface, the vector is indicated in lowercase boldface, and the elements are implied in lowercase italics. Those matrices, vectors, elements from the same matrix are using same alphabet (i.e., **A**, a, a), whereas the transpose operation is represented by superscript^{T}, and identity matrix is expressed as **I**. The data table analysed by PCA includes the observation value of I described by the J variable and is indicated by the $I \times J$ matrix **X**, where the general element of which is x_{ij}. The level of matrix **X** is L, where $L \leq \min\{I, J\}$.

Additionally, preprocessing of the data table typically occurs before analysis. The columns of **X** are almost always centred, so the average value of each column is equal to 0. Since the matrix $\mathbf{X}^{T}\mathbf{X}$ is a covariance matrix in this case, the analysis is implied to be a covariance PCA if each element of **X** is split by $\sqrt{I}$ (or $\sqrt{I-1}$). Additionally, the matrix X will have singular value decomposition (SVD). A rectangular matrix is broken down into three easily built matrices (two orthogonal matrices and one diagonal matrix) using the eigen-decomposition method, which is generalized by SVD.

$$\mathbf{X} = \mathbf{P}\Delta\mathbf{Q}^{\mathbf{T}} \qquad \text{(Eqn. 3.17)}$$

where **P** is the $I \times L$ matrix of left singular vectors, **Q** is the $J \times L$ matrix of right singular vectors, and Δ is the diagonal matrix of singular values.

On the other hand, a column's inertia is defined as the sum of its squared elements, as is figured as below.

$$\gamma^2{}_j = \sum_i^I x^2{}_{ij} \quad \text{(Eqn. 3.18)}$$

Next, The vector of the means of each column of **X** is therefore known as the centre of gravity of the rows, which are represented by the variable **g**. The centre of gravity of **X**, when viewed as the core, is equal to the $1 \times J$ row vector 0^{T}. As a result, the *i*-th observation's distance from **g** is equal to what is indicated.

$$d^2{}_{i,\boldsymbol{g}} = \sum_j^J (x_{i,j} - g_j)^2 \quad \text{(Eqn. 3.19)}$$

When the data are centralized, Equation 3.19 will decrease to

$$d^2{}_{i,\boldsymbol{g}} = \sum_j^J x_{i,j} \quad \text{(Eqn. 3.20)}$$

Apart from that, PCA aims to achieve the objectives of extracting the most crucial data from the data sheet, minimizing the size of the data set by retaining crucial data, streamlining the dataset's description, and analysing the make-up of the observations and variables. Therefore, PCA creates new variables called principle components that are

obtained by linearly combining the original variables to achieve these goals. According to Abdi and Williams (2010), the highest variance required for the first principle component, while the second component must have the most inertia and be orthogonal to the first component to be calculated.

Intentionally, the potential ICT variable in this study is identified using PCA, which helps to determine which variable is the best suited for inclusion in the empirical model to estimate. The ICT variables that implicate in the PCA are referring to some previous studies (Lin, 2015; Nath & Liu, 2017; Ozcan, 2018; Wang & Choi, 2019). The variables are the percentage of individuals using the internet (% of population), fixed telephone subscriptions (per 100 people), and mobile cellular subscriptions (per 100 people).

3.4.3 Dynamic Generalized Method of Moments (GMM) Panel Estimation

A statistical method known as GMM produces estimation of the unknown parameters of an economic model by combining observable economic data with data from demographic moment conditions. Besides, in GMM method, the number of moment conditions is allowed to be greater than the number of parameters. According to Jagannathan et al. (2002), GMM can also be used to predict the model parameters and examine a set of moment conditions that occur in this natural way.

Additionally, one-step and two-step GMM estimations are the two different types of GMM estimations. Commonly, two-step GMM estimation will be used in the study instead of one-step GMM estimation. In accordance with Erickson and Whited (2002), the benefit of utilizing the two-step method is because the number of equations and parameters in the nonlinear GMM approach will not expand with the number of perfectly measured regressors. In other words, the two-step approach is more robust than one-step GMM estimation. Additionally, Roodman (2009) also mentioned that two-step GMM estimation is more effective and resistant to heteroskedasticity and autocorrelation test during estimation of model.

Consequently, in this study, the two-step dynamic GMM panel estimation is utilised for estimation of the model. The dynamic GMM panel estimation is firstly launched by Arellano and Bond (1991) and later advance introduced by Blundell and Bond (1998). Blundell et al. (2000) mentioned that in dynamic panel data model, the series model has greater autoregressive mode, and the observations number is opportunely small. In other words, in dynamic GMM panel model, the autoregressive parameter is larger than the number of time series observations which is smaller (Blundell & Bond, 1998). Hence, the dynamic GMM panel estimation is employed to grab the dynamic view of interaction between CAB and independent variables, and to avoid instrument proliferation.

Apart from that, in the dynamic two-step GMM panel estimation, the lagged of parameter interest of the dependent variable (CAB) is considered to constitute in the model

to draw a more significant outcome. Nevertheless, there is an issue that arise on the inclusion of lagged dependent variable. It will bring an effect to OLS estimates to have greater bias due to the correlations occur between time specific effects and lagged variables. Hence, to solve the endogeneity issue and to maintain the estimation is consistent, an instrumental variable (IV) approach is needed (Baum et al., 2003). The most popular adopted instruments are lagged dependent variable and lagged of independent variable. Hence, in this study, the lag of current account balance is employed as instrumental variable. The primary cause for the choice is the possible endogenous barriers that could result from including contemporary current account balances. The greater level of the current account deficit may lead to further expansion in the budget deficit and vice versa.

The general equation for dynamic GMM panel estimation is written as the following:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 X_{it} + \tau_t + \varepsilon_{it} \quad \text{(Eqn. 3.21)}$$

where

Y_{it} = Dependent variable of country *i* at time *t*;

Y_{it-1} = Lagged dependent variable of country *i* at time *t*;

X_{it} = Vector of dependent variable of country *i* at time *t*;

τ_t = Unobserved time-specific effects; and

ε_{it} = Error term or stochastic term.

When adding the dependent and independent variables into the Eqn. 3.21, the dynamic GMM panel estimation equation of this study for Model 1 is performed as Eqn. 3.22 and equation for Model 2 is demonstrated as Eqn. 3.23.

$$LCAB_{it} = \beta_0 + \beta_1 LCAB_{it-1} + \beta_2 LFB_{it} + \beta_3 LPD_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 LREER_{it} + \tau_t + \varepsilon_{it} \quad \text{(Eqn. 3.22)}$$

$$LCAB_{it} = \beta_0 + \beta_1 LCAB_{it-1} + \beta_2 LFB_{it} + \beta_3 LPD_{it} + \beta_4 LHD_{it} + \beta_5 LADRO_{it} + \beta_6 LADRY_{it} + \beta_7 LICT_{it} + \beta_8 LRGDP_{it} + \beta_9 LREER_{it} + \tau_t + \varepsilon_{it} \quad \text{(Eqn. 3.23)}$$

Furthermore, to keep the validity of instrument in dynamic two-step GMM estimation, autocorrelation test (AR) that is introduced by Arellano and Bond (1991) and further improved by Arellano and Bover (1995) and Sargan test proposed by Sargan (1958) are employed. Autocorrelation test is utilised to test the correlation of residuals, while Sargan test is used to examine the overidentifying restrictions. There are rejection rules for autocorrelation test and Sargan test to fulfil in the estimation, to ensure the model to become valid. In the autocorrelation test, there are classification into 1st order and 2nd order.

When the *p*-value is less than the significance level of 5%, the null hypothesis must be rejected in the first order autocorrelation test (AR1). In contrast, when the *p*-value is greater than 5% of significance level in the second order autocorrelation test (AR2), the null hypothesis should be accepted. In other words, residuals in 1st order are correlated, whereas residuals are not correlated in 2nd order. In addition, when the *p*-value is more than 5% of significance level, it is necessary to accept the null hypothesis that the instruments are correlated and valid for both Hansen and Sargan tests.

The following is the hypothesis of autocorrelation test introduced by Arellano and Bond (1991):

H_0: no autocorrelation (uncorrelated)

H_a: has autocorrelation (correlated)

Moreover, Sargan (1958) proposed Sargan test is with null hypothesis as shown below:

H_0: instruments are valid in the model

H_a: instruments are not valid in the model

3.4.4 Robustness Checks for GMM Estimation

Lu and White (2014) strengthened the importance of robustness check has become an ordinary perform that carried out by researchers in conducting empirical research. When changing regression specifications by expanding or eliminating regression variables, use of the robustness checks to verify how to express specific "core" regression coefficient measures. Besides, to solve the diagnose misspecification on sensitivity analysis, Lu and White (2014) argued that frequent robustness check should be applied. Additionally, based on argument by Sriboonchitta et al. (2017), robustness check is a method of predicting the model by using the estimation method of financial development and the new natural dependence agent. In this study, it is involving the robustness check for estimation methods that enclosed by GMM estimation with a 3-year average in sample period, PMG estimation, and DOLS estimation. Overall, in this study, the outcomes of using the ARDL approach are assumed to be reliable.

3.4.4.1 Dynamic GMM Panel Estimation

GMM panel estimation is again adopted in robustness check by reducing the sample period. In accordance with the original long sample period, the new sample period is reduced to 10 observations by taking a 3-year average. The period is covered from 1991 to 2020. This is because of the odd number issue. Additionally, the panel unit root tests and

panel cointegration tests will not be carried out, because the sample has become a short sample period and the variables are assumed to be stationary.

3.4.4.2 Pooled Mean Group (PMG) Estimation

Pesaran and Smith (1995) pointed out that with widespread use of non-stationary panel data, the problem of panel data econometrics has turned to study the asymptotic properties. Pedroni (1996), Kao and Chiang (1999), Phillips and Moon (1999), Baltagi and Kao (2000) in the work of OLS, FMOLS, and DOLS panel cointegration estimators strengthened the differences in the asymptotic statistical properties of non-stationary panel groups. The MG estimator and the PMG estimator, on the other hand, are two widely used techniques for measuring and estimating dynamic model parameters using panel data.

MG estimator is introduced to measure *N* (individual regressions) and is also used to calculate the mean or collect data and assume that the slope coefficient and variance are uniform (Pesaran et al., 1999). Pesaran and Smith (1995) had become the first researchers who launched the MG estimator for panel estimation work. Meanwhile, the PMG estimator is initiated by Pesaran et al. (1999). PMG estimator is complying with the association of pooling and averaging of coefficients, where it is applied to execute the same long run coefficient so that the short run coefficient and error variance will modify when alternating the countries or regions. To analyse the non-stationary dynamic panels, where the parameters vary between the different model units, a PMG estimator is specifically used.

In accordance with Pesaran and Smith (1995), they denoted that a coherent estimate of the parameter mean will be generated by the long run coefficients in the MG estimator. However, Pesaran et al. (1999) indicated that the PMG estimator will have rapid and consistent long run coefficients than the MG estimator. In addition, the PMG estimator also has the benefit of allowing the intercept, error variance, and short run coefficients to be easily changed between groups while maintaining the long run coefficients. Inversely, for the MG estimator, all parameters, intercept, long run and short run coefficients, and error variance can be changed in different countries/regions. As a result, the long run association between independent variables and CAB in the study should be consistent across all nations, whereas the short-term coefficients should likewise be country specific.

At the beginning, panel unit root and panel cointegration tests are employed to test the stationarity and cointegration of variables. The panel unit root test is adopted to gauge the process's stationarity over time. Moreover, it is also to examine the variables and determine whether the normative assumptions of the asymptomatic analysis are correct, a stationarity test is necessary. The panel unit root test applied is introduced by Levin et al. (2002). The hypothesis rules are H_0 indicates there is unit root exists (non-stationary) and H_a signifies no unit root (stationary). On the other hand, the cointegration tests is frequently used to examine if two variables have an equilibrium connection over the long run. Cointegration test shows that variables can be used as cointegration vectors, which can directly interpret the coefficients as being in a long-term equilibrium state. The cointegration tests that are being utilised are presented by Pedroni (1999, 2001, 2004) and Kao (1999). The hypothesis rules for the cointegration tests are H_0 indicates that there is no

cointegration (no long run), whereas H_a implies that cointegration exists (has long run). The decision rule for both panel unit root test and panel cointegration test is rejecting H_0 when *p*-value is smaller than significance level of 10%. After that proceeding to Hausman test to determine the suitability of MG or PMG estimator.

In keeping with Bangake and Eggoh (2012), the Hausman test should be demonstrated to differentiate between the MG and PMG estimators, to evaluate the null hypothesis of homogeneity. Apart, Hausman test is based on a decision rule where the null hypothesis (H_0) of homogeneity is unable to be rejected if the *p*-value is greater than 5%. As concluded, if H_0 is not rejected, the model sustains the availability and existing of PMG estimator.

The hypothesis for Hausman test is shown as the following:

H_0: Long run homogeneity is valid. PMG is preferred.

H_a: Long run homogeneity is invalid.

Additionally, if the Hausman test does not result in the null hypothesis being rejected, the ARDL model is determined, which is used in the panel analysis of the PMG model of the time frame, $t = 1, 2, \ldots, \mathrm{T}$, and several groups, $i = 1, 2, \ldots, \mathrm{N}$. Therefore, the ARDL model is with y_{it} as dependent variable is shown:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad \text{(Eqn. 3.24)}$$

According to the model shown at above, y_{it} is the dependent variable that implies the CAB. Meantime, x_{it} $(k \times 1)$ is the vector of the exogenous (independent) variables for group i, which are included fiscal balance, public debt, household debt, age dependency ratio for old, age dependency ratio for young, ICT component, real GDP, and real effective exchange rate. Furthermore, μ_i expresses the country particular effects; the scalar coefficients of the lagged exogenous variables are showed byλ_{ij}, and δ'_{ij} represent the $k \times 1$ coefficient vectors.

Likewise, the re-parameterization of Equation 3.24 is formulated as follow:

$$\Delta y_{it} = \Phi_i (y_{i,t-1} + \beta_i x_{it}) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^{*\prime}_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad \text{(Eqn. 3.25)}$$

where Φ_i represents that the lagged dependent variable is scalar, whereby β_i indicates the $k \times 1$ vector of coefficients on the independent variables. Besides, λ^*_{ij} signifies the lagged first difference between the dependent variables of the scalar coefficients. Then, $\delta^{*\prime}_{ij}$ is the $k \times 1$ vector of the coefficients implied on the lagged first differences of the independent variables and the lagged values.

When substituting the endogenous and exogenous variables of this study into Eqn. 3.25, the equation for Model 1 (Eqn. 3.26) and Model 2 (Eqn. 3.27) are written below.

$$\Delta LCAB_{it} = \Phi_i\big(LCAB_{i,t-1} + \beta_1 LFB_{it} + \beta_2 LPD_{it} + \beta_3 LADRO_{it} + \beta_4 LADRY_{it} + \beta_5 LICT_{it} + \beta_6 LRGDP_{it} + \beta_7 LREER_{it}\big) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^{*\prime}_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad \text{(Eqn. 3.26)}$$

$$\Delta LCAB_{it} = \Phi_i\big(LCAB_{i,t-1} + \beta_1 LFB_{it} + \beta_2 LPD_{it} + \beta_3 LHD_{it} + \beta_4 LADRO_{it} + \beta_5 LADRY_{it} + \beta_6 LICT_{it} + \beta_7 LRGDP_{it} + \beta_8 LREER_{it}\big) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^{*\prime}_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad \text{(Eqn. 3.27)}$$

3.4.4.3 Dynamic OLS (DOLS) Estimation

Hayakawa and Kurozumi (2008) indicated the issues of OLS estimation which relate to second order of bias can be solved through applying the DOLS estimation. DOLS estimator is launched by Phillips and Loretan (1991), Saikkonen (1991), and Stock and Watson (1993). According to the previous studies done by Phillips and Loretan (1991) and Saikkonen (1991), the DOLS estimation in the case of *I*(1) is used to perform a cointegration regression on the regression between the universal *I*(d) variable and the common deterministic units. On the other hand, Masih and Masih (1996) mentioned that to

settle the simultaneity problem included in the regression, Stock and Watson (1993) has exploited a sequence that allows integration of variables in an optional sequence (higher-order integration).

Apart from that, the DOLS estimator is also a parametric method that can deal with the order of integration and whether there is integration regardless of the object. The DOLS estimator always centres and stays focused on its objective, adding the leads and lags of the integral variable's first difference, *I*(1) (Hayakawa & Kurozumi, 2008). In addition, the DOLS estimator also conveys the asymptotic deviation embodied in the OLS estimation by adding different sequences of leads and lags. Based on the argument of Masih and Masih (1996), they mentioned Stock and Watson (1993) showed that compared with several alternative estimators of long-term parameters, DOLS estimator is comparatively favourable, especially in small samples. Likewise, DOLS approximates the standard normal density much better than statistics from OLS and FMOLS.

The DOLS estimator proposed by Stock and Watson (1993) is with easier proposed procedure for implementing and checking, although the DOLS estimator is alike to Phillips and Loretan (1991) and Saikkonen (1991). The following is presented the DOLS estimator model that recommended by Stock and Watson (1991).

$$B= [\ c, \alpha, \beta], X=[1, P_t, Y_t] \quad \text{(Eqn. 3.28)}$$

$$C_t = B'X_t + \sum_{j=-J}^{j=J} \eta_j \triangle P_{t-j} + \sum_{j=-K}^{j=K} \lambda_J \triangle Y_{t-j} + \zeta_t \quad \text{(Eqn. 3.29)}$$

Likewise, Hayakawa and Kurozumi (2008) has concisely introduced in their research study regarding the importance of leads and lags that fulfil tasks in the DOLS estimation of cointegrating regression models. They consider that a typical cointegrating regression model is presented as shown below:

$$y_t = \alpha + \beta' x_t + u_{1t} = \theta' z_t + u_{1t} \quad \text{(Eqn. 3.30)}$$

$$\triangle x_t = u_{2t}$$

where $\theta = [\alpha, \beta']'$, $z_t = [1, x'_t]'$, x_t is an n-dimensional $I(1)$ vector, and $u_t = [u_{1t}, u'_{2t}]'$ is a stationary process that honor demand of multivariate invariance principle. Additionally, in line with the regular term raised by Saikkonen (1991), u_{1t} is derived as

$$u_{1t} = \sum_{j=-\infty}^{\infty} \Pi'_j u_{2t-j} + v_t \quad \text{(Eqn. 3.31)}$$

where $\sum_{j=-\infty}^{\infty} \|\Pi_j\| < \infty$ and v_t is a stationary process such that $E(u_{2s} v_t) = 0$ for all s and t.

Then, by substituting Equation 3.31 into Equation 3.30, the model can be conveyed as

$$y_t = \alpha + \beta' x_t + \sum_{j=-K}^{K} \Pi_j' \triangle_{Xt-j} + v_t \quad \text{(Eqn. 3.32)}$$

where $v_t = v_t + \sum_{|j|>K} \Pi_j' u_{2t-j}$ and K is known as the lead-lag truncation parameter. Saikkonen (1991) also executed that the OLS estimator of β based on Equation 3.32 is unsustainable from second-order bias and is adequate in a specific allocation.

Furthermore, by inputting the dependent and independent variables of this study into Eqn. 3.32, the equation for Model 1 and Model 2 are illustrated as Eqn. 3.33 and Eqn. 3.34.

$$LCAB_t = \alpha + \beta'(LFB + LPD + LADRO + LADRY + LICT + LRGDP + LREER)_t + \sum_{j=-K}^{K} \Pi_j' \triangle_{Xt-j} + v_t \quad \text{(Eqn. 3.33)}$$

$$LCAB_t = \alpha + \beta'(LFB + LPD + LHD + LADRO + LADRY + LICT + LRGDP + LREER)_t + \sum_{j=-K}^{K} \Pi_j' \triangle_{Xt-j} + v_t \quad \text{(Eqn. 3.34)}$$

When it comes to estimation, the DOLS estimator performs significantly better than the FMOLS estimator, and the DOLS estimator can reduce the deviation better than the FMOLS estimator. Apart from that, the DOLS estimator also approximates the standard rule density more effectively than the statistical data of the OLS and FMOLS estimators.

3.4.5 Panel Threshold Estimation

In keeping with Šuliková and Tykhonenko (2017), they mentioned in their study that a balanced panel data threshold model was introduced by Hansen (1999), in which several "schemes" of the interaction between endogenous and exogenous variables are assessed through the estimate of threshold variables. The threshold model solves the problem of estimating the regression function in the endogenous variable and the exogenous variable. These variables are not the same in the entire data sample but can be divided into several sub-samples. On the other hand, Law et al. (2021) stated that Panizza and Presbitero (2013) issue a cautionary note regarding the idea that thresholds and nonlinearities play a significant role in the relationship between debt and economic growth and emphasize that additional research is required to determine the existence of debt thresholds.

In previous, there are some researchers proposed the panel threshold model in their studies, for example Hansen (1999), Caner and Hansen (2004), and Kremer et al. (2013). Moreover, there are also many researchers adopted threshold estimation in their studies, for

instance, Cordella et al. (2005), Caner et al. (2010), Kourtellos et al. (2013), Pescatori et al. (2014), Égert (2015), Gonźalez et al. (2017), Law et al. (2021), Awadzie et al. (2022), Bousnina and Gabsi (2023), and Soo et al. (2023b). In addition, Law et al. (2021) also denoted that it is important to understand the debt threshold for policymakers, and they can concentrate on other growth-promoting initiatives if the necessary debt threshold is attained.

In addition, this study employs the Hansen (1999) panel threshold model. This technique by Hansen (1999) can test the hypothesis, where according to the value of the threshold variable, the equation can be divided into multiple regions (Nguyen & To, 2017). The nexus between public debt and double balances, however, is non-linear if there is at least one threshold.

According to Wang (2015), the threshold effect test is equivalent to the test used to determine whether the coefficients in each scenario are the same. To inspect the existence of a threshold effect, the *F* statistics is employed as the likelihood ratio test. To support the asymptotic distribution of the likelihood ratio test, Hansen (1999) developed the bootstrap technique.

The null hypothesis and the alternative hypothesis (linear versus single threshold model) are distributed as shown below.

$$H_0: \beta_1 = \beta_2$$

$$H_a: \beta_1 \neq \beta_2$$

In H_0, it is distinguished that no existence of threshold in the model. The H_0 will be rejected if the *p*-value for the *F* statistics under H_0 is less than the critical value, indicating that the model is a non-linear (Wang, 2015).

The *F* statistics is constructed as:

$$F = \frac{(S_0 - S_1)}{\hat{\sigma}^2} \qquad \text{(Eqn. 3.35)}$$

Apart from that, Hansen (2000) also developed a statistical principle for threshold estimation in regression, that considers least squares estimate of the variables. As an example, the sample is $\{y_i, x_i, q_i\}_{i-1}^{n}$, where y_i and q_i are real-valued, x_i is an *m*-vector, and γ is the threshold level. Likewise, q_i is a threshold variable and it is assumed to have a continuous distribution. The sample pattern of the threshold regression model is shown below.

$$y_i = \theta'_1 x_i + e_i, \qquad q_i \leq \gamma \qquad \text{(Eqn. 3.36)}$$

$$y_i = \theta'_2 x_i + e_i, \qquad q_i > \gamma \qquad \text{(Eqn. 3.37)}$$

Then, the Eqn. 3.36 and Eqn. 3.37 are merged into a single equation as a single threshold sample splitting model as shown.

$$y_i = \theta'_1 x_i 1(q_i \leq \gamma) + \theta'_2 x_i 1(q_i > \gamma) + e_i \qquad \text{(Eqn. 3.38)}$$

Likely, in this study, there are two different types of debts applied in threshold estimation, which are public debt and household debt. Hence, the threshold estimations are divided into 2 models, named Model 3 and Model 4 respectively. The endogenous and exogenous variables are integrated into Eqn. 3.38 to provide a clear idea of Model 3 and Model 4 that are tabulated as Eqn. 3.39 and Eqn. 3.40.

$$LCAB_i = \theta'_1 (LFB + LADRO + LADRY + LICT + LRGDP + LREER)_i 1(LPD_i \leq \gamma) + \theta'_2 (LFB + LADRO + LADRY + LICT + LRGDP + LREER)_i 1(LPD_i > \gamma) + e_i \qquad \text{(Eqn. 3.39)}$$

$$LCAB_i = \theta'_1 (LFB + LADRO + LADRY + LICT + LRGDP + LREER)_i 1(LHD_i \leq \gamma) + \theta'_2 (LFB + LADRO + LADRY + LICT + LRGDP + LREER)_i 1(LHD_i > \gamma) + e_i \qquad \text{(Eqn. 3.40)}$$

Additionally, the model also enhances the regression parameters to change depends on the value of q_i. Then Equation 3.36 and Equation 3.37 can also substitute to write into a single equation by assuming Equation 3.36 – Equation 3.37 to become

$$y_i = \theta'_1 x_i + \delta'_n x_i(\gamma) + e_i \quad \text{(Eqn. 3.41)}$$

Equation 3.41 sustains all the parameters to switch among the regimes (Hansen, 2000). Hansen (2000) denoted that this overcome usually appears in the following situations; only certain parameters are swapped between certain regimes and sometimes when certain regressors move only in one of the two regimes, it also occurs.

Furthermore, the Equation 3.41 is then written into the matrix notation form, shown as follow.

$$Y = X\theta + X_\gamma \delta_n + e \quad \text{(Eqn. 3.42)}$$

The regression parameters are $(\theta, \delta_n, \gamma)$ and the least square is the natural estimator. Then the aggregate of squared error's function is formed as below.

$$S_n(\theta, \delta_n, \gamma) = \left(Y - X\theta - X_\gamma \delta\right)'\left(Y - X\theta - X_\gamma \delta\right) \quad \text{(Eqn. 3.43)}$$

Next, to define the least square estimators $\hat{\theta}, \hat{\delta}, \hat{\gamma}$, Equation 3.43 will be minimized, and presume the restriction of γ. The least squares estimation is figured through the easiest mode, which will be known as the concentration method. Therefore, the concentrated sum of squared errors function is composed as the following, where $\hat{\gamma}$ is the minimized value.

$$S_n(\gamma) = S_n\big(\hat{\theta}(\gamma), \hat{\delta}(\gamma), \gamma\big) = Y'Y - Y'X_\gamma{}^*\big(X_\gamma{}^{*\prime}X_\gamma{}^*\big)^{-1}X_\gamma{}^{*\prime}Y \qquad \text{(Eqn. 3.44)}$$

In addition, using thresholds and regression slopes, Hansen (2000) noted that there is an asymptotic distribution theory for estimating regression. The likelihood ratio statistics are also transposed to raise asymptotic confidence intervals. According to Hansen (1999), the gain of this practice shows that it will generate an asymptotically conserved confidence region.

Finally, there is a robustness check applied for the threshold estimation. It is proposed by Koenker and Bassett (1978) and Powell (2015, 2020), which to known as panel quantile regression. This skill issues the limitations related to quantile regression with fixed effects and other mean estimators (Law et al., 2021).

3.4.6 Robustness Check for Threshold Estimation

3.4.6.1 Panel Quantile Regression Analysis

Most recently, quantile regression has gained much attention from theoretical and empirical point of view (Buhai, 2005). Quantile estimator is beneficial in estimating the effect of conditional quantile effects. Moreover, Canay (2011) mentioned that quantile regression is beneficial in tackling the unseen heterogeneous and heterogeneity covariates effect. Powell (2020) stated that there are two quantile estimators that are involved in quantile estimation, for instance, quantile regression estimator which is introduced by Koenker and Bassett (1978) and utilizing Chernozhukov and Hansen (2005) suggested the instrumental variable quantile regression estimator. In accordance with Koenker and Hallock (2001), the conditional quantile function model, in which the quantile of the conditional distribution of the response variable is presented as a function of the observed covariate, is an attempt to further ideas first put forth by Koenker and Bassett (1978).

The Koenker and Bassett (1978) presented quantile regression (QR) can take the place of least squares regression since it is flexible to error distribution and robust to outliers (Kuan et al., 2017). Furthermore, it can investigate the response's entire conditional distribution, not simply its meaning (Kuan et al., 2017). Moreover, Sahni et al. (2020) also brought up the fact that analysts can model estimates of all conditional quantile functions using the quantile regression method put out by Koenker and Bassett (1978). In other words, quantile regression parameter predictions are showed at the multiple points of

the conditional distribution (Asongu & Kodila-Tedika, 2015). Besides, Sahni et al. (2020) assert that quantile regression has three key advantages over traditional models. First, because quantile regression formulates the median rather than the mean and measures by minimizing the absolute value of the bias component, the calculated coefficient is less sensitive to outliers of the dependent variable (Dumas, 2018). Second, the entire conditional distribution of the endogenous variable is described using quantile regression, Furthermore, a statistically more effective estimate of the error term also offers quantile regression which is abnormal (Sahni et al., 2020).

This study makes use of Powell (2015) proposed panel quantile regression technique, which overcomes the drawbacks of quantile regression with fixed effects and other mean estimators (Law et al., 2021). With nonadditive fixed effects, Powell (2015) presented the QRPD. The QRPD is an estimate that keeps the indivisible interference property that typically drives the adoption of quantile estimators while using within-group variation for identification. While controlling the fixed effects for identification reasons, the estimator can be used to determine how treatment variables, either exogenous or endogenous, affect the distribution of findings (Powell, 2015). Besides, QRPD also allows the parameters to differ based on nonadditive disturbance terms. The ease of understanding and applying the torque conditions is also another benefit of QRPD. Unlike most quantile panel data estimators, this one has lesser parameters that need to be estimated and is easier to implement because the individual fixed effects are never estimated or even described (Powell, 2015).

An estimator in the context of an instrumental variables that is promoted by Powell (2015), given as $Z_i = (Z_{il}, \dots, Z_{iT})$. If there is exogenous of treatment variable, then $Z_i = D_i$ and easily meet many recognition conditions. Assume that all the conditions are jointly established with probability one.

Furthermore, for the first condition (C1), namely as potential outcomes and monotonicity. It is a prerequisite for monotonicity in quantile estimators (Chernozhukov & Hansen, 2006). The equation for the first condition is shown below.

$$Y_{it} = D'_{it}\beta(U^*_{it}) \qquad \text{(Eqn. 3.45)}$$

where $D'_{it}\beta(U^*_{it})$ is firmly raising in $U^*_{it} \sim U$ (0,1). U^*_{it} may be a function of some uninspected interference terms, which are aggregated into a rank variable. Or imagine using unrestricted disturbance term ϵ^* in the equation of interest, where $Y_{it} = D'_{it}\beta(\epsilon^*_{it})$. Hence, the retain of mapping on ϵ^* to U^* is occurred.

Next, in accordance with Powell (2015), moving to the second condition (C2) that is known as conditional independence. It is a conditional independence assumption as shown in the following.

$$E[1(U^*_{it} \leq \tau) - 1(U^*_{is} \leq \tau)|Z_i\} = 0, \text{ for all } s, t. \qquad \text{(Eqn. 3.46)}$$

The Equation 3.46 can be substituted by a stronger assumption of stationarity, for instance, $U^*_{it}|Z_i \sim U^*_{is}|Z_i$. Nevertheless, the distribution of $U^*_{it}|Z_i$ can alter over time if Z_i does not assume the changes. To support intuition, let employing again the ϵ^*. If Equation 3.46 has no structure on the entire mean or variance of ϵ^*_{it} for any t. Chernozhukov et al. (2013) stated that this assumption allows $\epsilon^*_{it} = c_t \times \epsilon^*_{il}$ for time-varying constants a_t, c_t.

Moreover, this conditional independence just needs Z_i not be methodically involved to transform in the distribution of ϵ^*_{it} when utilizing the panel nature of data to release the corresponding hypothesis for instrumental variable quantile regression (IVQR). There is also no limitation on relationship between U^*_{it} and α_i (i.e., $U^*_{it} = f(\alpha_i, U_{it})$). Besides, the assumptions are not valid on the relationship between α_i and Z_i, which paralleling the fixed effect mean regression model.

On the other hand, these estimations bring to two detach period conditions. Both situations are important for recognition. To state the theorem on movement condition, assuming that C1 and C2 are on hold. Then, for every $\tau \in (0,1)$,

$$E\left\{\frac{1}{2T^2}\sum_t \sum_e (Z_{it} - Z_{is})\left[1\left(Y_{it} \leq D'_{it}\beta(\tau)\right) - 1\left(Y_{is} \leq D'_{is}\beta(\tau)\right)\right]\right\} = 0 \qquad \text{(Eqn. 3.47)}$$

$$E\left[1\left(Y_{it} \leq D'_{it}\beta(\tau)\right) - \tau\right] = 0 \qquad \text{(Eqn. 3.48)}$$

The estimator can be reduced to a sequence of internal comparisons, as seen by Equation 3.47, which is a useful formulation. The estimator makes use of the panel features of the data to allow for individual (even within individuals) variation in the likelihood that Y is less than the quantile function. When arguing identification and other characteristics, it is liable to apply the following equivalent formula.

$$E\left\{\frac{1}{T}\sum_t (Z_{it} - \bar{Z}_\iota)\left[1\left(Y_{it} \leq D'_{it}\beta(\tau)\right)\right]\right\} = 0 \qquad \text{(Eqn. 3.49)}$$

where $\bar{Z}_\iota = \frac{1}{T}\sum_{t=1}^{T} Z_{it}$. Equation 3.49 shows that although the quantile function is like the quantile function estimated by IVQR (if the IVQR hypothesis is satisfied), the identification comes from the variation of the internal personnel of the instrument (Powell, 2015).

Furthermore, the Equation 3.50 is maintained with the traditional quantile estimators, for instance, QR and IVQR. In accordance with IVQR, considering that both equations as shown below are:

$$P\left(Y_{it} \leq D'_{it}\beta(\tau)\right) = \tau, \text{ and} \qquad \text{(Eqn. 3.50)}$$

$$P(Y_{it} \leq D'_{it}\beta(\tau)|Z_{it}) = \tau \qquad \text{(Eqn. 3.51)}$$

At once, the QRPD estimator substitutes the next with a weaker assumption. Hence, this is the benefit of using panel data.

3.5 Concluding Remarks

With reference to the intention of this study, the specific goals of the study have been carried out. The main objectives are to analyse the determinants of current account imbalance, to examine the impacts of different types of debt on twin imbalances, and as well as to assess the relationship between current account balance and fiscal balance on threshold level of different type of debts. The countries that are included in this study are 48 countries in the whole Asia region.

Apart from that, as a dependent variable in this study, the current account balance (CAB) also plays a role. Meanwhile, the independent variables are fiscal balance (FB), public debt (PD), household debt (HD), age dependency ratio for old and young (ADRO/ADRY), ICT, real GDP, and REER. Moreover, the main methodologies employed in this study to carry out the estimations are dynamic panel GMM estimation, panel threshold estimation, and robustness checks (GMM estimation with 3-year average, PMG estimation, DOLS estimation, & panel quantile regression analysis).

In this study, it is assumed that fiscal balance and debt are always in the same direction as the CAB. Additionally, when state debt levels climb, so does consumer demand for imported goods. Therefore, the trade balance will be negatively impacted, widening the current account deficit. In other words, CAB is likely to be negatively impacted by public debt. In addition, the CAB is predicted to be positively associated with the real GDP and age dependency ratios. Additionally, it is forecasted that the ICT component variable will indirectly positively correlate with the current account balance.

Additionally, the twin deficit linkage is positive, which corresponds to the twin deficit hypothesis. Thus, when examining the relationship between double balances, the impact of public debt and household debt as exogenous variables are also considered to show positive correlation. Besides, the nature of current account balance in the outlook of panel threshold estimation is estimated to demonstrate a potential threshold level. Moreover, the robustness checks on quantile regressions panel data are expected to show different characteristics at each quantile level which is robust to the estimation results of panel threshold estimation.

In short, the results of panel studies or single country studies are not always the same in all countries in the world. Therefore, the nexus between the CAB and debts may be affected according to the kinds of debt at different debt levels of separate countries. Obviously, data needs to be extracted carefully, and more in-depth exploration of each research topic is also required.

CHAPTER 4

EMPIRICAL FINDINGS AND RESULTS ANALYSIS

4.1 Introduction

All tests and estimates used in this study were tabulated, analysed, and discussed. Interpretation of hypothesis tests will be performed and the estimated results between positive or negative relationship variables will be recorded in the table. In addition, the significant levels associated with the *p*-values for rejection rules are 1%, 5%, and 10%, respectively. However, the significance levels are shown separately in the tabular results.

First, the mean and standard deviation of the variables are calculated using descriptive statistics to provide a quick overview of the dataset. Secondly, proceed to perform principle component analysis (PCA) to determine the most suitable variable that should be adopted as the proxy for the ICT variable. Additionally, the main estimations of this study are applying the dynamic GMM panel estimation and panel threshold estimation. Next, there are robustness checks on the dynamic GMM panel estimation, which are performed by GMM estimation (with a 3-year average), panel mean group (PMG) estimation, and DOLS estimation. On the other hand, panel single threshold estimation is demonstrated by using a threshold sample splitting model. Moreover, there is also a robustness check for panel threshold estimation, which employs the panel quantile regression analysis introduced by Powell (2015).

Last by not least, based on the empirical results obtained, the objectives are underlined to analyse the determinants of current account imbalance and to examine the impacts of different types of debt on twin imbalances. Likewise, the purpose is to assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts. The dependent variable is CAB, whereas the independent variables are fiscal balance, public debt, household debt, age dependency ratio for old, age dependency ratio for young, ICT component, real GDP, and real effective exchange rate.

4.2 Descriptive Statistics

The measures of variance and central tendency are used in descriptive statistics. In the measurement of central tendency, the mean is calculated. Besides, in a measure of variability, the standard deviation is enclosed. The results of the mean and standard deviation of the CAB, FB, PD, HD, ADRO, ADRY, ICT, RGDP, and REER for 48 individual Asia countries from 1990 to 2020 are demonstrated separately in the following tables shown in Table 4.1 to Table 4.9.

Table 4.1 presents the mean and standard deviation of current account balance for 48 Asia countries. There are 48 nations in the study and 22 of them have negative mean of current account balances, with Lebanon having the worst average current account balance at 21.02% of GDP. Furthermore, 26 countries have a positive mean of current account balance, of which Timor-Leste has the highest mean value at 60.23% of GDP. On the other

hand, from the data in Table 4.2, it is apparent that only 9 countries acquire a positive mean of fiscal balance, where the highest value is 11.13% of GDP obtained by Iraq. On the contrary, this indicates that most Asia countries are undergoing a negative fiscal balance from 1990 to 2020 on average.

Table 4.1: Mean and Standard Deviation of Current Account Balance

Country	Mean (% of GDP)	Standard Deviation		Country	Mean (% of GDP)	Standard Deviation
Afghanistan	24.02	55.03		Macau	31.69	6.57
Armenia	-8.51	5.81		Malaysia	5.25	7.99
Azerbaijan	0.77	18.25		Maldives	-10.79	9.27
Bahrain	0.88	7.31		Mongolia	-8.92	13.67
Bangladesh	0.09	1.45		Myanmar	-1.35	3.52
Bhutan	-12.88	13.33		Nepal	-1.40	5.15
Brunei	29.51	13.57		Oman	0.49	10.74
Cambodia	-6.37	3.08		Pakistan	-2.37	3.00
China	2.81	2.57		Philippines	0.07	3.35
Georgia	-11.09	4.21		Qatar	5.41	18.25
Hong Kong	5.13	4.95		Saudi Arab	5.66	13.04
India	-1.23	1.36		Singapore	17.05	4.88
Indonesia	-0.19	2.55		Sri Lanka	-3.29	1.92
Iran	2.99	4.29		Syrian Arab	-3.26	9.03
Iraq	3.42	9.17		Taiwan	7.20	3.92

Table 4.1 continued

Country	Mean (% of GDP)	Standard Deviation		Country	Mean (% of GDP)	Standard Deviation
Israel	0.79	2.97		Tajikistan	-7.66	6.85
Japan	2.74	1.00		Thailand	1.69	6.04
Jordan	-5.97	6.62		Timor-Leste	26.21	121.03
Kazakhstan	-2.04	3.20		Turkey	-2.69	2.59
Korea	2.14	3.21		Turkmenistan	-2.41	11.94
Kuwait	15.51	49.29		UAE	8.00	5.35
Kyrgyzstan	-8.61	6.66		Uzbekistan	1.21	4.04
Laos	-5.01	5.44		Vietnam	-2.00	5.39
Lebanon	-21.02	11.72		Yemen	-2.35	9.07

Note: The total number of Asia countries is 48.
Source: Calculation

Table 4.2: Mean and Standard Deviation of Fiscal Balance

Country	Mean (% of GDP)	Standard Deviation		Country	Mean (% of GDP)	Standard Deviation
Afghanistan	-0.92	1.65		Macau	8.53	10.08
Armenia	-1.51	5.73		Malaysia	-1.75	3.13
Azerbaijan	2.21	7.96		Maldives	-7.00	5.12
Bahrain	0.22	9.75		Mongolia	-4.35	4.73
Bangladesh	-2.57	1.61		Myanmar	-3.81	1.29

Table 4.2 continued

Country	Mean (% of GDP)	Standard Deviation	Country	Mean (% of GDP)	Standard Deviation
Bhutan	-1.42	4.38	Nepal	-0.86	1.82
Brunei	-2.27	16.21	Oman	1.07	9.26
Cambodia	-3.25	2.77	Pakistan	-3.94	4.48
China	-2.03	2.24	Philippines	-1.19	2.36
Georgia	-7.79	20.78	Qatar	4.33	9.36
Hong Kong	1.15	3.53	Saudi Arab	-0.24	10.87
India	-7.88	2.24	Singapore	2.36	6.45
Indonesia	-0.32	3.23	Sri Lanka	-6.80	1.50
Iran	-2.44	2.50	Syrian Arab	-3.32	2.01
Iraq	11.13	26.50	Taiwan	-4.33	2.02
Israel	-5.61	4.12	Tajikistan	-1.57	4.44
Japan	-5.23	3.27	Thailand	-0.85	2.60
Jordan	-5.30	3.39	Timor-Leste	-25.88	19.61
Kazakhstan	2.48	3.83	Turkey	-23.23	52.20
Korea	1.17	1.27	Turkmenistan	1.65	2.39
Kuwait	7.53	35.96	UAE	4.13	6.57
Kyrgyzstan	-4.69	4.68	Uzbekistan	0.25	3.82
Laos	-3.45	1.52	Vietnam	-2.32	1.67
Lebanon	-11.21	13.21	Yemen	-5.06	4.48

Note: The total number of Asia countries is 48.
Source: Calculation

Apart from that, it is interesting to see the data exhibited in Table 4.3. Table 4.3 exhibits the mean and standard deviation of public debt in 48 Asia countries. It appears from Table 4.3 that, Iraq achieves the greatest mean and standard deviation of public debt from 1990 to 2020 at 427.53% of GDP and 435.45% of GDP. On the other hand, from 1990 to 2020, Macau was the only country in Asia with no debt.

Macau is very successful in handling its debt borrowing issue from foreign markets or international banks to solve the country's financial problem. Since it was handed over to China in 1999, Macau's economy has been one of the most open in the world, which makes it more responsive to changes in global demand trade flows. Besides, Macau is also known for its thriving tourism and gaming industry, where Macau is the largest gaming market in the world, which generates more than USD 24 billion in revenue, about seven times that of Las Vegas. Moreover, Macau enjoys lower levels of public expenditure than other countries and this is a factor in helping reduce its fiscal deficit and increase its current account surplus. There are also favourable economic policies in the region, which support external investment and promote growth.

Table 4.3: Mean and Standard Deviation of Public Debt

Country	Mean (% of GDP)	Standard Deviation		Country	Mean (% of GDP)	Standard Deviation
Afghanistan	251.92	261.67		Macau	0.00	0.00
Armenia	41.00	15.42		Malaysia	47.81	11.41
Azerbaijan	14.84	7.62		Maldives	53.45	20.53
Bahrain	35.80	31.83		Mongolia	56.53	22.04
Bangladesh	42.33	6.60		Myanmar	116.62	73.06
Bhutan	72.38	25.69		Nepal	46.11	14.12
Brunei	1.00	1.22		Oman	0.44	10.69
Cambodia	31.24	5.00		Pakistan	-2.27	2.68
China	29.22	15.37		Philippines	53.07	10.57
Georgia	44.63	13.72		Qatar	4.55	19.77
Hong Kong	0.38	0.56		Saudi Arab	5.66	13.05
India	72.66	7.52		Singapore	93.60	18.31
Indonesia	40.47	19.25		Sri Lanka	80.14	7.64
Iran	24.22	12.28		Syrian Arab	-1.02	5.54
Iraq	427.53	435.45		Taiwan	28.08	10.13
Israel	85.44	21.19		Tajikistan	-9.05	8.65
Japan	163.98	61.45		Thailand	38.85	12.71
Jordan	96.64	39.15		Timor-Leste	1.53	3.33
Kazakhstan	19.36	10.43		Turkey	40.39	12.54
Korea	24.99	12.20		Turkmenistan	-2.48	8.09

Table 4.3 continued

Country	Mean (% of GDP)	Standard Deviation		Country	Mean (% of GDP)	Standard Deviation
Kuwait	32.65	37.65		UAE	8.13	5.40
Kyrgyzstan	64.64	24.17		Uzbekistan	0.67	4.36
Laos	94.98	49.22		Vietnam	70.50	61.13
Lebanon	132.42	37.88		Yemen	-0.61	4.83

Note: The total number of Asia countries is 48.
Source: Calculation

Nevertheless, Table 4.4 tabulated the mean and standard deviation of household debt for 48 Asia countries. Among the countries, Taiwan has the highest mean household debt value at 85.7% of GDP, surpassing China, Hong Kong, Korea, and Singapore. According to Shih and Tsao (2004), the major component of Taiwan household debt is housing loans or so-called mortgage loans. The booming of the housing market at the time in Taiwan caused expectations of rising housing prices which stimulated banks to increase their loan-to-value ratios (Shih & Tsao, 2004). Besides, housing debt growth is accelerated by raises in units and values of homes purchased. Hence, this led to a significant growth in household loans, which led to the accumulation of household debt. Meanwhile, Iraq gains the lowest mean of household debt among those Asia countries, which is at 41.63% of GDP, and with a standard deviation of 0.52.

Table 4.4: Mean and Standard Deviation of Household Debt

Country	Mean (% of GDP)	Standard Deviation	Country	Mean (% of GDP)	Standard Deviation
Afghanistan	48.13	0.37	Macau	66.72	5.10
Armenia	63.50	2.63	Malaysia	60.54	1.15
Azerbaijan	64.52	1.10	Maldives	59.93	6.74
Bahrain	67.37	2.76	Mongolia	60.80	1.52
Bangladesh	71.73	1.70	Myanmar	77.61	0.99
Bhutan	68.96	3.64	Nepal	84.72	1.17
Brunei	65.78	1.37	Oman	59.24	4.01
Cambodia	80.99	1.44	Pakistan	52.33	1.97
China	75.65	3.38	Philippines	65.55	1.13
Georgia	64.90	1.02	Qatar	81.98	4.34
Hong Kong	63.81	6.95	Saudi Arab	51.76	2.03
India	57.80	2.76	Singapore	66.05	1.60
Indonesia	67.17	1.00	Sri Lanka	55.93	1.20
Iran	44.89	1.43	Syrian Arab	47.22	3.63
Iraq	41.63	0.52	Taiwan	85.70	3.31
Israel	57.33	4.31	Tajikistan	67.13	0.59
Japan	64.00	4.80	Thailand	74.17	2.40
Jordan	68.98	7.66	Timor-Leste	48.86	9.67
Kazakhstan	70.66	1.24	Turkey	50.05	3.03
Korea	82.29	5.63	Turkmenistan	60.64	0.60

Table 4.4 continued

Country	Mean (% of GDP)	Standard Deviation		Country	Mean (% of GDP)	Standard Deviation
Kuwait	66.81	2.68		UAE	77.06	2.17
Kyrgyzstan	66.00	1.14		Uzbekistan	60.17	1.04
Laos	78.98	1.46		Vietnam	77.55	0.72
Lebanon	45.42	1.87		Yemen	47.26	1.42

Note: The total number of Asia countries is 48.
Source: Calculation

Next, Table 4.5 shows the mean and standard deviation for the age dependency ratio for the old. Japan is a country that has the highest mean age dependency ratio for the old, at 30.90% of the working age population within the 48 nations the in Asia region. This implies that Japan is moving towards an aging population where their old age people are surpassing the young population day by day. Besides, higher old-age dependency rates also induce greater financial stress and possible instability of the political workforce. Inversely, the U.A.E. has the lowest mean age dependency ratio for the old at only 1.26% of the working age population. A low old-age dependency ratio means there are enough working forces to support the dependent population, which could provide citizens with better pensions and healthcare.

Table 4.5: Mean and Standard Deviation of Age Dependency Ratio for Old

Country	Mean (% of working age population)	Standard Deviation	Country	Mean (% of working age population)	Standard Deviation
Afghanistan	4.66	0.10	Macau	10.48	1.80
Armenia	15.19	2.39	Malaysia	7.31	1.26
Azerbaijan	8.78	0.71	Maldives	6.07	0.71
Bahrain	3.22	0.33	Mongolia	6.12	0.59
Bangladesh	6.93	0.74	Myanmar	7.43	0.55
Bhutan	7.42	1.06	Nepal	7.73	0.99
Brunei	4.74	1.09	Oman	3.68	0.38
Cambodia	6.04	0.53	Pakistan	7.33	0.10
China	11.05	2.22	Philippines	6.35	0.94
Georgia	20.06	2.47	Qatar	1.66	0.49
Hong Kong	17.22	3.58	Saudi Arab	4.78	0.37
India	7.71	0.88	Singapore	10.01	2.60
Indonesia	7.45	0.72	Sri Lanka	11.23	2.56
Iran	7.43	0.79	Syrian Arab	6.14	0.44
Iraq	6.31	0.61	Taiwan	14.19	3.38
Israel	16.87	1.56	Tajikistan	6.23	1.00
Japan	30.90	9.76	Thailand	11.38	3.25
Jordan	5.81	0.39	Timor-Leste	6.87	0.84

Table 4.5 continued

Country	Mean (% of working age population)	Standard Deviation		Country	Mean (% of working age population)	Standard Deviation
Kazakhstan	10.75	0.72		Turkey	10.28	1.59
Korea	10.59	2.71		Turkmenistan	6.90	0.46
Kuwait	2.61	0.51		UAE	1.26	0.29
Kyrgyzstan	8.28	1.16		Uzbekistan	7.31	0.72
Laos	6.52	0.27		Vietnam	9.97	0.51
Lebanon	9.28	0.66		Yemen	5.43	0.54

Note: The total number of Asia countries is 48.
Source: Calculation

Furthermore, the mean age dependency ratio for young is illustrated in Table 4.6. As shown in the figure, Afghanistan has the highest mean age dependency ratio for the young at 93.55% of the working age population. This implies that Afghanistan has a large cohort of young people with slowly emerging. Yet the young population in Afghanistan exposes significant challenges related to health, education, employment, and gender inequalities. Contrary, Hong Kong gained the lowest mean of 20.61% of the working age population in the age dependency ratio for young among 48 Asia countries. As of 2020, Hong Kong has one of the lowest birth rates in the world, where its fertility rate has been on the low side and continuously dropping. This may be due to the issue of decreasing the marriage rate, yet the delay in marriage and childbearing are the major contributing factors to the low fertility rate.

Table 4.6: Mean and Standard Deviation of Age Dependency Ratio for Young

Country	Mean (% of working age population)	Standard Deviation	Country	Mean (% of working age population)	Standard Deviation
Afghanistan	93.55	7.20	Macau	25.69	9.14
Armenia	35.93	7.58	Malaysia	47.53	9.57
Azerbaijan	41.97	9.61	Maldives	56.46	26.65
Bahrain	35.65	9.35	Mongolia	51.71	11.79
Bangladesh	57.01	11.47	Myanmar	49.46	7.67
Bhutan	59.46	16.16	Nepal	66.11	10.73
Brunei	41.93	7.96	Oman	50.28	18.60
Cambodia	66.43	16.52	Pakistan	70.90	8.98
China	31.66	7.04	Philippines	60.70	8.45
Georgia	30.77	3.48	Qatar	26.29	10.21
Hong Kong	20.61	7.04	Saudi Arab	54.81	15.75
India	52.45	8.27	Singapore	22.19	4.92
Indonesia	46.93	6.43	Sri Lanka	40.57	4.50
Iran	50.37	19.56	Syrian Arab	68.69	13.68
Iraq	77.29	7.44	Taiwan	26.57	7.20
Israel	46.16	2.12	Tajikistan	70.16	11.20
Japan	21.98	1.58	Thailand	31.92	7.05
Jordan	67.02	8.75	Timor-Leste	76.60	8.36

Table 4.6 continued

Country	Mean (% of working age population)	Standard Deviation		Country	Mean (% of working age population)	Standard Deviation
Kazakhstan	41.54	5.15		Turkey	45.58	7.19
Korea	35.11	4.04		Turkmenistan	55.92	10.61
Kuwait	37.05	8.13		UAE	26.46	10.68
Kyrgyzstan	54.66	7.73		Uzbekistan	55.68	12.83
Laos	70.21	13.54		Vietnam	44.83	12.11
Lebanon	46.73	7.58		Yemen	89.97	15.99

Note: The total number of Asia countries is 48.
Source: Calculation

Moreover, ICT averages and standard deviations for 48 Asia nations are shown in Table 4.7. The ICT is the proxy for the percentage of individuals who use the internet in corresponding to the population. According to Table 4.6, Korea has the highest mean percentage of the population who use the Internet, which is 56.51%. Korea is an advanced developed country with well-equipped internet coverage over the country. Hence, the usage of the Internet in daily life is common use. Whereas, Bangladesh owns the lowest mean value at 3.31%. The reason for the low internet usage rate in Bangladesh is that people cannot subscribe due to higher mobile internet price which is nearly double compared to other countries. Besides, the lack of spectrum and poor infrastructure also contribute to the sense of low percentage of individuals using the Internet.

Table 4.7: Mean and Standard Deviation of ICT

Country	Mean (% of population)	Standard Deviation	Country	Mean (% of population)	Standard Deviation
Afghanistan	3.57	4.78	Macau	38.13	31.79
Armenia	20.51	26.25	Malaysia	39.89	30.76
Azerbaijan	28.22	33.43	Maldives	21.55	24.22
Bahrain	40.84	39.91	Mongolia	11.24	16.25
Bangladesh	3.31	4.42	Myanmar	5.62	10.29
Bhutan	13.13	17.79	Nepal	7.30	11.05
Brunei	37.81	34.15	Oman	28.86	34.01
Cambodia	10.90	22.80	Pakistan	6.05	5.72
China	21.64	23.94	Philippines	17.90	22.06
Georgia	19.83	24.89	Qatar	39.66	39.48
Hong Kong	48.51	33.62	Saudi Arab	31.02	34.67
India	7.86	12.25	Singapore	48.85	32.07
Indonesia	10.68	14.83	Sri Lanka	7.87	10.11
Iran	19.22	25.73	Syrian Arab	12.67	13.86
Iraq	10.55	20.22	Taiwan	43.51	22.33
Israel	38.91	33.18	Tajikistan	7.43	8.79
Japan	51.86	36.53	Thailand	19.64	21.72
Jordan	22.94	24.90	Timor-Leste	7.53	12.73
Kazakhstan	25.49	33.09	Turkey	26.09	26.19

Table 4.7 continued

Country	Mean (% of population)	Standard Deviation		Country	Mean (% of population)	Standard Deviation
Korea	56.51	37.15		Turkmenistan	5.31	7.81
Kuwait	37.69	36.81		UAE	46.01	38.00
Kyrgyzstan	13.44	14.58		Uzbekistan	16.17	22.33
Laos	7.22	10.38		Vietnam	21.39	24.15
Lebanon	29.32	31.78		Yemen	8.68	10.75

Note: The total number of Asia countries is 48.
Source: Calculation

Table 4.8 tabulates the mean and standard deviation of real GDP for 48 Asia countries from 1990 to 2020. In accordance with the calculation result, China gains the highest mean of real GDP at 5971.87 billion USD, whereas Timor-Leste has the lowest mean of real GDP at 0.91 billion USD. On the other hand, Table 4.9 displays the mean and standard deviation of REER for 48 Asia countries. According to Table 4.9, the highest mean of REER is 316.81 by Uzbekistan, while Iraq has the smallest REER mean value at 67.18.

Table 4.8: Mean and Standard Deviation of Real GDP

Country	Mean (USD billion)	Standard Deviation	Country	Mean (USD billion)	Standard Deviation
Afghanistan	11.82	5.46	Macau	28.13	16.58
Armenia	6.48	4.71	Malaysia	183.89	111.51
Azerbaijan	27.29	25.06	Maldives	2.69	1.25
Bahrain	18.73	11.95	Mongolia	6.84	3.76
Bangladesh	125.72	65.12	Myanmar	32.23	28.44
Bhutan	1.20	0.70	Nepal	14.59	5.48
Brunei	10.00	4.86	Oman	40.13	26.38
Cambodia	9.75	7.95	Pakistan	192.86	69.36
China	5971.87	4379.61	Philippines	161.87	103.90
Georgia	9.11	5.86	Qatar	80.19	75.18
Hong Kong	226.84	69.39	Saudi Arab	395.02	253.02
India	1312.28	723.06	Singapore	177.08	120.42
Indonesia	503.74	354.21	Sri Lanka	51.06	23.40
Iran	321.59	84.99	Syrian Arab	25.40	15.39
Iraq	91.68	85.38	Taiwan	380.35	138.78
Israel	192.33	105.65	Tajikistan	5.36	2.61
Japan	4051.81	312.86	Thailand	259.02	143.14
Jordan	19.94	14.28	Timor-Leste	0.91	0.48
Kazakhstan	120.48	52.84	Turkey	522.24	283.56

Table 4.8 continued

Country	Mean (USD billion)	Standard Deviation		Country	Mean (USD billion)	Standard Deviation
Korea	1027.45	393.16		Turkmenistan	20.20	12.72
Kuwait	81.36	54.13		UAE	213.25	138.78
Kyrgyzstan	4.88	1.54		Uzbekistan	49.56	26.25
Laos	6.54	6.28		Vietnam	94.81	85.25
Lebanon	28.08	17.47		Yemen	18.00	10.54

Note: The total number of Asia countries is 48.
Source: Calculation

Table 4.9: Mean and Standard Deviation of REER

Country	Mean	Standard Deviation		Country	Mean	Standard Deviation
Afghanistan	86.06	31.70		Macau	123.77	17.20
Armenia	127.07	61.42		Malaysia	104.35	9.73
Azerbaijan	87.04	36.82		Maldives	113.68	12.55
Bahrain	113.03	9.76		Mongolia	109.75	23.95
Bangladesh	122.67	22.93		Myanmar	149.75	32.27
Bhutan	96.30	4.83		Nepal	100.58	14.13
Brunei	106.26	6.76		Oman	116.86	9.28
Cambodia	115.34	19.50		Pakistan	108.27	10.72

Table 4.9 continued

Country	Mean	Standard Deviation		Country	Mean	Standard Deviation
China	109.52	18.65		Philippines	104.70	14.30
Georgia	110.48	95.15		Qatar	93.79	16.24
Hong Kong	117.61	15.94		Saudi Arab	117.87	10.33
India	100.65	16.28		Singapore	111.60	11.33
Indonesia	99.03	14.99		Sri Lanka	99.16	11.64
Iran	252.15	312.60		Syrian Arab	136.27	45.11
Iraq	67.18	50.86		Taiwan	113.89	13.08
Israel	116.57	9.05		Tajikistan	86.92	36.21
Japan	122.49	18.38		Thailand	102.78	10.59
Jordan	109.88	14.04		Timor-Leste	116.86	18.28
Kazakhstan	88.42	27.60		Turkey	79.07	15.41
Korea	87.46	7.98		Turkmenistan	99.20	25.94
Kuwait	107.89	12.17		UAE	95.05	17.66
Kyrgyzstan	115.02	67.42		Uzbekistan	316.81	568.43
Laos	117.02	22.44		Vietnam	110.87	25.72
Lebanon	114.96	36.51		Yemen	170.76	123.35

Note: The total number of Asia countries is 48.
Source: Calculation

4.3 Principle Component Analysis (PCA)

Abdi and Williams (2010) claim that PCA is a multivariate method used to evaluate data tables where observations are represented by several interconnected quantitative dependent variables. Additionally, PCA aims to extract the crucial facts from the dataset. Moreover, PCA also with a simple idea to reduce the dimension of a dataset while holding as much as possible the "variability".

Purposely, PCA is carried out in this study to identify the potential proxy of ICT variable that is suitable to be included in the empirical model to fulfil the 1st objective to analyse the determinants of current account imbalance in 48 Asia countries. The variables that are involved in the PCA are the percentage of individuals using the internet (% of the population) (ICT_internet), fixed telephone subscriptions (per 100 people) (ICT_phone), and mobile cellular subscriptions (per 100 people) (ICT_mobile). To interpret a PCA, first is examining the eigenvalues to determine the number of principal components that should be considered, second is to interpret each principal component with original variables, and third is to identify the suitable variable.

Table 4.10 tabulated the eigenvalues analysis of PCA. In accordance with the Kaiser criterion, the component with an eigenvalue greater than 1 should be retained. Hence, referring to the result in Table 4.10, there is only one component that has an eigenvalue larger than 1, so the first component should be considered. Apart, proportion of

variation explained by the first component is 0.6758, which implies that the first principal component justifies 68% of the variation in the data, whereby it is an acceptably large percentage among the three components. In an alternative way, the number of principal components can be identified through the scree plot (Figure 4.1). Figure 4.1 shows that there is only one principal component that has an eigenvalue greater than 1.

Table 4.10: Eigenvalues Analysis in Principle Component Analysis (PCA)

Component	Eigenvalue	Proportion	Cumulative
Comp1	2.0275	0.6758	0.6758
Comp2	0.7553	0.2518	0.9276
Comp3	0.2172	0.0724	1.0000

Source: Calculation

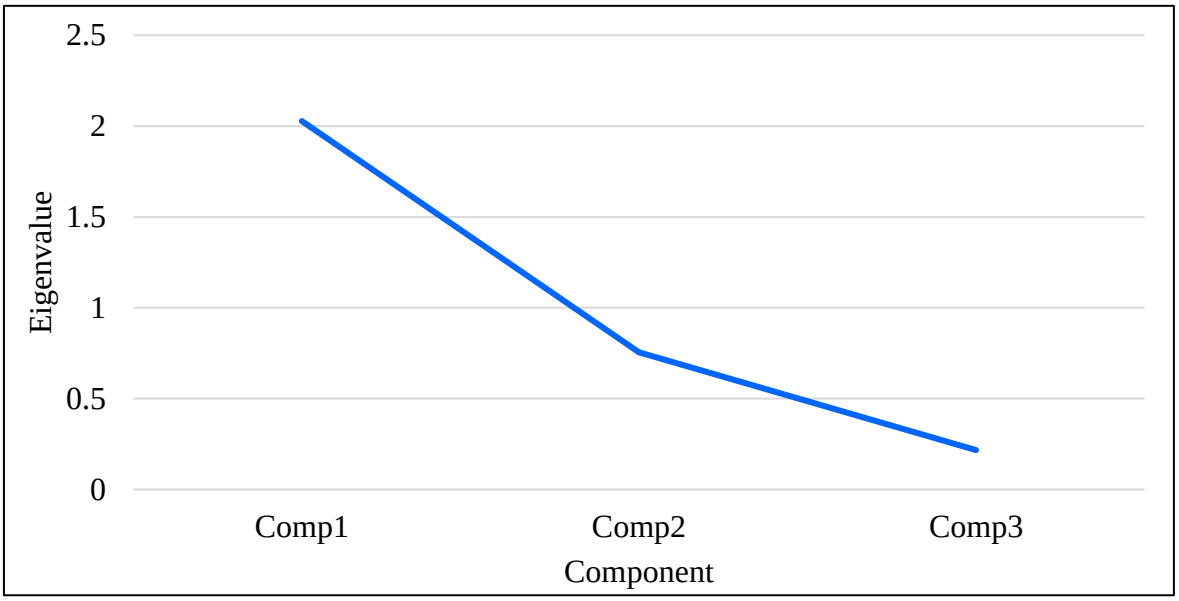


Figure 4.1: Scree Plot of Eigenvalues After PCA

Next, the correlations between the principal component and original data are computed and interpreted, where results are tabulated in Table 4.11. Based on the resulting outcome, the interpretation of principal components is preferable to which variable has a higher correlation. In this interpretation, assuming the correlation between 0.50 and 0.70 is a moderately positive correlation, and 0.30 to 0.50 is stated as a low positive correlation (Mukaka, 2012). Moreover, in accordance with the previous variable statement, only the first principal component is included. Referring to the outcome in Table 4.11 demonstrates that the first principal component, ICT_internet is moderately correlated with one of the original variables, where it has the higher correlation among the three variables. The correlation value of ICT_internet is at 0.6381, which is in between the 0.50 and 0.70 correlation range, whereas the correlation values of ICT_phone and ICT_mobile fall between 0.30 and 0.50 low correlation range. Therefore, it can be concluded that ICT_internet is more suitable to set as a proxy for the ICT variable in the empirical model of this study.

Table 4.11: Eigenvectors Analysis of Principle Components

Variable	Comp1	Comp2	Comp3
ICT_internet	0.6381	-0.2913	-0.7127
ICT_phone	0.4389	0.8982	0.0258
ICT_mobile	0.3326	-0.3292	0.7010

Source: Calculation

4.4 Dynamic Generalized Method of Moments (GMM) Panel Estimation

Generally, a linear function with a greater number of cross-sectional data (*N*) and smaller time series (*T*) is required for the estimated model to be used with GMM panel estimation. There are 31 time series and 48 cross-sectional data points in this study, where it meets the general rule. Considering this, a dynamic GMM panel estimation is used. The dynamic GMM panel estimation is employed to grab the dynamic view of the interaction between CAB and the independent variables.

First, the association between FB and CAB is primarily predicted by applying a classic panel data model. Proceed, the dynamic GMM panel estimation is utilised in this study to fulfil the first and second objectives to analyse the determinants of current account imbalance (Model 1) and to examine the impacts of different type of debts on twin imbalances (Model 2) by adding household debt as the second type of indebtedness. Instead of one-step GMM estimation, this study performs the augmented two-step difference GMM panel estimation. The key benefit of the two-step GMM system over the one-step GMM estimation is that it is more reliable. In addition, Roodman (2009) also mentioned the two-step GMM estimation is more accurate and resistant to the heteroskedasticity and autocorrelation test. Apart from that, the lagged CAB is adopted as an instrument in the model to portray more significant results. Besides, lagged parameter interest can also perform its function to dominate the omitted variables effects and endogeneity bias. Accordingly, the results of GMM estimations for Model 1 and Model 2 are demonstrated in Table 4.16.

With regards to Table 4.16, the post-estimation tests of autocorrelation and instrument validity for Model 1 and Model 2, both tests fulfil the criteria to accept the two-step difference GMM panel estimation. First, is conducting the autocorrelation test (AR) introduced by Arellano and Bond (1991) and Arellano and Bover (1995). For both models, the *p*-value of AR(1) is 0.0310 and 0.0360, which is smaller than 0.05 and is significant, hence rejecting the H_0 of no autocorrelation; while the *p*-value of AR(2) is 0.6060 and 0.6020, larger than 0.05 which is insignificant, thus the absence of autocorrelation is accepted as the null hypothesis. Second, is the validity test of the instrument proposed by Sargan (1958). In the instrument validity test for both models, there is no rejection for the null hypothesis, which is insignificant. In other words, the instruments are valid for both Hansen and Sargan tests, where the *p*-value is more than a significant level of 0.05. This shows that there is no connection between the disturbance error and the residuals.

The GMM estimation result (Table 4.16) for Model 1 is employed to analyse the determinants of current account imbalance. The result shows that LFB, LPD, LADRO, and LRGDP are significant to LCAB at a 10% significance level, where the coefficient of LFB, LADRO, and LRGDP indicate a positive sign, whereas LPD denotes a negative sign. However, LICT, LADRY, and LREER do not have a significant impact on LCAB. As referred to Table 4.16, there is a strong positive correlation between FB and CAB at 1.9504. This demonstrates that when there is a 1% increase in LFB, will contribute to LCAB rising by 1.9504%. This study is compatible with the research studies of Bucevska (2018), Behera and Yadav (2019), Abu and Gamal (2020), Ahmad et al. (2020), Handoyo et al. (2020), Magoti et al. (2020), Su and Nguyen (2021), Dey and Tareque (2022), Sahoo et al.,

(2022), Hailemareiam (2023), and Soo et al. (2023a). These researchers concluded that the CAB is positively and significantly impacted by the government budget balance, which sustains the twin deficits hypothesis on their co-movement in the model.

Furthermore, LADRO has a positive significant relation of 0.7299 with LCAB. This estimation result is consistent with the findings from Gehringer (2013) and Girma (2018), who stated that there is a positive nexus between CAB and age dependency ratio in the long run. On the other hand, LRGDP is 0.0129 positive significant with LCAB. Previous studies by Kurt and Ozkiper (2015) concluded that a rise in GDP growth will lead to the current account deficit decreasing; Das (2016) and Hailemareiam (2023) also sum up that real GDP will always show a positive association with CAB. Meanwhile, LPD has a negative nexus with LCAB at 0.0686. The result shows an inverse outcome with the findings from Alam and Taib (2013), Lazar and Andreica (2013), and Samsu and Ismail (2020). According to their analysis, debt has a long run significant impact on the current account balance.

Whereas the other determinants such as LADRY, LICT, and LREER remain insignificant with LCAB. The study by Brissimis et al. (2012) on age dependency ratios also concluded that age dependency ratios do not play a role in explaining the evolution of the current account. Moreover, the insignificant effect of LREER on LCAB is supported by Bollano and Ibrahimaj (2015), Afonso and Opoku (2018), and Mohanty (2019). Likewise, LICT also does not have an immediate and significant influence on LCAB in this study.

This result of LICT can be concluded from the works of literature by Nath and Liu (2017), Ozcan (2018), Toader et al. (2018), Wang and Choi (2019), and Kurniawati (2022) that ICT only has a significantly positive impact on trade. Those researchers concluded in their studies that ICT has a positive and significant impact on export volume. When an increase in the export volume brings a rise in government revenue and exceeds expenditure, later drives the grow in the current account surplus. Nevertheless, the insignificant result of LICT to LCAB is supported by Soo et al. (2023a). Their empirical study is also focused on Asia countries but is employing the PMG estimation. Therefore, using GMM estimation, the fiscal balance (FB), public debt (PD), age dependency ratio for old (ADRO), and real GDP (RGDP) are all determinants that contribute to current account imbalance in 48 Asia countries' panel data.

In accordance with the 2nd objective of this study, to examine the impacts of different types of debts on twin imbalances, for Model 1, which only includes public debt, the LFB coefficient is 1.9504 and there is a statistically and positive significant association between LCAB at the 10% level of significance. Moreover, when referring to Model 2, it added household debt as another independent variable, at a level of significance of 10%, LFB also has a significant and positive connection with LCAB, with a coefficient of 1.9583.

According to the Keynesian Theory and the twin deficits hypothesis, the predicted sign of LFB to current account balance is positive, thus it can be concluded that LFB meets

the rule of theory. According to Keynesian theory, government spending is the driver of aggregate demand, whereas spending on infrastructure, education, and unemployment is more favoured by the government. During an economic depression, when taxable income falls, it causes the fiscal deficit to rise as the government consumes more to meet the demand. Besides, it would also allow government spending to exceed government revenue. In this situation, it reflects domestic absorption, where government spending rises, and demand also increases. Thus, a deficit in the current account of the nation is inevitable. In sum, the dynamic GMM panel estimation which expresses the importance of the lagged dependent variable offers robust, efficient, and consistent results in this study.

Table 4.12: Dynamic GMM Panel Estimations

	Model 1	Model 2
	Panel Group	
	GMM Estimations	
LFB	1.9504(0.0000)*	1.9583(0.0000)*
LPD	-0.0686(0.0377)*	-0.0721(0.0370)*
LHD	-	-0.2736(0.2990)
LADRO	0.7299(0.0780)*	0.6802(0.0100)*
LADRY	0.2504(0.2570)	0.1758(0.3150)
LICT	0.0697(0.2420)	0.0591(0.2600)
LRGDP	0.0129(0.0350)*	0.0124(0.0330)*
LREER	-0.0263(0.2990)	-0.0292(0.2830)
	Post Estimation Tests	
Autocorrelation Tests		
AR(1)	0.0310**	0.0360**
AR(2)	0.6060	0.6020
Instrument Validity Tests		
Sargan Test	0.9540	0.9490
Hansen Test	0.5550	0.5230

Notes: In GMM estimations and post-estimation tests, the asterisk (*) and asterisk (**) indicate variables statistically significant at 10% and 5% levels respectively. While in post-estimation tests, if the *p*-value is greater than 5% significance level (0.05), do not reject H_0 or vice versa. The number of instruments for Model 1 is 12 and Model 2 is 13. The application of lag is (2 4).

4.5 Robustness Checks for GMM Panel Estimation

When the regression specification is altered by adding or removing regressors, robustness checking is a behaviour to examine how the core regression coefficient estimations will be demonstrated. Intentionally, to robustly check the results for dynamic GMM panel estimation of Model 1 and Model 2, GMM (using a 3-year average), PMG, and DOLS estimations are selected to perform.

4.5.1 Dynamic GMM Estimation

In this robustness check, dynamic GMM estimation is repeated by reducing the sample period to a 3-year average, which becomes a short sample that the variables are assumed to be stationary. Table 4.13 tabulates the results of dynamic GMM estimation where the sample period has 10 observations with a 3-year average from 1991 to 2020. The outcome for Model 1 indicates that only LFB and LRGDP are positive and statistically significant to LCAB; while LPD, LICT, and LREER are negatively insignificant; LADRO and LADRY are positively insignificant to LCAB. In other words, when reducing the sample period to a short sample, the determinants of current account imbalances are fiscal balance and real GDP. Hence, this short sample robustness checking is partially robust as an alternative estimation technique in this study.

Apart from that, Table 4.13 also demonstrates the estimation outcome of Model 2 that was employed to accomplish the 2nd objective. The outcome illustrates that LFB has a positively significant nexus to LCAB with the addition of LHD as a new variable. When there is a 1% raise in LFB, will lead the LCAB to increase by 0.49%. This estimation result is a tally of the result of long sample dynamic GMM panel estimation. Intentionally, this robust checking by narrowing the sample size to a 3-year average is robust as an alternative estimation technique in this study.

Table 4.13: Robustness Check - Dynamic GMM Panel Estimations

	Model 1	**Model 2**
	Panel Group	
	GMM Estimations	
LFB	0.4750(0.0000)*	0.4899(0.0000)*
LPD	-0.0244(0.4130)	-0.0258(0.4160)
LHD	-	-0.1411(0.0530)*
LADRO	0.1370(0.3930)	0.1110(0.4830)
LADRY	0.1034(0.2140)	0.6920(0.3380)
LICT	-0.0228(0.2980)	-0.0245(0.2610)
LRGDP	0.0047(0.0800)*	0.0047(0.0780)*
LREER	-0.0423(0.3820)	-0.0454(0.1290)
	Post Estimation Tests	
Autocorrelation Tests		
AR(1)	0.0290**	0.0270**
AR(2)	0.1200	0.1200
Instrument Validity Tests		
Sargan Test	0.4330	0.4170
Hansen Test	0.4190	0.3920

Notes: In GMM estimations and post-estimation tests, the asterisk (*) and asterisk (**) indicate variables statistically significant at 10% and 5% levels respectively. In post-estimation tests, if the *p*-value is greater than 5% significance level (0.05), do not reject H_0 or vice versa. The number of instruments for Model 1 is 10 and Model 2 is 11. The application of lag is (3 3).

4.5.2 Pooled Mean Group (PMG) Estimation

The strength of the linear association between each variable is first estimated using a correlation test. Moreover, the directions of all these variables are also provable through the correlation test. Table 4.14 exhibits the result of the correlation test which is arranged as a correlation matrix. The outcomes indicate that CAB is positively correlated to FB, ADRO, ICT, and RGDP at 0.298, 0.008, 0.079, and 0.040, whereas CAB is negatively correlated to PD, ADRY, REER, and HD at 0.004, 0.036, 0.011, and 0.039. In other words, CAB has either a positive or negative correlated relationship with variables in the study.

Table 4.14: Correlation Matrix

	LCAB	LFB	LPD	LADRO	LADRY	LICT	LRGDP	LREER	LHD
LCAB	1.0000								
LFB	0.2981	1.0000							
LPD	-0.0045	0.0144	1.0000						
LADRO	0.0074	-0.0364	0.1974	1.0000					
LADRY	-0.0360	-0.0918	0.1531	-0.3908	1.0000				
LICT	0.0794	0.0888	-0.0527	0.2762	-0.6311	1.0000			
LRGDP	0.0402	-0.0027	0.0516	0.4643	-0.4047	0.3371	1.0000		
LREER	-0.0108	0.0039	-0.2055	0.0197	0.0067	0.0329	0.0203	1.0000	
LHD	-0.0393	0.0951	-0.1444	0.0256	-0.3840	0.1771	0.0909	-0.0485	1.0000

Source: Calculation

Next, before moving on to the PMG estimation, the panel unit root test and panel cointegration test are implemented to test the stationarity and cointegrating of variables. After that, the Hausman test is undertaken to distinguish between the choice of MG or PMG estimation to estimate whether the long run coefficients are homogeneous or heterogeneous (Bangake & Eggoh, 2012).

The Levin et al. (2002) unit root test is employed at levels and first differences to reveal the possibility of a unit root or non-unit root. Referring to Table 4.15, in the first difference, *I*(1), variables have a *p*-value that is smaller than the 10% of significance level, where the H_0 with unit root exists is rejected. Therefore, it can be said that most of the variables are stationary at *I*(1) and there is no unit root.

Next, panel cointegration tests from Pedroni (1999, 2001, 2004) and Kao (1999) are used in this study to inspect the cointegration relationship over the long run between the variables in the empirical model. Table 4.16 demonstrates the panel cointegration outcomes from Pedroni (1999, 2001, 2004) and Kao (1999) for Model 1 (basic panel model). The result of Pedroni (1999, 2001, 2004) cointegration test in Table 4.16 shows that five out of seven statistics have *p*-values that are less than 10% of the significance level. In other words, the statistics meet the majority requirement for the panel cointegration test's rejection of the H_0 that no cointegration occurred. In contrast, the *p*-value in Kao (1999) cointegration test is less than the level of significance at 10%. Hence, the H_0 with no cointegration also is rejected. To sum up, Model 1 exhibits cointegration, where variables are cointegrated.

Table 4.15: Levin, Lin, and Chu (LLC) Panel Unit Root Tests

	Test Statistics	
	Levin, Lin, & Chu	
	Individual Intercept	**Individual Intercept and Trend**
	Level	
LCAB	-54.3417(0.0000)*	-56.7332(0.0000)*
LFB	12.9400(1.0000)	18.1285(1.0000)
LPD	-0.8093(0.2092)	4.7086(1.0000)
LHD	-4.9795(0.0000)*	-1.3268(0.0923)*
LADRO	3.8747(0.9999)	3.5841(0.9998)
LADRY	-19.8086(0.0000)*	-8.5187(0.0000)*
LICT	12.0062(1.0000)	1.9066(0.9717)
LRGDP	2.1933(0.9859)	-2.9794(0.0014)*
LREER	-2.9230(0.0017)*	-1.3764(0.0844)*
	First Difference	
ΔLCAB	-32.0584(0.0000)*	-24.1334(0.0000)*
ΔLFB	-28.5773(0.0000)*	-19.2307(0.0000)*
ΔLPD	-14.5836(0.0000)*	-13.5524(0.0000)*
ΔLHD	13.6433(0.0000)*	-13.6865(0.0000)*
ΔLADRO	2.8298(0.9977)	0.8038(0.7892)
ΔLADRY	-3.3612(0.0004)*	-3.6298(0.0001)*
ΔLICT	-9.0084(0.0000)*	-9.7470(0.0000)*
ΔLRGDP	-10.4473(0.0000)*	-5.9816(0.0000)*
ΔLREER	-26.5389(0.0000)*	-22.7614(0.0000)*

Notes: LLC indicates the Levin et al. (2002) panel unit root and stationary tests. The LLC examines the null hypothesis of non-stationary variables. The parenthesized values are the probability of rejection. Asterisks (*) indicate statistically significant at a 10 percent level. Variables all are in log form.

Table 4.16: Pedroni and Kao Panel Cointegration Tests (Model 1)

A: Pedroni Residual Cointegration Test	
Panel cointegration statistics (within-dimension)	
Panel *v*-statistics	1.8654(0.0311)*
Panel *rho*-statistics	4.0897(1.0000)
Panel *PP*-statistics	-12.0226(0.0000)*
Panel *ADF*-statistics	-7.4405(0.0000)*
Group mean panel cointegration statistics (between-dimension)	
Group *rho*-statistics	7.1162(1.0000)
Group *PP*-statistics	-12.9165(0.0000)*
Group *ADF*-statistics	-9.6772(0.0000)*
B. Kao Residual Cointegration Test	
ADF	-1.7503(0.0400)*

Notes: The number of lag truncations used in the calculation of the seven Pedroni statistics is 5 while Kao ADF statistic is 7. The parenthesized values are the probability of rejection. Asterisks (*) indicate statistically significant at a 10 percent level.

Furthermore, Table 4.17 indicates the results of Hausman tests for both Model 1 and Model 2. The *p*-values of both models denoted that they have more than a 5% level of significance (α=0.05), which are 0.8984 for Model 1 and 0.9908 for Model 2. According to the decision rule of the Hausman test for the choice of either MG or PMG estimation, in cases where the *p*-value is above the 5% level of significance, the H_0 should not be rejected. Hence, it can be concluded that H_0 for both Model 1 and Model 2 is unable to be rejected. In other words, Model 1 and Model 2 support the PMG estimator for the estimations on Model 1 and Model 2 to fulfil the objectives.

Likewise, Table 4.17 also tabulated the results of PMG estimations for Model 1 and Model 2. The PMG estimation result for Model 1 is used to analyse the determinants of current account imbalance. The result shows that LFB, LPD, LADRO, LADRY, LICT, and LRGDP are significant to LCAB at a 10% significance level, where the coefficient of LFB, LPD, LADRO, and LICT indicate positive sign, whereas LADRY and LRGDP denote negative sign. In other words, the potential determinants of CAB in panel data of 48 Asia nations are fiscal balance (FB), public debt (PD), age dependency ratio for old (ADRO), age dependency ratio for young (ADRY), ICT component (ICT) and real GDP (RGDP).

There is a strong correlation between the fiscal and current account balances, where a 1% rise in FB will bring to the increase of CAB by 0.0356%. On the other hand, LPD indicates a positive coefficient of 0.1660 and has a significant relationship with LCAB, which has the same outcomes as Aristovnik (2008) and Samsu and Ismail (2020) that debt has a positive significant relationship with CAB. This signifies that when 1% growth in LPD will lead the LCAB to increase by 0.1660%. Furthermore, with a correlation coefficient of 0.7068, LADRO likewise shows a statistically significant and positive association with LCAB. Besides, LICT has a positive coefficient of 0.0238 to LCAB, which implies that when 1% growth in LICT will lead to a 0.0238% growth in LCAB. This outcome is coherent with the studies by Bankole et al. (2015), Nath and Liu (2017), Ozcan (2018), Toader et al. (2018), Wang and Choi (2019), and Kurniawati (2022). They emphasized that ICT significantly affects Asia's economic development, where ICT's influence on trade becomes more prominent over time.

Furthermore, at a 10% level of significance, LADRY and LRGDP have negative coefficients of 0.1650 and 0.0262, respectively, and are statistically significant to LCAB. In other words, the rise in 1% of LADRY and LRGDP, will denote a decline in 0.1650% and 0.0262% of LCAB respectively. In accordance with previous studies by Gossé and Serranito (2014), Behera and Yadav (2019), and Sahoo et al. (2022), they concluded that a rise in age dependency will increase the current account deficit significantly. Moreover, for LRGDP, Das (2016), Bucevska (2018), Girma (2018), Behera and Yadav (2019), Ahmad et al. (2020), and Samsu and Ismail (2020) concluded that increased GDP growth causes a larger current account deficit due to increased capital and import flows. However, LREER displays a negative insignificant relationship with LCAB to a close result from Bollano and Ibrahimaj (2015) Afonso and Opoku (2018).

In accordance with the 2nd objective of this study, to examine the impacts of different type of debts on twin imbalances, for Model 1 only has public debt, the coefficient of LFB is 0.0356 with a positive statistically significant relationship with LCAB at 10% of the significance level. Moreover, when referring to Model 2, it added household debt as another independent variable, at the 10% level of significance, LFB also has a significant and positive connection with LCAB, with a coefficient of 0.4336.

In sum, the PMG estimation shows a slightly different result in assessing potential determinants of current account imbalance (Model 1) as compared to the dynamic GMM panel estimation result. However, the PMG estimation for Model 2 has a consistent outcome as dynamic GMM panel estimation.

Table 4.17: Robustness Check - PMG Estimations and Hausman Test

	Model 1	**Model 2**
	Panel Group	
	PMG Estimations	
LFB	0.0356(0.0000)*	0.4336(0.0000)*
LPD	0.1660(0.0000)*	0.1817(0.0000)*
LHD	-	-0.0348(0.7890)
LADRO	0.7068(0.0001)*	0.7038(0.0001)*
LADRY	-0.1650(0.0000)*	-0.2388(0.0000)*
LICT	0.0238(0.2440)*	0.0443(0.0460)*
LRGDP	-0.0262(0.0000)*	-0.0194(0.0001)*
LREER	-0.0071(0.3040)	-0.0010(0.8160)
	Speed of Adjustment	
ECT	-0.4240(0.0000)*	-0.4139(0.0000)*
	Hausman Test	
Chi-square statistics	2.8500	1.6100
p-value	0.8984	0.9908

Notes: In PMG estimations, it is estimated using ARDL (2,2) specification. The asterisks (*) in PMG estimations indicate statistically significant at a 10% level; while in Hausman test, if the *p*-value is greater than a 5% significance level (0.05), do not reject H_0.

4.5.3 Dynamic OLS (DOLS) Estimation

The DOLS estimator is proposed by Phillips and Loretan (1991) and Saikkonen (1991), where the asymptotic bias is resolved by adding leads and lags of difference series, and the DOLS estimator is more effective in resolving OLS situations containing second-order biases. However, Stock and Watson (1993) pointed out that the DOLS is superior to other long run parameter estimators in small samples. So, DOLS estimators will be applied to investigate the robust checking that shows differences in the results.

The estimation results of DOLS for Model 1 and Model 2 are tabulated in Table 4.18. First, Model 1 is used to analyse the determinants of current account imbalance in 48 Asia countries, while Model 2 is used to examine the impacts of different type of debts on twin imbalances. According to Table 4.18, all variables are significant at the 10% level of significance in DOLS estimation for Model 1. In Model 1, all variables have a positively significant relationship to LCAB, except LREER which is negatively significant to LCAB. Meanwhile, when there is a 1% growth in FB, the CAB is estimated to give rise to 0.57%. The positive significant relation for LFB to LCAB implies that the twin hypothesis theorem is established in Model 1 for both estimations

Besides, Model 2 is applied to examine the impacts of different type of debts on twin imbalances. The result in Table 4.18 shows that in DOLS estimation, fiscal balance implies a positive significant relationship to LCAB. The coefficient of LFB to LCAB with

the occurrence of public debt and household debt in Model 2 that applying DOLS estimations as robustness check is 0.1786. Meantime, the 1% raise in LFB leads LCAB to rise by 0.1786%. In other words, the robustness check by DOLS estimation for Model 1 and Model 2 have almost similar outcomes as dynamic GMM panel estimation, where LFB demonstrates a positive significant nexus to LCAB.

Table 4.18: Robustness Check - DOLS Estimations

	Model 1	**Model 2**
	Panel Group	
	DOLS Estimations	
LFB	0.5759 (0.0000)*	0.1786 (0.0047)*
LPD	0.1023 (0.0000)*	0.0919 (0.0000)*
LHD	-	0.2107 (0.0003)*
LADRO	0.0834 (0.0000)*	0.4039 (0.0000)*
LADRY	0.1627 (0.3044)	0.0579 (0.1207)
LICT	0.0733 (0.0000)*	0.0606 (0.0063)*
LRGDP	0.0133 (0.0064)*	-0.0234 (0.0410)*
LREER	-0.0204 (0.0170)*	0.0039 (0.3681)

Notes: Asterisks (*) indicate the *p*-values are statistically significant at a 10 percent level.

Likewise, the robustness check by employing PMG and DOLS estimations on the 1st and 2nd objectives are robust to the findings in dynamic GMM panel estimation (refer to

Table 4.12). In other words, PMG and DOLS estimations are robust as alternative estimation techniques in the study.

4.6 Panel Threshold Estimation

The value of the threshold variable in various intervals connected to the nexus between the dependent and independent variables is predicted using a panel threshold model. This model was originally introduced by Hansen (1999). According to *Šuliková* and Tykhonenko (2017), stated that threshold estimation can also help to solve the issues of estimated regression function between endogenous and exogenous variables that are not identical in a sample.

In accordance with the 3rd objective of this study, to assess the relationship between current account balance and fiscal balance on the threshold levels of different type of debts in 48 Asia countries, the threshold splitting model is employed to view the threshold effects that perhaps below or above the threshold level between LCAB and LFB with the presence of LPD and LHD in two different models.

Before proceeding to the threshold interval estimation, tests for both threshold variables LPD and LHD in a single threshold model estimator (TH-1) and threshold effect are carried out. Single threshold model estimator is compiled to ascertain the existence and

number of thresholds in the model, where H_0 is the linear model and H_a is the threshold model. In keeping with the outcomes in Table 4.19, the TH-1 for the LPD threshold variable is 6.0929 with a 95% confidence interval of [6.0718, 6.1043] and for LHD, the single threshold estimator is 5.6454 with 95% confidence interval of [5.6444, 5,6462]. The F-stat *p*-value for both LPD and LHD threshold variables in the TH-1 are 0.0911 and 0.0864 respectively, which are highly significant. Hence, H_0 of the linear model is rejected and proceeds to the threshold effect test.

Moreover, in the threshold effect test, there are also hypothesis rejection rules. The single conforms to H_0 (linear model) and H_a (single threshold model); double agrees to H_0 (single threshold model) and H_a (double threshold model); and triple matches to H_0 (double threshold model) and H_a (triple threshold model). In the threshold effect test for LPD, the *p*-values of single-, double-, and triple thresholds are 0.0899, 0.9988, and 0.8967 respectively. Since the *p*-value of the single threshold is significant at 10% of significant level, hence H_0 (linear model) is rejected, whereas the *p*-values for double- and triple thresholds are insignificant at 10% significant level, hence do not reject H_0. On the other hand, in the threshold test for LHD, the *p*-values are recorded at 0.0862, 0.6500, and 0.7633 for single-, double-, and triple thresholds (refer to Table 4.19). Due to the *p*-value of the single threshold being significant at a 10% level, H_0 (linear model) is rejected. However, in the double- and triple threshold, *p*-values are insignificant at a 10% level, therefore H_0 are not rejected. In conclusion, both the threshold variables LPD and LHD demonstrate a single threshold model in this study to investigate their threshold indebtedness characteristics to current account balance.

Table 4.19: Single Threshold Model Estimator and Threshold Effect Tests

	Threshold Variables	
	LPD	**LHD**
	Single Threshold Model Estimator (TH-1)	
Threshold	6.0929	5.6454
Lower	6.0718	5.6444
Upper	6.1043	5.6462
F-stat	0.0911*	0.0864*
	Threshold Effect Tests	
Threshold	**Probability**	
Single	0.0899*	0.0862*
Double	0.9999	0.6500
Triple	0.8967	0.7633

Notes: LPD denotes public debt and LHD denotes household debt. The TH-1 is at a level of 95% confidence. If *F*-stat in TH-1 is significant, reject H_0 and proceed to the threshold effect test. In the threshold effect test, the bootstrap in threshold effect test is 300 300 300. If the *p*-value is greater than a 10% significance level (0.10), do not reject H_0. Asterisks (*) indicate statistically significant at a 10 percent level.

Since the threshold effect test confirms that both threshold variables LPD and LHD are indicating a single threshold effect model, then continue to the threshold estimation. Table 4.20 tabulates the threshold estimation result where public debt (PD) acts as a threshold indicator, which refers to Model 3. The threshold estimation result shows that the threshold value of the public debt-to-GDP ratio is 62.72%. In line with the threshold splitting Model 3, the public debt allocates the association between LCAB and LFB into two intervals, which are the public debt-to-GDP ratio is smaller or equal to 62.72% and the public debt-to-GDP ratio is greater than 62.72%.

In both regimes, LFB performs a positive and statistically significant relationship to LCAB where LFB gains a different coefficient in each interval. In other words, there are either twin surpluses or twin deficits between current account balance and fiscal balance. Additionally, Šulikovᵃ and Tykhonenko (2017) mentioned that there are different regressions among LCAB and LFB in each interval, this is due to the threshold estimation model predicting different coefficients. Hence, when the public debt-to-GDP threshold level is less or equal to 62.72%, LFB shows a coefficient of 0.0882 to LCAB; while, above the 62.72% public debt-to-GDP threshold level, LFB expressed a coefficient of 4.2363. These symbolize that a 1% fiscal balance contraction will enhance the CAB by 0.088% below the threshold level, while above the threshold level, a 1% raise in FB will give rise to 4.236% of LCAB.

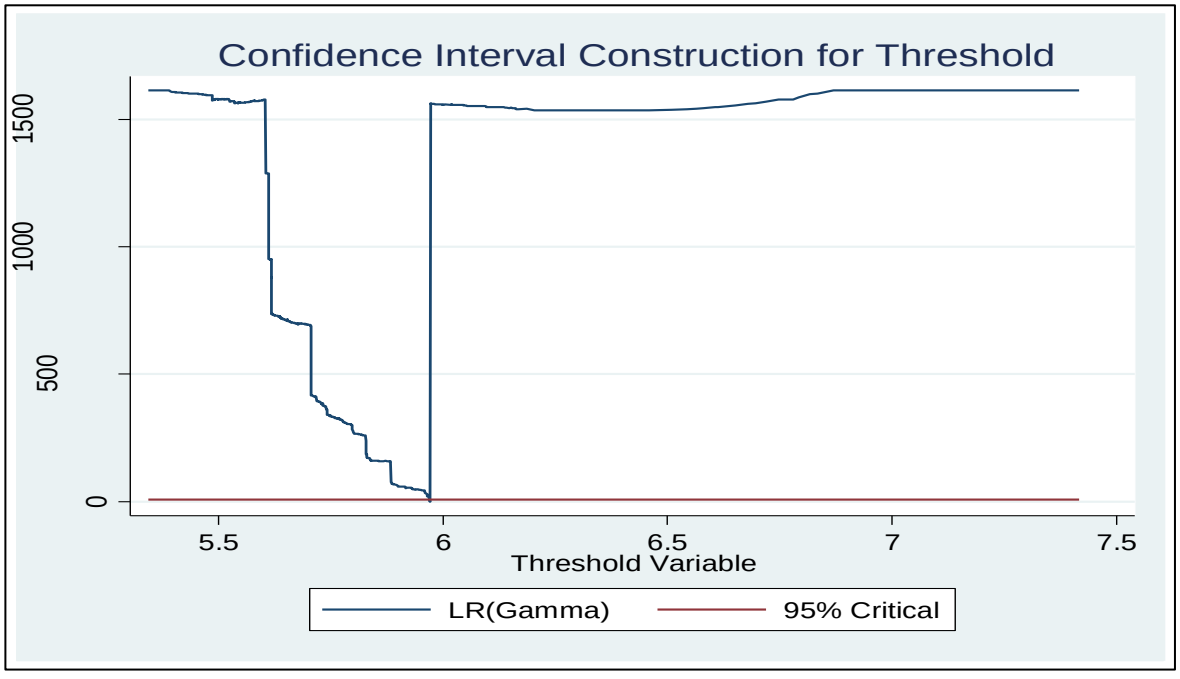


Figure 4.2: Public Debt Threshold Level Diagnostic Result
Source: Stata threshold estimation

Table 4.20: Panel Threshold Estimation – Public Debt as Threshold Indicator

	Public Debt Threshold	
	Below	Above
	$q \leq 62.72$	$q > 62.72$
LFB	0.0882 (0.0368)*	4.2363 (0.1057)*
LADRO	-0.4412 (0.1944)*	2.0496 (1.1378)*
LADRY	-0.1172 (0.0628)*	2.9451 (0.3117)*
LICT	0.0764 (0.0374)*	1.1404 (0.3065)*
LRGDP	0.0053 (0.0052)	-0.0103 (0.0404)
LREER	0.0088 (0.0215)	1.4747 (0.1236)*
Observations	1401	87
R-squared	0.0357	0.7691

Notes: The dependent variable is current account balance in the unit, percentage of GDP. Asterisks (*) indicate a 10% of significance level. Values in parentheses denote standard errors.

The results of public debt-to-GDP threshold level with a positive and statistically significant relationship between LCAB and LFB are compatible with the findings by Gevorkyan (2010), Soo and Kueh (2019), Okombi (2020), Rajakaruna et al. (2021), Awadzie et al. (2022), and Soo et al. (2023b). Gevorkyan (2010) examined 12 CIS countries from 1989 to 2008 and found that with the presence of debt in the model, CAB and FB produce a positive statistically more significant relationship. Besides, Soo and Kueh (2019) investigated 6 ASEAN countries from 1990 to 2016 and suggested that public debt affects the relationship between both balances, where there is a positive significant relationship. Furthermore, Okombi (2020) established in his research that the public debt

threshold is at 78.4%, when below the debt threshold, FB has a significantly positive influence on CAB with studies on 30 African countries from 2004 to 2017.

Likewise, Rajakaruna et al. (2021) used a panel threshold model to examine the effects of public debt on twin deficits in South Asia countries from 1980 to 2018. They concluded in their study that both below and above threshold levels, twin imbalances demonstrated a positive significant relationship. Those studies by previous researchers are highly coherent with the result of public debt as a threshold indicator in the model. Furthermore, the result is in the lines of recent literature by Awadzie et al. (2022) that estimates the debt threshold level which affects the economic growth of Ghana from 1990 to 2020. According to Awadzie et al. (2022), there is a positive association between public debt and growth when it is below a certain threshold. Moreover, the positive relation between twin balances is also supported by Soo et al. (2023b), who found that when above the public debt-to-GDP threshold of 63.36%, twin balances will illustrate a positive significant relationship.

On the other hand, it is apparent from Table 4.20, the relationship between other independent variables and LCAB in different regimes with the presence of LPD in the model is revealed. When the public debt-to-GDP threshold is below or equal to 62.72%, LADRO, LADRY, and LICT are significant to LCAB, whereas LRGDP and LREER are insignificant. Yet, LADRO and LADRY indicate a negative relation; LICT, LRGDP, and LREER are in a positive relationship. However, because the public debt-to-GDP ratio is

over 62.72%, all independent variables, except for LRGDP, are positively significant to LCAB.

Likewise, proceeding to the next, household debt performs as another threshold indicator which is stated as Model 4 in this study. The threshold estimation result shows that the threshold value of the household debt-to-GDP ratio is at 52.22% and the result is presented in Table 4.21. Since it is a single threshold estimation (stated as Model 4), the threshold is divided into two boundaries, which are household debt-to-GDP ratio is less or equal to 52.22% and household debt-to-GDP ratio is greater than 52.22%. When the threshold is below or equal to 52.22% household debt-to-GDP ratio, LFB reveals a negative and statistically significant relationship to LCAB with a coefficient of 0.0543 (refer to Table 4.21). This indicates that when there is a 1% increase in LFB, LCAB will decrease by 0.0543%. Besides, when the threshold of the household debt-to-GDP ratio is greater than 52.22%, LFB indicates a statistically significant and positive nexus to LCAB with a coefficient of 2.6729. This denotes that a 1% rise in LFB will bring 2.6729% of LCAB to expand.

The discussion on the threshold estimation result of the household debt-to-GDP ratio begins with the threshold level below or equal to 52.22%. The relationship between LFB and LCAB demonstrates statistically negative significance in the model. This occurrence is fulfilling the characteristics of twin divergence, where growth in the budget deficit complies with a rise in current account surplus. While above the 52.22% household

debt-to-GDP threshold level, both balances imply a positive significant association, this indicates the situation of twin deficits to occur.

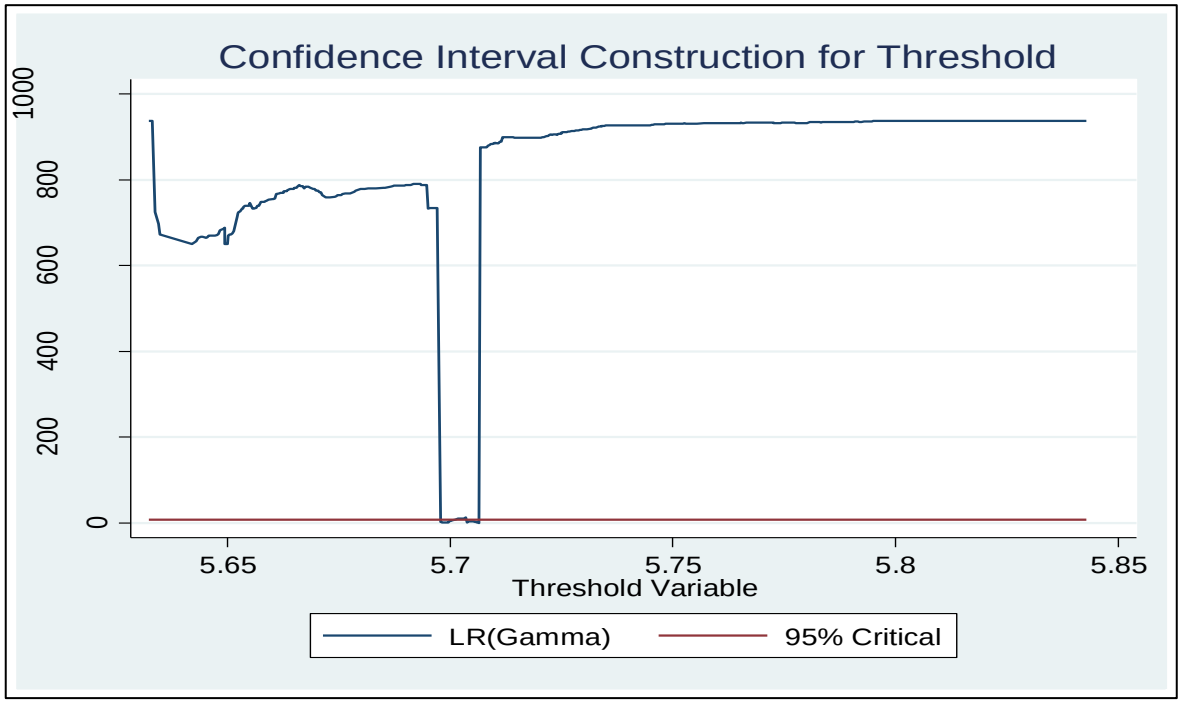


Figure 4.3: Household Debt Threshold Level Diagnostic Result
Source: Stata threshold estimation

Table 4.21: Panel Threshold Estimation – Household Debt as Threshold Indicator

	Household Debt Threshold	
	Below	Above
	$q \leq 52.22$	$q > 52.22$
LFB	-0.0543 (0.0328)*	2.6729 (0.0805)*
LADRO	0.1667 (0.3634)	0.6447 (0.2184)*
LADRY	0.4140 (0.1207)*	0.1313 (0.0930)
LICT	0.1521 (0.0908)*	0.0336 (0.0481)
LRGDP	-0.0038 (0.0130)	0.0108 (0.0064)*
LREER	-0.0349 (0.0270)	-0.0087 (0.0476)
Observations	455	1033
R-squared	0.0371	0.5262

Notes: The dependent variable is current account balance in the unit, percentage of GDP. Asterisks (*) indicate a 10% of significance level. Values in parentheses denote standard errors.

The threshold estimation result below the public debt threshold level is supported by Coban and Balikcioglu (2016), Kueh et al. (2017), *Šulikvá* and Tykhonenko (2017), Bentour (2020), and Bousnina and Gabsi (2023). Research findings by Coban and Balikcioglu (2016) point towards the consent of the twin divergence situation between the FB and CAB in transition economies. According to Kueh et al. (2017), when Malaysia's external debt falls below the 4% threshold level, it has a detrimental effect on economic growth, while above the 4% threshold level implies a positive nexus. Similarly, *Šulikvá* and Tykhonenko (2017) highlighted in the study where twin divergence takes place when public debt is below the 40% threshold level and exceeds the 96.6% threshold public debt.

Besides, another study by Bentour (2020) investigated the threshold effect on economic growth in 20 developed countries and discovered that a debt ratio below a certain threshold will have a negative impact. In addition, Bousnina and Gabsi (2023) also provide a conclusion in their study on 15 countries in MENA, where twin divergence occurs between CAB and FB when below the public debt threshold level of 36.71% and above 72.99% of public debt-to-GDP threshold.

However, some studies show that significant differences do exist, such as Nickel and Tudyka (2014), Kueh et al. (2016), and Law et al. (2021). In contrast, Nickel and Tudyka (2014) concluded that twin deficits occur at a low level of debt, whereas twin divergence happens at a high debt level. Moreover, according to Kueh et al. (2016), when public debt is below the 41% debt threshold, it has a positive impact on economic growth; but, when it surpasses the threshold level, there is an adverse association between public debt and economic growth. Interestingly, a study by Law et al. (2021) on 71 developing countries from 1984 to 2015 on economic growth and public debt concluded with high levels of public debt, debt has a negative and statistically significant impact on economic growth.

Additionally, Table 4.21 shows the nexus between LCAB and other independent variables as well as the inclusion of LHD in the model. When below or equal to the threshold level of 52.22% denoted by household debt, LADRY, and LICT demonstrate positive and statistically significant relationship to LCAB, whereas the LADRO performs a

positively insignificant, as well as LRGDP and LREER indicate a negatively insignificant relationship. Likewise, household debt-to-GDP threshold level greater than 52.22%, LADRO and LRGDP present a positively significant nexus between LCAB; whereas LADRY and LICT display a positively and insignificant relation, and LREER illustrates a negatively insignificant relationship to LCAB.

Based on the above findings on the threshold level of debt for two debt indicators (PD & HD), The presence of either twin deficits or twin surpluses in the model is shown by the positive and strong link between debt and current account. Countries with high levels of debt threshold denote countries that are experiencing large debts and thus fiscal deficits. As a result, countries must credit extra money to solve the debt problems, leading to the happening of deficits in current accounts. Therefore, the Keynesian theory of deficits can be observed. In other words, a rising fiscal deficit causes domestic absorption, which in turn causes imports to expand, introducing a current account deficit. Besides, when the budget deficit increases, the government is likely to receive less than it spends, bringing to the pushing of the current account deficit too. However, countries that have lower threshold debt levels will have a vice-versa situation. As they gain a lesser debt-owing status, countries will not feel the burden of borrowing extra money to overcome the huge fiscal deficit circumference.

The next important finding from this research is the negative and statistically significant relationship between debt and current accounts. This happens when the debt-to-

GDP threshold level of household is lower than 52.22%. In other words, this demonstrates the occurrence of twin divergence in the model. In 2017, Šulikovά and Tykhonenko published a paper in which they emphasized that the implementation of expansionary fiscal policy benefits nations whose household debt levels decline under this regime and do not impair the current account balance. Likewise, regardless of the rise in output or consumption, the fiscal stimulus also will not be affected or even worsen, which later brings to the current account deficit adjustment (Šulikovά & Tykhonenko, 2017).

Table 4.22 gives an overview of the threshold levels of public debt and household debt as debt indicators in addition to reveal the threshold levels for 48 Asia countries. Besides, the plot graphs of the threshold debt level and mean debt values of 48 Asia countries from 1990 to 2020 are tabulated as Figure 4.4 (PD as debt indicator) and Figure 4.5 (HD as debt indicator). When public debt acts as a debt threshold indicator, the estimated threshold debt level is 62.72%. There are a total of ten countries that have mean public debt value above the estimated threshold level of public debt-to-GDP, which are Afghanistan, Bhutan, India, Iraq, Israel, Japan, Jordan, Myanmar, Singapore, and Sri Lanka. However, public debt-to-GDP threshold estimation likewise shows a positive statistically significant association between FB and CAB beneath and above the threshold level. This induces the twin deficits phenomenon with non-Ricardian behaviour, where a rise (reduction) in the fiscal deficit will prompt the growth (shrink) in the current account deficit.

In addition, in accordance with the tabulated data in Table 4.22, when household debt performs as a debt threshold indicator, there are 9 out of 48 countries that are ranked below the estimated debt-to-GDP threshold level of 52.22%. Those countries are Afghanistan, Iran, Iraq, Lebanon, Saudi Arab, Syrian Arab, Timor-Leste, Turkey, and Yemen. In other words, these nine countries have undergone a twin divergence phenomenon, signifying the application of the Ricardian view. As household debt levels increase, people realize the return on future taxes, so this will incentivize them to save more rather than spend. Therefore, the current account will turn into a surplus.

Table 4.22: Mean Values of Public Debt and Household Debt with Threshold Debt Levels of 48 Asia Countries

Public Debt (PD)		**Country**	**Household Debt (HD)**	
Mean (% of GDP)	**Threshold Level (62.72%)**		**Mean (% of GDP)**	**Threshold Level (52.22%)**
251.92	Above	Afghanistan	48.13	Below
41.00	Below	Armenia	63.50	Above
14.84	Below	Azerbaijan	64.52	Above
35.80	Below	Bahrain	67.37	Above
42.33	Below	Bangladesh	71.73	Above
72.38	Above	Bhutan	68.96	Above
1.00	Below	Brunei	65.78	Above
31.24	Below	Cambodia	80.99	Above

Table 4.22 continued

Public Debt (PD)		Country	Household Debt (HD)	
Mean (% of GDP)	**Threshold Level (62.72%)**		**Mean (% of GDP)**	**Threshold Level (52.22%)**
29.22	Below	China	75.65	Above
44.63	Below	Georgia	64.90	Above
0.38	Below	Hong Kong	63.81	Above
72.66	Above	India	57.80	Above
40.47	Below	Indonesia	67.17	Above
24.22	Below	Iran	44.89	Below
427.53	Above	Iraq	41.63	Below
85.44	Above	Israel	57.33	Above
163.98	Above	Japan	64.00	Above
96.64	Above	Jordan	68.98	Above
19.36	Below	Kazakhstan	70.66	Above
2.14	Below	Korea	82.29	Above
15.51	Below	Kuwait	66.81	Above
-8.61	Below	Kyrgyzstan	66.00	Above
-5.01	Below	Laos	78.98	Above
-21.02	Below	Lebanon	45.42	Below
0.00	Below	Macau	66.72	Above
47.81	Below	Malaysia	60.54	Above

Table 4.22 continued

Public Debt (PD)		Country	Household Debt (HD)	
Mean (% of GDP)	**Threshold Level (62.72%)**		**Mean (% of GDP)**	**Threshold Level (52.22%)**
53.45	Below	Maldives	59.93	Above
56.53	Below	Mongolia	60.80	Above
116.62	Above	Myanmar	77.61	Above
46.11	Below	Nepal	84.72	Above
0.44	Below	Oman	59.24	Above
-2.27	Below	Pakistan	52.33	Above
53.07	Below	Philippines	65.55	Above
4.55	Below	Qatar	81.98	Above
5.66	Below	Saudi Arab	51.76	Below
93.60	Above	Singapore	66.05	Above
80.14	Above	Sri Lanka	55.93	Above
-1.02	Below	Syrian Arab	47.22	Below
28.08	Below	Taiwan	85.70	Above
-9.05	Below	Tajikistan	67.13	Above
38.85	Below	Thailand	74.17	Above
1.53	Below	Timor-Leste	48.86	Below
40.39	Below	Turkey	50.05	Below
-2.41	Below	Turkmenistan	60.64	Above

Table 4.22 continued

Public Debt (PD)		Country	Household Debt (HD)	
Mean (% of GDP)	**Threshold Level (62.72%)**		**Mean (% of GDP)**	**Threshold Level (52.22%)**
8.00	Below	UAE	77.06	Above
1.21	Below	Uzbekistan	60.17	Above
-2.00	Below	Vietnam	77.55	Above
-2.35	Below	Yemen	47.26	Below

Notes: Public debt and household debt act as debt threshold indicators. The threshold levels of both debt indicators are estimated in the panel threshold estimation. The total number of countries in this study is 48 Asia countries.

Source: Calculation

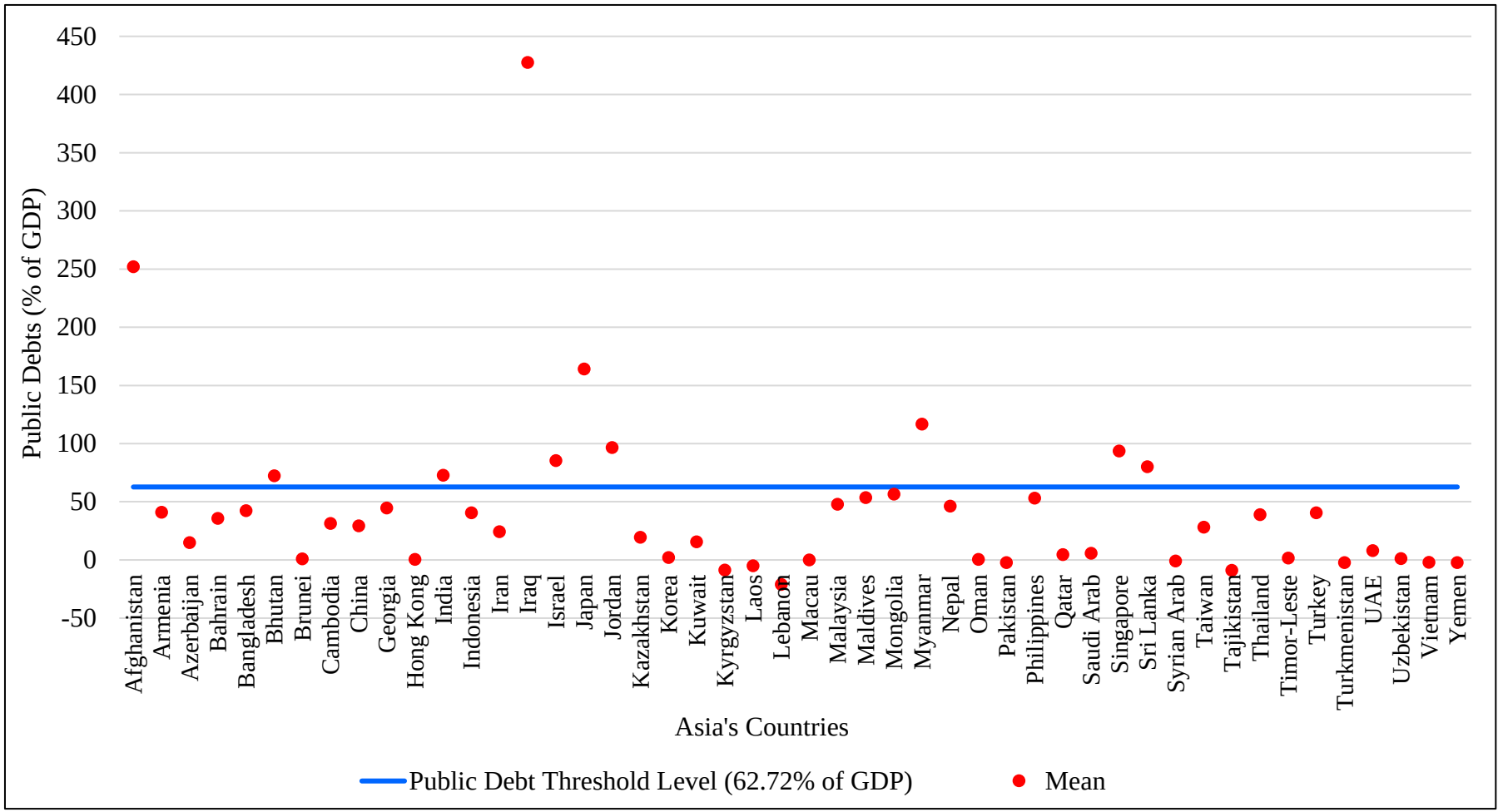


Figure 4.4: Plot of Public Debt Threshold Level and Mean Public Debt Values of 48 Asia Countries from 1990 to 2020

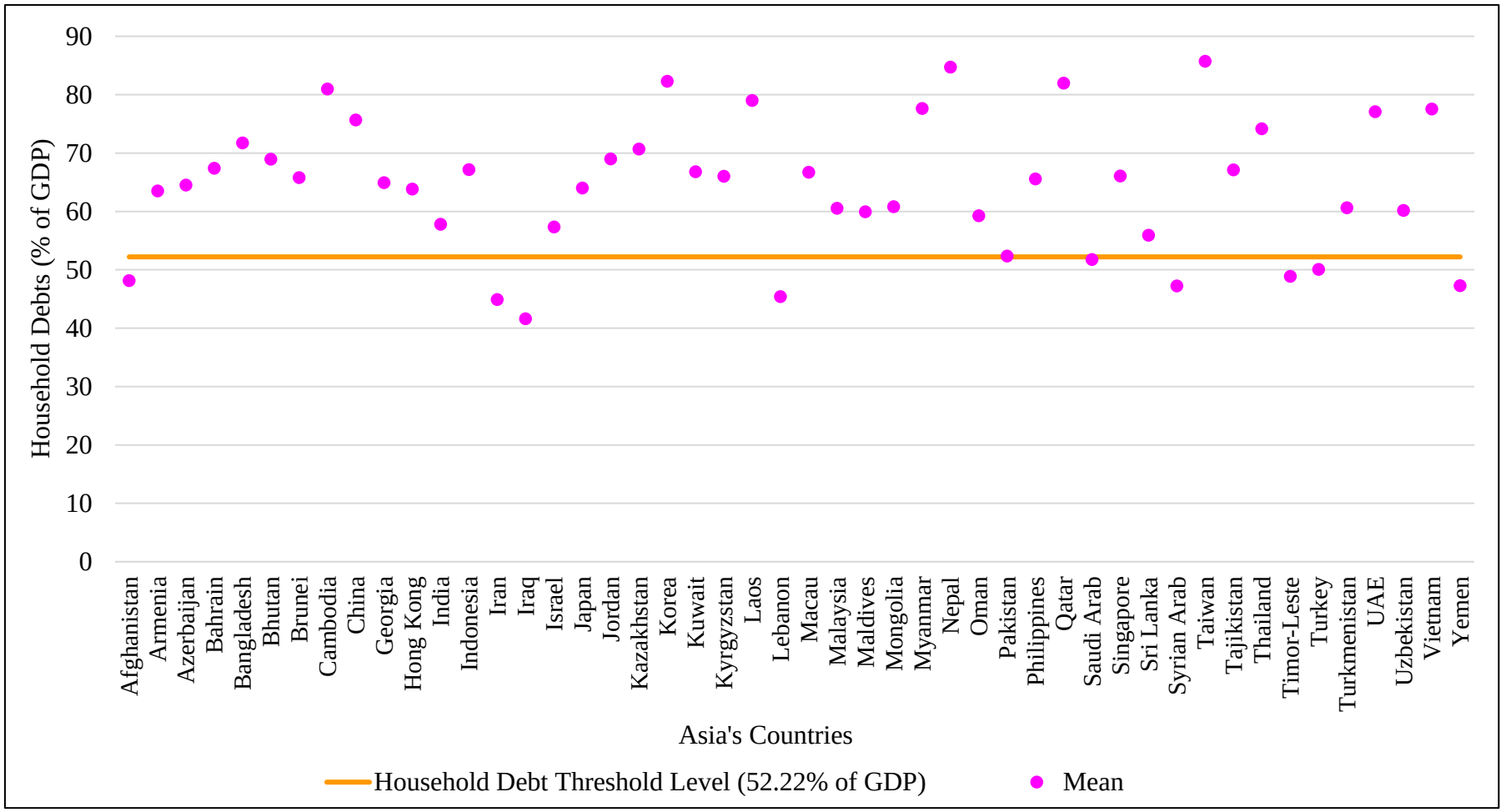


Figure 4.5: Plot of Household Debt Threshold Level and Mean Household Debt Values of 48 Asia Countries from 1990 to 2020

Lastly, the threshold effect test confirms that when public debt and household debt perform as debt indicators in the model, both demonstrate a single threshold model (stated as Model 3 and Model 4). When proceeding to threshold estimation, public debt acts as a threshold indicator, the debt-to-GDP threshold level is at 62.72%. Below and above the threshold level, FB and CAB are showing a statistically positive significant relationship, where both balances are always shifting in the same path.

On the other hand, the debt-to-GDP threshold level when household debt acts as a debt indicator is calculated at 52.22%. The estimated threshold level indicates that when the household debt-to-GDP threshold level is less or equal to 52.22%, twin balances will withstand the twin divergence appearance, where FB and CAB have a negatively significant relation; whereas when household debt-to-GDP threshold level is greater than 52.22%, twin balances execute positive statistically significant connection. In other words, non-Ricardian characteristics can be examined in the model of household debt as a debt indicator.

4.7 Robustness Check for Threshold Estimation

4.7.1 Panel Quantile Regression

Quantile regression is an extension of linear regression with no powerful distributional assumptions that later is involved in estimating the conditional median of the

responding variables. It is applied when the conditions of linear regression are not met, such as linearity, homoscedasticity, and normality. Moreover, a quantitative regression analysis method also enables researchers to look at the correlation of a set of individual variables, with an interdependent variable that differs from one quantile to another in terms of distribution. According to Law et al. (2021), there is a QRPD with nonadditive fixed effects proposed by Powell (2015). The QRPD is an estimator that keeps the indivisible interference property that typically drives the adoption of quantile estimators while using within-group variation for identification. Moreover, Powell (2015) stated that QRPD is easy to interpret and apply due to the individual effects are not estimated compared to most quantile data estimators, where the amount of parameters required to be tested is small, hence the implementation of an estimator is comparable easier.

In line with Law et al. (2021), a robustness check is performed to inspect the sensitivity of the estimation outcomes for other estimation schemes and methods on the debt threshold estimation. To further assess for robustness of this study, Powell (2015) introduced the panel quantile regression analysis. The panel quantile regression robustness check, there are involving quantile regression analysis, quantile process estimates, quantile slope equality test, and symmetric quantiles test. Besides, the quantile analysis is carried out for two models, where public debt and household debt are performed separately as debt indicators.

In every analysis and test that involves the quantile regression, they will have different rules of hypotheses. In accordance with quantile regression median analysis, H_0 has no significant impact on LCAB due to the independent variable, and H_a has a significant impact on LCAB due to the independent variable. Besides, are the tests of quantile regression coefficients that included of quantile slope equality test and symmetric quantiles test. In the slope quantile equality test, H_0 indicates slope equality does not differ across quantile levels and H_a represents slope equality is different across quantile levels. Likewise, in the symmetric quantiles test, H_0 indicates the symmetry quantile and H_a represents the asymmetry quantile.

Firstly, is the robustness check on Model 3, where public debt is present as the debt indicator in the threshold estimation model. In quantile regression median analysis, it refers to the result tabulated in Table 4.23. Due to their *p*-values being less than 10% of the significance level, the results indicate that all independent variables are statistically significant to LCAB, whereas except LREER is insignificant to LCAB with a *p*-value greater than 10% significance level. For LFB, when it grows to a 1% median value, causes the LCAB to rise by 0.35% in the median value. Additionally, to determine the goodness-of-fit of quantile regression, investigate the R-squared and probability of the analysis. The Pseudo R-squared is 6.42% and the adjusted R-squared is 5.98%. So, a 5.98% variation in the conditional median in LCAB is due to LFB. Besides, the Quasi-LR statistic value is 289.3369 and the *p*-value is significant, which denotes that Model 3 is stable.

Table 4.23: Quantile Regression Median Analysis – Public Debt as Debt Indicator

	Quantile Regression (Median)
LFB	0.3489(0.0806)*
LPD	0.0115(0.0906)*
LADRO	-0.2519(0.0000)*
LADRY	-0.0930(0.0002)*
LICT	0.0429(0.0002)*
LRGDP	0.0066(0.0000)*
LREER	0.0012(0.7457)
Pseudo R-squared	0.0642
Adjusted R-squared	0.0598
Quasi-LR statistics	289.3369
Probability	0.0000*

Notes: The dependent variable is LCAB. The debt indicator is LPD. Values in parentheses denote *p*-value. Asterisks (*) indicate *p*-value statistically significant at a 10% level.

Likewise, this is the quantile estimation of Model 3 (PD as debt indicator). According to Table 4.24, in the 10th quantile, LCAB will increase by 0.7681% when there is a 1% rise in LFB. However, from the 20th quantile, coefficients of LCAB start to decline until the 90th quantile (0.0335%). In other words, in the 90th quantile, when there is a growth in LFB of 1%, LCAB will increase by 0.0335%. Figure 4.6 depicts the trend of the coefficient of LFB from 10th to 90th quantiles in relationship to LCAB when public debt acts as a debt indicator, and it shows a downward-sloping pattern. Apart from that, the coefficient of LFB below the 60th quantile and above the 60th quantile is positive and statistically significant to LCAB (Table 4.24). Hence, the robustness check has similar

findings to threshold estimation (Table 4.20). Besides, overall, the majority number of quantiles in LFB have *p*-values smaller than a 10% significance level. Hence, LFB is statistically significant to LCAB in the model. Additionally, while most of the *p*-values are below the significance level, LPD, LICT, and LRGDP also have positive significant relationships to LCAB, but LREER has a positive insignificant relation. Yet, LADRO and LADRY reveal an inverse relationship between LCAB.

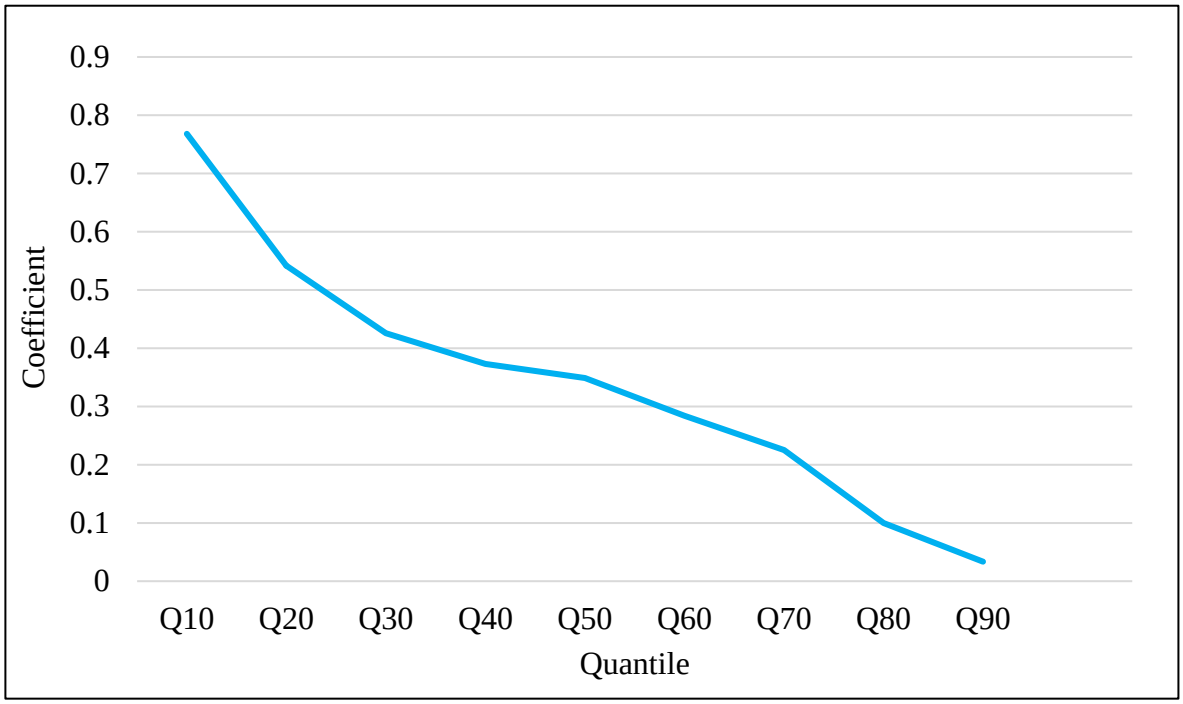


Figure 4.6: Coefficients of Fiscal Balance at Different Quantiles in Relationship to Current Account Balance (Model 3)

Table 4.24: Quantile Process Estimation – Public Debt as Debt Indicator

Quantile Process Estimation							
Quantile	**Independent Variables**						
	LFB	**LPD**	**LADRO**	**LADRY**	**LICT**	**LRGDP**	**LREER**
10th	0.7681	-0.0280	0.0432	-0.0768	0.0190	0.0231	-0.0027
	(0.0003)*	(0.0459)*	(0.6744)	(0.2866)	(0.3705)	(0.0000)*	(0.9262)
20th	0.5415	-0.0075	-0.0613	-0.0319	0.0260	0.0180	0.0035
	(0.0105)*	(0.6536)	(0.4890)	(0.4825)	(0.0586)*	(0.0000)*	(0.7372)
30th	0.4256	0.0102	-0.1749	-0.0632	0.0247	0.0127	0.0071
	(0.1000)*	(0.4015)	(0.0033)*	(0.0743)*	(0.0424)*	(0.0000)*	(0.0958)*
40th	0.3730	0.0092	-0.2166	-0.0709	0.0422	0.0095	0.0036
	(0.1153)	(0.3589)	(0.0000)*	(0.0053)*	(0.0001)*	(0.0000)*	(0.3557)
50th	0.3489	0.0115	-0.2519	-0.0930	0.0429	0.0066	0.0012
	(0.1178)	(0.0906)*	(0.0000)*	(0.0002)*	(0.0002)*	(0.0000)*	(0.7457)
60th	0.2838	0.0110	-0.3194	-0.1104	0.0694	0.0044	0.0002
	(0.0944)*	(0.0527)*	(0.0001)*	(0.0001)*	(0.0000)*	(0.0157)*	(0.9649)
70th	0.2250	0.0152	-0.4325	-0.1699	0.0846	0.0003	0.0023
	(0.3406)	(0.0079)*	(0.0003)*	(0.0000)*	(0.0001)*	(0.9147)	(0.6497)
80th	0.1001	0.0175	-0.6759	-0.1568	0.1391	-0.0004	-0.0026
	(0.0518)*	(0.0506)*	(0.0000)*	(0.0000)*	(0.0000)*	(0.8866)	(0.5497)
90th	0.0335	0.1214	-1.0530	-0.1558	0.1827	-0.0128	-0.0120
	(0.0104)*	(0.0000)*	(0.0000)*	(0.0046)*	(0.0010)*	(0.0155)*	(0.0491)*

Notes: The dependent variable is LCAB. Debt indicator is LPD. Number of process quantiles is 10. Values in parentheses denote *p*-value. Asterisks (*) indicate the *p*-value is statistically significant at the 10% level.

In addition, Table 4.25 is on the tests of quantile regression coefficients where public debt is a debt indicator. According to the result in Table 4.25, the Wald test Chi-square statistics is 536.8010, which is statistically significant at a 10% significance level. Hence, H_0 is rejected, which means that slope equality is different across quantile levels. On the other hand, is the symmetric quantiles test. The value of 53.8657 is statistically significant with a *p*-value of 0.0000, as shown by the Wald test Chi-square statistics in Table 4.25. Thus, the model shows the sign of asymmetry.

Table 4.25: Tests of Quantile Regression Coefficients – Public Debt as Debt Indicator

Quantile Slope Equality Test	
Wald Test Chi-square Statistics	536.8010
Probability	0.0000*
Symmetric Quantiles Test	
Wald Test Chi-square Statistics	53.8657
Probability	0.0000*

Notes: The dependent variable is LCAB. Debt indicator is LPD. Asterisks (*) indicate the *p*-value is statistically significant at the 10% level.

Secondly, keep on to the robustness check on Model 4, where household debt is marked as a debt indicator in the threshold estimation model. In quantile regression median analysis, all independent variables are statistically significant to LCAB, since their *p*-values are less than 10% significance level, whereas except LREER is insignificant to LCAB with a *p*-value greater than 10% of significance level (refer to Table 4.26). The outcome indicates that when there is 1% median value increase in the LFB, the LCAB will

increase by 0.3604%. Yet, the goodness-of-fit of quantile regression is decided by the R-squared and probability of the analysis. The Pseudo R-squared is 6.55% and the adjusted R-squared is 6.11%. So, a 6.11% variation in the conditional median in LCAB is due to LFB. Besides, the Quasi-LR statistic value is 294.1743 and the *p*-value is significant, which denotes that Model 4 is stable.

Table 4.26: Quantile Regression Median Analysis - Household Debt as Debt Indicator

	Quantile Regression (Median)
LFB	0.3604(0.0815)*
LPD	-0.0767(0.0239)*
LADRO	-0.2342(0.0001)*
LADRY	-0.0862(0.0003)*
LICT	0.0499(0.0000)*
LRGDP	0.0074(0.0000)*
LREER	-0.0004(0.9180)
Pseudo R-squared	0.0655
Adjusted R-squared	0.0611
Quasi-LR statistics	294.1743
Probability	0.0000*

Notes: The dependent variable is LCAB. Debt indicator is LHD. Values in parentheses denote *p*-value. Asterisks (*) indicate the *p*-value is statistically significant at the 10% level.

Apart from that, is the quantile regression estimation of Model 4 (HD as debt indicator). Based on Table 4.27, in the 10th quantile, LCAB will increase by 0.7553% when

there is a 1% rise in LFB. However, from the 20th quantile, coefficients of LCAB start to decline until the 90th quantile (0.0538%). In other words, in the 90th quantile, when there is a growth in LFB of 1%, LCAB will increase by 0.0538%. Figure 4.7 depicts the trend of the coefficient of LFB from 10th to 90th quantiles in relationship to LCAB when HD acts as a debt indicator and it shows a downward-sloping pattern. Moreover, the coefficient of LFB below the 50th quantile and above the 50th quantile is positive and statistically significant to LCAB (Table 4.27).

However, the robustness check has a different outcome compared to threshold estimation (Table 4.21), while threshold estimation performs a negative significant nexus to LCAB below the 52.22% threshold level. On the other hand, overall, there is a majority number of quantiles in LFB that have *p*-values smaller than the 10% significance level. Hence, LFB is statistically significant to LCAB in the model. Additionally, while most of the *p*-values are lower than the significance level, LHD, LADRO, LADRY, LICT, and LRGDP also exhibit significant relation to LCAB, whereas LREER is insignificant to LCAB. However, LHD, LADRO, and LADRY illustrate an adverse association between LCAB, while LICT and LRGDP have a positive linkage.

Table 4.27: Quantile Process Estimation – Household Debt as Debt Indicator

Quantile Process Estimation							
Qua	**Independent Variables**						
ntile	**LFB**	**LHD**	**LADRO**	**LADRY**	**LICT**	**LRGDP**	**LREER**
10th	0.7553	0.2342	0.0924	-0.0575	0.0104	0.0211	0.0141
	(0.0005)*	(0.0001)*	(0.2089)	(0.3762)	(0.5072)	(0.0000)*	(0.7977)
20th	0.5081	0.0966	-0.0576	-0.0401	0.0191	0.0176	0.0092
	(0.0018)*	(0.0076)*	(0.2800)	(0.2802)	(0.1523)	(0.0000)*	(0.0423)*
30th	0.4258	-0.0529	-0.1767	-0.0651	0.0310	0.0134	0.0031
	(0.0202)*	(0.4474)	(0.0007)*	(0.0589)	(0.0150)*	(0.0000)*	(0.5934)
40th	0.3964	-0.0806	-0.2134	-0.0850	0.0365	0.0098	0.0014
	(0.0847)*	(0.0717)*	(0.0000)*	(0.0011)*	(0.0004)*	(0.0000)*	(0.7391)
50th	0.3604	-0.0767	-0.2342	-0.0862	0.0499	0.0074	-0.0004
	(0.1000)*	(0.0239)*	(0.0001)*	(0.0003)*	(0.0000)*	(0.0000)*	(0.9180)
60th	0.3149	-0.0874	-0.2867	-0.1151	0.0640	0.0044	-0.0022
	(0.1687)	(0.0037)*	(0.0003)*	(0.0001)*	(0.0000)*	(0.0158)*	(0.5981)
70th	0.2273	-0.1480	-0.4051	-0.1851	0.0882	0.0001	-0.0045
	(0.4440)	(0.0000)*	(0.0047)*	(0.0001)*	(0.0004)*	(0.9662)	(0.3563)
80th	0.1046	-0.2371	-0.5695	-0.2354	0.1083	-0.0031	-0.0082
	(0.0577)*	(0.0000)*	(0.0000)*	(0.0000)*	(0.0002)*	(0.3567)	(0.0351)*
90th	0.0538	-0.6964	-0.6314	-0.3572	0.1104	-0.0166	-0.0292
	(0.0001)*	(0.0000)*	(0.0000)*	(0.0000)*	(0.0020)*	(0.0000)*	(0.0001)*

Notes: The dependent variable is LCAB. Debt indicator is LHD. Number of process quantiles is 10. Values in parentheses denote *p*-value. Asterisks (*) indicate the *p*-value is statistically significant at the 10% level.

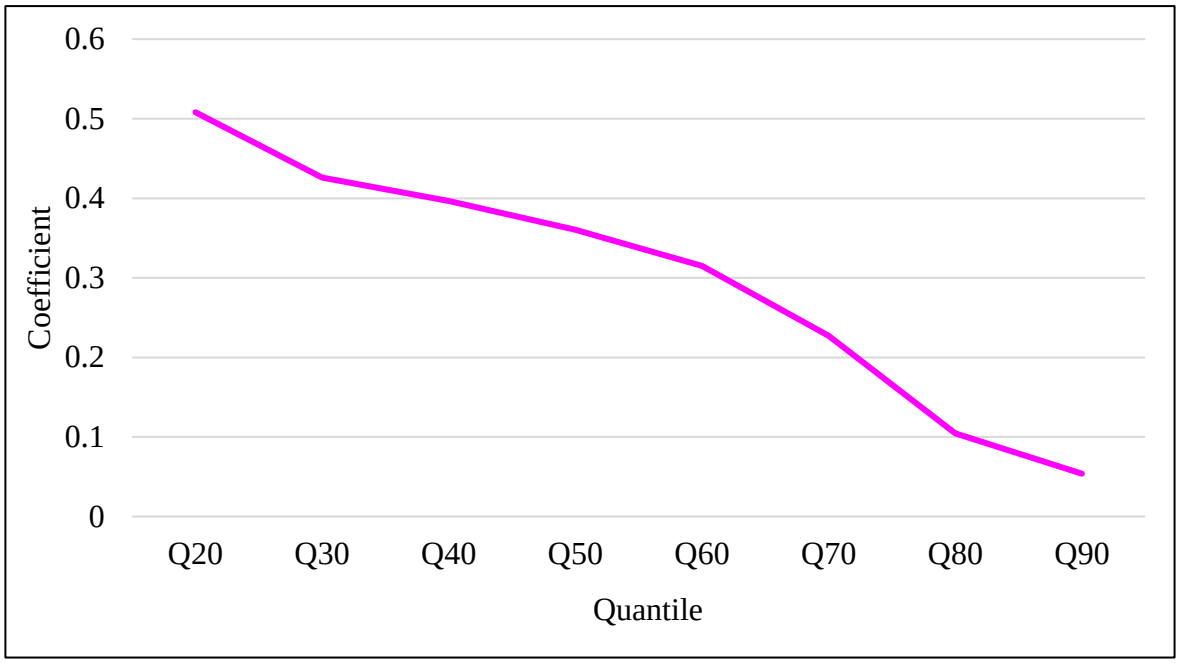


Figure 4.7: Coefficient of Fiscal Balance at Different Quantiles in Relationship to Current Account Balance (Model 4)

Next, Table 4.28 is on the tests of quantile regression coefficients where public debt is the debt indicator. According to the result in Table 4.28, the Wald test Chi-square statistics is 681.0761, which is statistically significant at a 10% significance level. Hence, H_0 is rejected, which means that slope equality is different across quantile levels. Beyond, is the symmetric quantiles test. According to Table 4.28 on the Wald test Chi-square statistics, the value is 43.5538, and the *p*-value of 0.0000 indicates that it is statistically significant. Hence, asymmetry in the model is demonstrated.

Table 4.28: Tests of Quantile Regression Coefficients – Household Debt as Debt Indicator

Quantile Slope Equality Test	
Wald Test Chi-square Statistics	681.0761
Probability	0.0000*
Symmetric Quantiles Test	
Wald Test Chi-square Statistics	43.5538
Probability	0.0836*

Notes: The dependent variable is LCAB. Debt indicator is LHD. Asterisks (*) indicate the *p*-value is statistically significant at the 10% level.

In conclusion, the robustness check for threshold estimation is carried out by utilizing quantile regression panel estimation (Law et al., 2021). According to the quantile regression estimation, both Model 3 and Model 4 demonstrate stable and asymmetry panel models with slope equality different across quantile levels. Furthermore, based on the quantile estimation for Model 3 and Model 4, LFB denotes a positive and statistically significant relationship to LCAB.

In other words, the quantitative nature of the quantile regression estimation results is highly robust to the threshold estimation of Model 3, whereas only partially robust to the threshold estimation of Model 4 as an alternative estimation technique.

4.8 Concluding Remarks

The general objective of this study is to focus on current account imbalances and indebtedness in Asia countries. This study has some specific objectives that will enable it to accomplish the main goal. The first objective is to analyse the determinants of current account imbalance, the second aim is to examine the impacts of different type of debts on twin imbalances, and the third purpose is to assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts. In addition, this study includes 48 Asia countries (refer to Appendix A) with annual data from 1990 to 2020. Current account balance (CAB) is the endogenous (dependent) variable, while the exogenous (independent) variables are fiscal balance (FB), public debt (PD), household debt (HD), age dependency ratio for old (ADRO), age dependency ratio for young (ADRY), ICT, real GDP (RGDP), and real effective exchange rate (REER). On the other hand, the number of cross-sectional (*N*) and the number of time series (*T*) is 48 and 31 respectively. Hence, this study is considered a micro-panel dataset.

Likewise, this study adopts balanced panel data with four different panel data models. Model 1 analyses the determinants of current account imbalance using a linear function without a threshold effect. Model 2 adds HD as a variable to meet the aim of examining the impacts of different type of indebtedness on twin imbalances. Next, to fulfil the 3rd objective on threshold effect, single panel threshold splitting models of Model 3 and Model 4 is created. Likewise, the Model 3 utilised public debt as a debt indicator, while the

Model 4 employed household debt as a debt indicator. Furthermore, the main methodologies applied in this study are dynamic GMM panel estimation and panel threshold estimation. Besides, there are robustness checks on the main estimations, which involve GMM estimation (with a 3-year average), PMG estimation, DOLS estimation, and panel quantile regression analysis.

Furthermore, descriptive statistics on mean and standard deviation are computed and tabulated to offer a quick capture of the movement of all variables before estimations are performed in this study. The PCA is also conducted to choose the best suit of the ICT variable that is applied in the study. This study is a micro panel dataset, hence, a dynamic two-step GMM panel estimation is being applied to fulfil the 1st and 2nd objectives.

As referring to the 1st objective on Model 1, the dynamic GMM panel estimation result indicates that LFB, LPD, LADRO, and LRGDP are significant to LCAB at a 10% significance level, where the coefficient of LFB, LADRO, and LRGDP indicate a positive sign, whereas LPD denotes negative sign. However, LICT, LADRY, and LREER do not have a significant impact on LCAB in the model. Nevertheless, the insignificant relationship between LICT and LCAB is inconsistent with the research outcomes by Ozcan (2018), Toader et al., (2018), Wang and Choi (2019), and Kurniawati (2022), where they concluded that ICT has a positive and highly significant impact on economic growth and exports of a country.

In accordance with the 2nd objective of this study, to examine the impacts of different type of debts on twin imbalances, Model 1 only has public debt, the coefficient of LFB is 1.9504 with a positive statistically significant relationship with LCAB at 10% significance level. Moreover, when referring to Model 2, it added household debt as another independent variable, LFB also has a positive and significant association with LCAB at a 10% significance level with a coefficient of 1.9583. In sum, LFB in Model 1 and Model 2 have positive and significant relationship to LCAB. This phenomenon is related to both the Keynesian theory and the twin deficits hypothesis.

Hereafter, robustness checks of dynamic GMM panel estimation, GMM estimation with a 3-year average, PMG estimation, and DOLS estimation are performed. In GMM estimation, the time range is reduced to a 3-year average to create a short panel sample and variables are assumed to be stationary. The outcome for Model 1 indicates that the determinants of LCAB are LFB and LRGDP, which show a positive and significant impact. Hence, this short sample robustness checking for Model 1 is partially robust as an alternative estimation technique in this study. Likewise, the result for Model 2 shows that LFB has a positive significant relationship with LCAB. This estimation result is a tally of the result of long sample dynamic GMM panel estimation.

Furthermore, in accordance with the robustness check by using PMG estimation, the Hausman test is performed to determine the selection of estimator either MG or PMG estimation. Based on the outcome of the Hausman test, the PMG estimator is preferable. In

keeping with the 1st objective, the result of PMG estimation reveals that the potential determinants are LFB, LPD, LADRO, LADRY, LICT, and LRGDP. Moreover, to keep with the practice of 2nd objective, PMG estimation indicates that LFB in Model 1 and Model 2 act positively significant relation to LCAB. This outcome meets with the practice in Keynesian Theory and the twin deficits hypothesis. Afterwards, is the robustness check by DOLS estimation. For the 1st objective in DOLS estimation, all variables demonstrate positive and statistically significant nexus to LCAB, except LREER is in negative significance. Besides, in keeping with the 2nd objective, LFB in DOLS estimation for both Model 1 and Model 2 also performs a positive statistically significant relationship to LCAB. In other words, the robustness checks practice by adopting PMG and DOLS estimations are robust to dynamic GMM panel estimations.

Furthermore, to serve with the 3rd objective to assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts, threshold estimation is applied. There are two models involved in estimations, Model 3 adopted PD as the debt indicator, and Model 4 employed HD as the debt indicator. Moreover, a threshold effect test is gone through to justify the pattern of the threshold model of Model 3 and Model 4, where it confirms that both models are single threshold splitting model which has two regimes (below or equal to threshold level & above threshold level). In threshold estimation, the public debt-to-GDP threshold level of Model 3 is 62.72%, while Model 4 has a household debt-to-GDP threshold level of 52.22%. In Model 3 of both regimes, LFB is illustrated positive statistically significant relation to LCAB, fulfilling the twin deficits hypothesis. However, in Model 4, LFB is negatively and

significant to LCAB below or equal to the 52.22% threshold level, which is the phenomenon of twin divergence; when above the threshold level of 52.22%, the LFB has a positive significant nexus to LCAB, with the occurrence of twin deficits. Besides, the twin divergence phenomenon indicates there is an inverse relation between LFB and LCAB, where increases in LFB will induce LCAB to decrease. Twin divergence becomes an obvious finding from this study where it is sustainable to studies by Coban and Balikcioglu (2016), Kueh et al. (2017), Šulikovᵃ and Tykhonenko (2017), Bentour (2020), and Bousnina and Gabsi (2023).

In addition, there is also a robustness check on panel threshold estimation with the application of panel quantile regression estimation. In panel quantile regression estimation, Model 3 and Model 4 concluded that both are stable and asymmetrical panel models with slope equality are different across quantile levels. Apart from that, both models also demonstrate a statistically significant and positive relationship to LCAB. In other words, the quantitative nature of the quantile regression estimation result is highly robust to the threshold estimation of Model 3, whereas only partially robust to the threshold estimation of Model 4 as an alternative estimation technique.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study comprises five main chapters which start from the introduction to the conclusion. Nevertheless, Chapter 5 is the last chapter of this study that mainly focuses on the conclusion and recommendations. In this last chapter, the study is summarized accordingly to provide a clear insight and quick understanding. All the information and message of work from Chapter 1 to Chapter 4 is extracted. In addition, policies and recommendations in line with the study's outcomes are included in subsequent section.

The outline of this chapter comprises four main sections. Firstly, Chapter 5.1 is a brief introduction to the chapter. Next is Chapter 5.2, which embodies the general summary and conclusions of the study. Furthermore, the policies and recommendations that apply to this study are discussed in Chapter 5.3. Then, Chapter 5.4 is subject to the limitations of the study and proposes suggestions to assist in further study on the same topic issue.

5.2 Summary and Conclusion

Current account imbalances are emerging around the world. According to UNCTAD, an economy's revenue received from dealings with other economies is frequently considerably different from its revenue paid. In 2019, most economies in the U.S., Africa, Eastern Europe, and Central Asia spent more than they received, leading to current account deficits. Moreover, UNCTAD also indicates that the rise in CAB is primarily attributable to the increase in the surplus of the developing Asia economies and the growth in deficit of developing economies in the U.S.

In accordance with the global current account issue, this study is research on current account imbalances and indebtedness. The specific purposes of this study are to analyse the determinants of the current account imbalance, to examine the impacts of different type of debts on twin imbalances, and to assess the relationship between fiscal balance and current account balance on the threshold level of different type of debts. Furthermore, this study includes 48 Asia countries with annual data from 1990 to 2020. Current account balance (CAB) acts as a dependent (endogenous) variable, whereas fiscal balance (FB), public debt (PD), household debt (HD), age dependency ratios for old and young (ADRO & ADRY), ICT, real GDP (RGDP), and real effective exchange rate (REER) are demonstrating as independent (exogenous) variables.

Furthermore, the theories that are related to this study primarily are the Keynesian theory of deficits and Ricardian equivalence. With the 2nd objective to examine the impacts of different types of debs on twin imbalances, the theory applied is the Keynesian theory of deficits. Keynesian absorption theory illustrates the dual relation between FB and CAB. According to the theory, the fiscal deficit and current account deficit are associated, while rising budget deficits lead to the growth of current account deficits and vice versa. When moving to the 3rd objective to assess the relationship between current account balance and fiscal balance on the threshold level of different types of debts, Ricardian equivalence is applicable. When the government attempts to boost the economy by increasing debt financing from government expenditures, but demand stays unchanged, Ricardian equivalence is obvious. That is because people save more money to cover anticipated tax hikes in the future, which will be used to reduce debt. Besides, Ricard's theory also envisions rational expectations for household consumption optimization. Thus, Ricardian's equivalence relationship shows that governments cannot incentivize consumers to spend when their future benefits are known.

Likewise, this study adopts balanced panel data with four different panel data models. Model 1 is a linear function without threshold effect where it is adopted to analyse the determinants of current account imbalance. Model 2 adds HD as a variable to meet the aim of examining the impacts of different types of debts on twin imbalances. Next, to fulfil the 3rd objective on threshold effect, single panel threshold splitting models of Model 3 and Model 4 are created. Model 3 adopted PD as a debt indicator, while Model 4 employed HD as a debt indicator. Furthermore, the major methodology that are engrafted in this study are

dynamic GMM panel estimation and panel threshold estimation. Besides, robustness checks are also applied to the main estimations. The methods that are utilised in robustness checks are GMM estimation (with a 3-year average), PMG estimation, DOLS estimation, and panel quantile regression analysis. Besides, descriptive statistics analysis and PCA have been adopted too.

Descriptive statistics on mean and standard deviation are computed and tabulated to offer a quick capture of the movement of all variables before estimations are performed in this study. Besides. the PCA is conducted to choose the best suit for the ICT variable. On the other hand, the number of cross-sectional (*N*) and the number of time series (*T*) of this study are 48 and 31 respectively. This study is considered a micro panel dataset. As a result, a dynamic two-step GMM panel estimation is being applied to fulfil the 1st and 2nd objectives.

As referring to the 1st objective on Model 1, the dynamic GMM panel estimation result indicates that LFB, LPD, LADRO, and LRGDP are significant to LCAB at a 10% significance level, where the coefficient of LFB, LADRO, and LRGDP indicate a positive sign, whereas LPD denotes negative sign. However, LICT, LADRY, and LREER do not have a significant impact on LCAB in the model. The study by Brissimis et al. (2012) on age dependency ratios also concluded that age dependency ratios do not play a role in explaining the evolution of the current account balance. Furthermore, the insignificant effect of LREER on the LCAB is supported by the studies of Bollano and Ibrahimaj (2015),

Afonso and Opoku (2018), and Mohanty (2019). Likewise, LICT also does not have an immediate and significant influence on LCAB in this study. The insignificant result of LICT to LCAB is only supported by Soo et al. (2023a). Nevertheless, the insignificant relationship between LICT and LCAB is inconsistent with the research outcomes by Ozcan (2018), Toader et al., (2018), Wang and Choi (2019), and Kurniawati (2022), where they concluded that ICT has a positive and highly significant impact on economic growth and trade of the country.

Following the 2nd objective of this study, to examine the impacts of different type of debts on twin imbalances, Model 1 only has public debt, the coefficient of LFB is 1.9504 with a positive statistically significant relationship with LCAB at a 10% significance level. Moreover, when referring to Model 2, it added household debt as another independent variable, LFB exhibits a positive and significant association with LCAB at a 10% level of significance with a coefficient of 1.9583. In sum, LFB in Model 1 and Model 2 have a positive and significant relationship with LCAB. The Keynesian theory and the twin deficits hypothesis are both tied to this phenomenon.

Hereafter, robustness checks of dynamic GMM panel estimation, GMM estimation with a 3-year average, PMG estimation, and DOLS estimation are performed. In GMM estimation, the time range is reduced to a 3-year average to create a short panel sample and variables are assumed to be stationary. The outcome for Model 1 indicates that the determinants of LCAB are LFB and LRGDP, which show a positive and significant impact.

Hence, this short sample robustness checking for Model 1 is partially robust as an alternative estimation technique in this study. Likewise, the result for Model 2 shows that LFB has a positive significant relationship with LCAB. This estimation result is a tally of the result of long sample dynamic GMM panel estimation.

Furthermore, following the robustness check by using PMG estimation, the Hausman test is performed to determine the selection of estimator either MG or PMG estimation. Based on the outcome of the Hausman test, the PMG estimator is preferable. In keeping with the 1st objective, the result of PMG estimation reveals that the potential determinants are LFB, LPD, LADRO, LADRY, LICT, and LRGDP. Moreover, to keep with the practice of 2nd objective, PMG estimation indicates that LFB in Model 1 and Model 2 act positively significant relation to LCAB. This outcome meets with the practice in Keynesian Theory and the twin deficits hypothesis. Afterwards, is the robustness check by DOLS estimation. For 1st objective in DOLS estimation, all variables demonstrate positive and statistically significant nexus to LCAB, except LREER is in negative significance. Besides, in keeping with the 2nd objective, LFB in DOLS estimation for both Model 1 and Model 2 also performs a positive statistically significant relationship to LCAB. In other words, the robustness checks practice by adopting PMG and DOLS estimations are robust to dynamic GMM panel estimations.

Furthermore, to serve with the 3rd objective to assess the relationship between CAB and FB on the threshold level of different types of debts, the threshold estimation is applied.

There are two models involved in estimations, Model 3 adopted PD as the debt indicator, and Model 4 employed HD as the debt indicator. Moreover, a threshold effect test is done to identify the kind of threshold model of Model 3 and Model 4, where it confirms that both models are single threshold splitting model which has two regimes (below or equal to threshold level & above threshold level). In threshold estimation, the public debt-to-GDP threshold level of Model 3 is 62.72%, while Model 4 has a household debt-to-GDP threshold level of 52.22%.

In Model 3 of both regimes, LFB is illustrated positive statistically significant relation to LCAB, fulfilling the twin deficits hypothesis. However, in Model 4, LFB is negatively significant to LCAB below or equal to the 52.22% threshold level, which is the phenomenon of twin divergence; when above the threshold level of 52.22%, LFB has a positive significant nexus to LCAB, with the occurrence of twin deficits. The twin divergence phenomenon indicates there is an inverse relation between LFB and LCAB, where increases in LFB will induce LCAB to decrease. Twin divergence becomes an obvious finding from this study where it is sustainable to studies by Coban and Balikcioglu (2016), Kueh et al. (2017), Šulikovᶏ and Tykhonenko (2017), Bentour (2020), and Bousnina and Gabsi (2023).

In accordance with the results of threshold estimations by PD and HD, Ricardian equivalence is shown in the models when a country's debt level is greater than the threshold level of debts. The countries and households will optimise the consumptions with

rational expectations, where they will take precautionary measures to increase their savings levels to pay future taxes. There may be new types of taxes introduced by the government to control the large fiscal deficit and hence cause debt levels to grow. Therefore, when debt is above the threshold level, people will rationally practice saving rather than consuming. Intentionally, a huge fiscal deficit situation can be lowered which leads to a current account surplus. Likewise, in the twin divergence scenario, nations with household debt-to GDP ratios beneath the threshold level gain from implementing fiscal policies that do not exacerbate the CAB. Also, any fiscal stimulus would not stimulate consumption or output, so would not exacerbate the current account balance, but fiscal stimulus could adjust the current account deficit (*Šulikov*á & Tykhonenko, 2017).

Apart from that, there is also a robustness check on threshold estimation with the application of panel quantile regression estimation. In panel quantile regression estimation, Model 3 and Model 4 concluded that both are stable and asymmetry panel models with slope equality are different across quantile levels. Apart, both models also demonstrate a statistically significant and positive relationship to LCAB. In other words, the quantitative nature of the quantile regression estimation result is highly robust to the threshold estimation of Model 3, whereas only partially robust to the threshold estimation of Model 4 as an alternative estimation technique.

In conclusion, this study analyses the determinants of current account imbalance in the Asia region. Additionally, this study also examines the impact of different type of debts

debts on twin imbalances. Reassuringly, the relationship between CAB and FB on the threshold level of different type of debts is being assessed too. Likewise, this study becomes a reference for policymakers in designing policies that suit countries, yet this does not mean that the authorities should stabilize their countries' debts at this level. It is suggested to revise the current account deficit by lowering the debt ratio (Bousnina & Gabsi, 2023). Instead, it is wiser to keep debt levels well below the debt threshold because governments cannot predict when a shock will strike. Lastly, Table 5.1 demonstrates the summaries of estimations results of the study.

Table 5.1: Summaries of Estimations Results

Objectives	Independent Variables	Estimations	Results
To analyse the determinants of current account imbalance	FB	Dynamic panel GMM	+ve
	PD		-ve
	ADRO		+ve
	ADRY		insignificant
	ICT		insignificant
	RGDP		+ve
	REER		insignificant
To examine the impacts of different type of debts on twin imbalances	PD	Dynamic panel GMM	+ve
	HD		+ve
To assess the relationship between current account balance and fiscal balance on threshold level of different type of debts	PD	Panel single splitting threshold	Below threshold is +ve Above threshold is +ve
	HD		Below threshold is -ve Above threshold is +ve

Notes: FB is fiscal balance; PD is public debt; ADRO is age dependency ratio for old; ADRY is age dependency ratio for young; ICT is information of communications of technology; RGDP is real GDP; REER is real effective exchange rate; HD is household debt; and GMM is a generalized method of moments. Moreover, "+ve" signifies a positive significant relationship and "-ve" implies a negative significant relationship.

5.3 Policies and Recommendations

Most recently, indebtedness has become a crucial global topic that highly attracts the attention of researchers and policymakers. In terms of policy perspectives, the inevitable debt accumulation is caused by the uncertainty in the contemporary economy. Additionally, when combined with the results of this study, it implies that effective debt management is essential to resolving fiscal and current account imbalances. The empirical findings support the issue that different type of debts will affect current account imbalances differently. Hence, the different debt issues should be handled carefully by policymakers to create policies that are well suited to the specific countries.

Firstly, Kueh et al. (2016) and Obiero and Topuz (2023) suggested that managing optimal debt positions is important to overcome external economic uncertainties such as oil price volatility, while ensuring long-term sustainable economic growth. In this regard, the quality of debt becomes a key issue, and the purpose of debt accumulation must be compensated for by favourable returns in the future. Moreover, the well-being of people is also part of the concern during debt composition. This is because using the newly acquired debt to settle the prior debt's interest would be detrimental to the country's future. Policies should be developed to closely monitor the debt levels to ensure optimal debt conditions and debt quality.

In addition, different types of debts will bring different threshold levels of debts which will then contribute different effects on the current account balance. Hence, it has become a difficult task for governments to manage their debt at optimal levels. It is important to know the threshold level which enables policymakers to be cautious about debt levels, whether high or low (Kueh et al., 2017). If debt levels are very high, the government should adopt the necessary measures to reduce the expansion of debt accumulation. Debt accumulation should be utilised to finance economic growth, but not budget deficits. Furthermore, to lessen the impact of excessive debt levels, debt management techniques should also include debt thresholds (Law et al., 2021).

Secondly, in accordance with Díaz-Roldán et al. (2013), applying fiscal regulations can serve in deficit reduction, where the fiscal rules are performed as a stabilization mechanism in moderating the current account of the country. Fiscal rules can help to limit government spending, revenue, windfalls, fiscal balances, and even debt. According to Molnar (2012), debt is stabilized during fiscal consolidation if spending is used as a fiscal adjustment rather than taxation. However, if driven solely by spending, the stabilization of debt will only be temporary. Then, these fiscal rules can be adopted in the present study on the empirical result of household debt-to-GDP threshold level. The fiscal rules are not significant when the household debt-to-GDP threshold level is low (lower than 52.22%), because the current account balance and fiscal balance have a negative association which induces current account surplus to occur when fiscal deficit. Nevertheless, when the household debt-to-GDP threshold level is high (above 52.22%), twin imbalances indicate a

positive nexus, while fiscal surpluses can also lead to current account surpluses if fiscal rules are applied.

Likewise, monetary policy is one of the economic policies that are widely applied by countries. To manage inflation and economic growth, monetary policy is a combination of interest rates and money supply. Monetary policies may be used to influence exchange rates and capital flows intending to manage the current account balance (Hailemareiam, 2023). For instance, to make foreign capital more readily available, the central bank could hike interest rates which would result in a strengthening of local currency and reduced current account deficit. Monetary policies may also be used to control the cost of borrowings by adjusting interest rates, as part of managing the fiscal balance and debt. On the other hand, exchange rate policy entails the use of government interventions to influence exchange rates and capital flows. For improving competitiveness and reducing the trade deficit, exchange rate policies can be used to manage the current account balance. A policy of devaluing the national currency can, for instance, be implemented by a government that would make exports more competitive and reduce imports. This is also likely to result in inflation and higher borrowing costs which can influence the fiscal balance and debt.

In addition, there is another measure involved in the stabilisation of debt level, which is called revenue consolidation. Molnar (2012) highlighted that this revenue consolidation is less effective because the ratcheting effect on the spending and the adverse

impact on economic growth, which disappears after only about a year when the impact of indirect taxes reducing the likelihood of debt stability is considered. Besides, some fiscal rules could also be introduced at the state level, allowing them to undertake fiscal consolidation with the central government to stabilize debt levels. Furthermore, Cecchetti et al. (2011b) suggested that the government should further cut down direct subsidies and favourable treatment of debt to decrease the high level of public debt. Moreover, governments can also focus on raising costs for borrowers' credit, thus leaving potential borrowers underfunded. Fully solvent and highly indebted governments may decide to enact restrictive fiscal policy to reduce sudden shifts in investor sentiment that could lead to a country's current account imbalances (Panizza & Presbitero, 2013).

Finally, policymakers should also wisely examine different debt positions before implementing fiscal stimulus to address current account deficit issues (Nickel & Tudyka, 2014). Furthermore, to address the twin deficit phenomenon, the causal relationship between twin deficits must be properly justified through fiscal discipline and the reduction of the country's public debt. As a result, the deficits in the current account can be reduced. This is in line with a recent study showing that a twin deficit develops when the public debt-to-GDP ratio exceeds a predetermined threshold. At long last, the wiser measurement to solve the indebtedness problems is to improve and enlarge the savings level of the country and its residents.

5.4 Limitations of the Study and the Future of the Study

This study focuses on current account imbalances and indebtedness in 48 Asia countries, as well as to analyse the determinants of current account imbalance, to examine the impacts of different type of debts on twin imbalances, and to assess the relationship between current account balance and fiscal balance on the threshold level of different type of debts.

There are several limitations faced in this study. First, is the scope of discussion. The scope and depth of the discussion in this paper may not be excessive compared to the research of more experienced scholars. The second is due to the lack of previous studies in the research area. Literature review plays an important role in research which helps to identify the scope of study, whereas the literature review in Asia region is limited. The third limitation is conducting the estimation methods. These estimation methods must be learned from the beginning by applying commands in software to perform every estimation. The availability of data is a fourth limitation. Despite there being a full collection of data related to this study, it must be accessed from several sources.

Furthermore, this study raises many questions that require further research. There are some ideas drawn up for further research:

- The more accurate and precise dataset can be obtained by acquiring quarterly data or using average data over a few years.

- Double threshold models can be exploited to examine the behaviour of twin imbalances.

- Country-specific effects affected by the financial crisis can be manipulated by including dummy variables for the years that affect the selected variables in the threshold estimation.

- The threshold analysis could be extended to compare the threshold levels between regions in Asia, for example, Central Asia, Eastern Asia, South Asia, Southeast Asia, and Western Asia.

- Threshold estimations can be compared to divide the period by the financial crisis experienced, such as pre-crisis, between crisis, post-crisis, and a whole period.

Additionally, there may be other ideas, suggestions, and opinions to make better of this study. Accordingly, this study may be useful as a guide for future research that is still being conducted.

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APPENDICES

Appendix A: Research Countries of the Study

Table 1: List of 48 Asia Countries

List of Asia Countries		
Afghanistan	Japan	Philippines
Armenia	Jordan	Qatar
Azerbaijan	Kazakhstan	Saudi Arabia
Bahrain	Korea	Singapore
Bangladesh	Kuwait	Sri Lanka
Bhutan	Kyrgyzstan	Syrian Arab Republic
Brunei Darussalam	Laos	Taiwan
Cambodia	Lebanon	Tajikistan
China	Macau	Thailand
Georgia	Malaysia	Timor-Leste
Hong Kong	Maldives	Turkey
India	Mongolia	Turkmenistan
Indonesia	Myanmar	UAE
Iran	Nepal	Uzbekistan
Iraq	Oman	Vietnam
Israel	Pakistan	Yemen