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EXAMINING THE SUSTAINABILITY OF THE CURRENT ACCOUNT BALANCE USING A PROBABILITY APPROACH

DOCTORAL SCHOOL OF ECONOMICS AND BUSINESS INFORMATICS

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NDZAMA NWABISA FLORENCE

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CHAPTER 1
INTRODUCTION

1.1 Introduction

The position of a current account balance reflects macroeconomic developments and the efficacy of trade and macro policies for open economies (Bahmani-Oskooee, 1994). By definition, the current account is the sum of trade balance (i.e. exports minus imports) of goods and services and net income and transfer payments. In any given year, for most countries the largest component of the current account is the trade balance. The current account does not necessarily need to be balanced, and various theories suggest that, under certain conditions, a current account deficit or surplus may be optimal for a country. However, chronic current account imbalances are often viewed as a problem that requires policy action.

After the global financial crisis (GFC) in 2008, one of the important revelations was that the current account imbalances were, in fact, large and persistent in the build-up to the crisis (IMF External Sector Report, 2022). Many analysts have argued that one fundamental cause of the GFC was global financial imbalances caused by large current account imbalances between the United States as the leading deficit country and China as the leading surplus country (Aizenman and Jinjarak, 2009; Obstfeld and Rogoff, 2009, and Portes, 2009). Thus, the renewed interest in the dynamics of the current account balances emerged post-GFC, along with a strong association with capital flows as the source of financing of current account deficits (Borio and Disyatat, 2015).

Discussions on current account imbalances and adjustments are not new in economic literature. Edwards (2004) asserts that in the 1940s, John Maynard Keynes was aware of these issues. John Maynard Keynes' proposal for an international "Clearing Union" was based on the notion that in the face of large current account imbalances, both deficit and surplus countries should share the burdens of current account adjustment. Amid persistent current account imbalances, the deficit countries are often expected to adjust to avert associated risks. Krugman (2013), however, argues that the world is ruled by inadequate demand, holding surplus countries responsible for constraining global demand and hoarding savings instead of financing investment opportunities in deficit countries. For instance, Germany is one of the countries with a persistent current account surplus and is blamed for partly playing a role in the Eurozone crisis

by pursuing austerity measures despite their creditor status (Krugman, 2013 and Skidesky, 2014).

While both excessive current account surpluses and deficits might reflect imbalances, deficits pose more significant risks to economic stability. Persistent and excessive current account deficits, especially those financed by short-term capital inflows, expose countries to the risk of sudden stops and capital outflows, leading to significant financial instability, and may induce painful and prolonged macroeconomic adjustments (Darvas *et al.,* 2015). The literature provides evidence that countries that have experienced sudden declines in capital inflows or abrupt current account deficit reversals have suffered a significant reduction in economic growth rate (Milesi-Ferretti and Razin, 2000; Adalet and Eichengreen, 2005; Edwards, 2006). Thus, in this thesis, we focus on the sustainability of current account deficits.

1.2 Background

To emphasize the dangers of the current account deficit and its abrupt adjustments, Fischer (1988, 1994, 2003), released a series of papers. The author cautioned that the Mexican current account deficit was large and mainly financed by portfolio investment, which could suddenly reverse and leave the country with no choice but to devalue its currency. Before the Peso crisis in 1982, Fischer (1988) argued that the "primary indicator of a looming currency crisis is the current account deficit". In 1982, Chile and Mexico experienced economic crises that were preceded by large deficits (approximately 15% and 8% of GDP for Chile and Mexico, respectively). In Mexico, abrupt policy actions (including imposing trade restrictions, cutting wages, and fiscal contraction) to correct the current account deficit resulted in an output contraction of more than 5%. In Chile output fell by 14% and unemployment was close to 20% in 1983. Other similar cases include Uruguay (1979-81 and 1982-84), Ireland (1979-1990), Israel (1982-1986), Malaysia (1991-1995), South Korea (1978-1988), and Thailand in the aftermath of the Asian crisis in 1998. Similar cases not so distant in the past include the Eurozone crisis (2009-2013).

Some studies provide empirical evidence on the economic cost of large upward adjustments in the current account balance after a period of large deficits, known as reversals (Edwards, 2004; Adalet and Eichengreen, 2005; Calvo, 2005; Komarek and Melecky, 2008). Edwards (2004) finds that current account reversals reduce economic growth on average by four percentage points and are inversely related to economic openness. Komarek and Melecky (2008) find that the reversals directly or indirectly contract economic growth by one percentage point in the

year after the reversal in emerging markets. Melecky (2005) finds that the growth rate immediately declined by 1.10 percentage points for the Central and Eastern European regions. Craighead and Hineline (2010) provide the analysis at a sectoral level (i.e. economic branches) and find that the output declines in the manufacturing sector, while the primary sector (commodities) performs relatively well following large upward adjustments in the current account balance.

Intertemporal borrowing and lending allow for more efficient allocation of investment and the smoothing of consumption (Obstfeld and Rogoff, 1994). However, when a country runs persistent and large current account deficits, concerns often arise about the sustainability of that deficit (Milesi-Ferretti and Razin, 1996). These concerns include creditworthiness and risk of default. This type of vulnerability may lead to a loss of investor confidence and capital outflows, increasing the risk of being unable to sustain the deficit. Once the country cannot sustain the current account deficit, it will be forced to implement abrupt policy responses, such as reducing public deficits, sharply depreciating the exchange rates, or increasing private savings (Ghosh and Ramakrishnan, 2018). This scenario suggests that unsustainable current account imbalances may indicate macroeconomic imbalances, exposing the country to the risk of difficulties in servicing outstanding foreign obligations.

The main challenge in analysing the (un)sustainability of a current account deficit is determining how much of it is appropriate and how much of it is an excessive deficit relative to the country's fundamentals and desired policies over the medium term (IMF External Sector Report, 2018). A conventional view suggests that a current-account deficit above 5% of Gross Domestic Product (GDP) should ring an alarm, primarily when the deficit is financed with short-term debt and when it reflects high consumption spending (Milesi-Ferretti and Razin, 1996). In this regard, historical episodes suggest that several countries such as Australia, Ireland, Israel, Malaysia, and South Korea have been able to sustain current account deficits above 5% of GDP. In contrast, other countries such as Chile and Mexico have not been able to do so and suffered severe external crises.

Milesi-Ferretti and Razin (1996) posit that a specific threshold on persistent current account deficits is not a sufficiently informative sustainability indicator. The authors suggest that the size of current account imbalances should instead be considered in conjunction with exchange rate policy and factors such as the levels of savings and investment. This view suggests that a specific threshold, like 5%, may ring an alarm for one economy but not for the other. This raises two questions. First, how serious should thresholds on current account deficit be taken? Second,

which factors should be considered in evaluating whether persistent external imbalances are likely to result in external crises? These questions underscore the difficulty in empirically measuring the sustainability of current accounts.

The literature provides a variety of measures of current account sustainability. Early studies such as Sachs (1981) and Corden (1994) identify current account deficits as sustainable if they are the result of large investments or driven by the private sector and not the government sector. Milesi-Ferretti and Razin (1998) and Obstfeld and Rogoff (2000) assert that an unsustainable current account deficit is indicated by an abrupt reversal of that deficit (also Rogoff, 2007).

Most studies have defined the concept of current account sustainability in the form of intertemporal solvency, with the key assumptions that economic agents have perfect foresight about the economic environment and that the markets are complete, such that the behaviour of economic agents remains constant overtime. Intertemporal solvency is defined in relation to the country's intertemporal budget constraint (IBC). The IBC refers to the country's ability to generate future trade surpluses, whose present value quals the present value of existing foreign debt if the limit of debt at infinity converges to zero (Trehan and Walsh, 1991, and Husted, 1992). According to this framework, a country runs a sustainable current account if it satisfies its IBC. In comparison, unsustainability implies that the country does not satisfy its IBC. Empirical testing of the solvency condition under the IBC mainly involves testing whether exports and imports are cointegrated. The framework implies that the current account series follows a mean reverting process. See studies such as Callamand *et al.* (2018); Donoso *et al.* (2014); Hatzinikolaou and Simos (2013); Yol (2009); Fountas *et al.* (1998) and Husted (1992).

Other two commonly used intertemporal models are the intertemporal model of optimal benchmark and the accounting approach. Some studies relate sustainability to the excessiveness of current account deficits, by comparing the present value of the optimal current account balance to the actual current account balance over time (see Kaufmann *et al.,* 2002; Kraay and Ventura, 2003; Makrydakis, 1999; and Ventura, 2003, 2009). Other studies have used an accounting approach (Trehan and Walsh, 1991; Holmes, 2004; Chortareas *et al.*, 2004; Dugler and Ozdemir, 2005; Opoku-Afari, 2007; Christopoulos and Leon-Ledesma, 2010; and Cigdem, 2017). This model defines a sustainable current account as the one that does not generate increases in the external debt-to-GDP ratio (Hudson and Stennett, 2003). However, this model implicitly assumes equality between interest rate and growth rate, which is unlikely in the real world given endogenous factors that influence both rates (Searle and Mama, 2010).

Other studies use the solvency approach and incorporate the role of structural breaks (see

Narayan and Srianantha kumar, 2020; Singh 2019; Singh, 2015; Önel and Utkulu, 2006; Baharumshah *et al*. 2003). The inclusion of an endogenous structural break allows for major economic shocks that caused major trade disruptions and would potentially affect current account sustainability. Over the years, the International Monetary Fund has made great strides to improve the assessment of the external sector (see IMF External Balance Methodology Update, 2022). The IMF concedes that the key challenge to the EBA current account model is that it still does not explain a large portion of the current account gap.

Milesi-Ferretti and Razin (1996) argue that the intertemporal solvency approach is not appropriate to define and gauge sustainability because it assumes the debtor is continuously "willing to pay" and the creditor is “willing to lend”. Their argument implies that this may not always be the case. The authors add that the framework fails to consider the role of asymmetric information in the international financial markets. As a result, the authors suggest that the use of solvency test should at the very least be supplemented by several indicators of sustainability, including trade openness (exports and imports as a ratio of GDP), the composition of trade (primary commodities versus manufactured goods), financing via equity and debt, and the levels of saving and investment.

1.3 Problem statement

My concern is that the intertemporal solvency methodology does not consider economic uncertainty. Thus, the main argument of my thesis is that the key assumption of the intertemporal solvency that an individual has perfect foresight about the economic environment is problematic. In a sense that economic uncertainty does exist, and its existence weakens the realism of intertemporal solvency theories. Moreover, the model assumes no drastic changes in the behaviour of the economic agents. Current account imbalances reflect interactions between trade, savings, and investment decisions of the government and domestic private sector agents, as well as the lending decisions of foreign investors. These interactions can be influenced by macroeconomic, financial, and fiscal uncertainty.

For example, if government foreign borrowing is increasing rapidly under its current policy, foreign investors' perceptions may arise on whether the debt can be repaid. Such perceptions may lead to expectations that an abrupt policy reversal might occur, taking the form of a debt default, a significant currency devaluation, or a fiscal adjustment. We can argue that a question of current account sustainability does not entail a yes or no answer but instead be viewed as a probabilistic concept.

Thus, the question of current account sustainability should be viewed as a stochastic process. Approaching the current account as a stochastic process entails taking account of economic uncertainty embodied in the time path of the current account. For each period ahead, the state of the economy is unknown until we reach that particular period. Therefore, it is appropriate to assess the sustainability of the current account in a probabilistic way under multi- factor uncertainty.

Few studies have shown that assuming the absence of drastic change in the behaviour of foreign investors (as implied by intertemporal solvency theory) is far from reality, particularly in the context of current account sustainability. Milesi- Ferretti and Razin (1996), Ades and Kaune (1997) and Edwards (2002) introduce the Portfolio Allocation Theory into the intertemporal solvency model. The aim is to capture changes in portfolio investment allocations and their association with current account sustainability. For instance, Edwards (2002) shows that even small changes in foreign investors' decisions may generate complex equilibrium adjustment paths for the current account. To attract new capital inflows, these current account adjustments will have to move in such a way that sustainability is maintained. The challenge with the portfolio approach, however, is that you need to know how the portfolio manager will behave in the future to determine what is sustainable in the long term.

We contribute to the existing literature by introducing a probabilistic concept for the analysis of current account sustainability. This new probabilistic concept aims to test sustainability using a density forecast. The main task is to predict the like likelihood of deficit unsustainability over the given forecast horizon. We are interested in the probability distribution of future current account balances. This approach can be seen as a way to determine the risk of unsustainability or an early warning signal to avoid abrupt policy shifts that could lead to a reversal of capital inflows.

It is well known that economic uncertainty plays a role in economic life (Obstfeld and Rogoff, 1994, and Anzuini *et al.,* 2020). The existence of economic uncertainty should not be a controversial issue, but as noted by Cochrane (2021), the question should be, how much uncertainty is there? One way of measuring uncertainty is to derive the probability distribution of a forecast based on a forecasting model (Rossi, 2014).

It is important to emphasise that the primary contribution of this thesis is empirical rather than theoretical. While it offers valuable insights from both observed and forecasted data patterns, it does not aim to develop or extend theoretical frameworks regarding the economic conditions under which a current account deficit may be deemed sustainable or unsustainable.

1.4 Research objectives

The overarching objective of the study is to make a substantial contribution to the analysis of the sustainability of the current account deficit. More specifically:

(i) To clarify the concept of current account sustainability;

(ii) To establish stylised facts based on historical current account reversals about the sustainability of current account deficits;

(iii) To provide a probabilistic definition for the sustainability of the current account deficit;

(iv) To test our probability approach on data from selected advanced and emerging economies.

1.5 Research questions

(i) Conceptually, how to define current account sustainability?

(ii) What are the strengths and weaknesses of conceptual definitions and empirical methods used in the literature to assess the current account's sustainability?

(iii) What are the main stylised facts about historical episodes of current account deficit reversals?

(iv) How to define current account sustainability in a probabilistic setting?

(v) By examining data from selected countries, what is the probability that future current account deficits would be on a sustainable path, and which factors contribute to a current account deficit reversal?

(vi) By examining data from selected countries, what is the likelihood that a current account deficit driven by the government sector is less sustainable than when the private sector drives the deficit?

1.6 Significance of the study

The significance of this research is underscored by the mixed experiences of countries that have had persistent current account deficits, and the limitations of models employed in the literature to examine the sustainability of current account deficits.

Our thesis introduces a novel probability-based framework for evaluating the sustainability of current account balances. By generating density forecasts, we calculate the probability that the current account balance will fall below a specified threshold. A low probability indicates

sustainability, suggesting the deficit is unlikely to spiral out of control. Conversely, a high or steadily increasing probability across forecast horizons signals unsustainability. The results show that our probability approach effectively identifies sustainability risks in current account balances.

The proposed framework offers significant advantages over traditional methods. By quantifying uncertainty and calculating probabilities, it allows identifying short-term risks and the likelihood of various economic outcomes. This approach adds precision and actionable insights, enabling policymakers to assess risks dynamically, tailor policies, allocate resources efficiently and uncover hidden risk factors. Below we elaborate on each of these aspects:

The probability approach highlights evolving risks, making it an effective early warning system. Policymakers can intervene proactively to prevent economic instability. The policies can be tailored, because the framework emphasises country-specific factors, allowing for customised policy design to address unique economic structures, policy frameworks, and vulnerabilities. Our framework can serve as an early warning system, allowing for timely interventions to prevent economic instability. Additionally, the flexibility in our approach means the framework can uncover specific risk factors that other methods might miss due to the imposed restrictive assumptions.

Our analysis reveals varied levels of current account sustainability across countries. Factors such as economic structure, policy frameworks, and external vulnerabilities contribute to these differences. More specifically, we identified cases of sustainable current account balance, high-risk of unsustainability and increasing risks over longer horizons. Therefore, it is important that policies are well-tailored and country specific. Furthermore, we find irrelevance of the sector driving the current account deficit: we find no compelling evidence that government-driven deficits are likely less sustainable than those driven by the private sector. This suggests policymakers should consider a broad range of factors, including fiscal discipline and external shocks, rather than focusing solely on sectoral drivers to assess current account sustainability.

The moving window out-of-sample forecast analysis highlights the model's sensitivity across forecast horizons, with the 1-year ahead forecast serving as an effective crisis signal when deficits are large, while longer-term forecasts better capture structural risks under moderate imbalances. The model's behaviour in 2022 underscores its responsiveness to global shocks—

most countries exhibited elevated unsustainability probabilities due to pandemic-related disruptions—yet country-specific dynamics prevailed: Ireland's probabilities remained flat, and Malaysia's declined, likely reflecting resilience shaped by prior corrections and strong fundamentals.

We acknowledge several limitations in our research. First, our main sample includes only ten countries with historically persistent current account deficits, limiting the generalisation of our findings. Second, the sectoral component uses a separate sample of European Union countries due to data constraints at sectoral level, reducing continuity across analyses, even if there are European countries which are included in both samples. Ideally, a broader regional representation would have been preferable to enhance the generalisability of results. Third, the database may lack some important variables that could potentially enhance the analysis. Fourth, the implementation of our probability approach relies on linear stochastic models, which may not capture potential non-linear dynamics. Finally, sustainability thresholds likely vary by country. For instance, the United States, as a reserve currency issuer, may sustain higher deficits than small emerging economies. Nevertheless, our primary focus remains on the dynamics of probability changes rather than specific threshold values. This focus on evolving probability dynamics allows us to capture trends in the likelihood of current account (un)sustainability across forecast horizons without needing country-specific thresholds. The significance of this limitation is further underscored by some of the discrepancies we identified in subsection 5.3.1.6.

Overall, our research offers a significant contribution to the field of economics by providing a more adaptable empirical approach for assessing current account sustainability. It addresses key limitations in existing models, making it a valuable tool for economic analysis and decision-making.

1.7 Thesis outline

The thesis is structured as follows. *Chapter two* provides a critical and detailed survey of the literature. The main goal of this chapter is to evaluate the strengths and weaknesses of the conceptual definitions and empirical methods used in the literature to assess the sustainability of the current account balance. This chapter answers the second research question and partly addresses the first question (see subsection 1.4 for the research questions).). *Chapter three* presents the stylised facts about historical current account (im)balances and provides empirical

analysis of current account reversals. This chapter discusses relevant literature, theoretical background, data, methodology and results. Chapter three answers the third research question and partially addresses the fifth question. *Chapterfour* explicates the concept of current account sustainability in the presence of uncertainty and describes its application of density forecasting to sustainability - which is in the core of our proposed probability approach. This chapter provides a detailed answer to the first and fourth research questions. *Chapter five* explains the sample, provides the empirical analysis, and discusses the results on current account forecasts, the probability distribution of these forecasts and the probability of current account sustainability. The chapter addresses research questions number five and six. *Chapter six* provides a summary of the thesis conclusions, policy implications, limitations, and areas of further research, and specific answers to each research question.

This research has been conducted under the supervision of Zsolt Darvas. Some of the analyses presented in Chapter five have been published in the journal, *Society and Economy*, while another manuscript is under review.

1.8 Summary

The chapter provided a comprehensive overview of the importance of current account balances, the historical context, several theoretical frameworks used to examine sustainability, and the limitations of these frameworks. We highlighted the significance of understanding current account sustainability in a probabilistic setting due to the inherent uncertainty in economic conditions. We outlined the key research issues and gaps in the literature that our thesis seeks to address. By proposing a probabilistic concept for examining sustainability, we aim to enhance understanding of the risks associated with current account deficits and their potential policy implications.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This section explores the theoretical and empirical literature on various measures and models used to define and examine the sustainability of the current account. It also highlights the caveats and limitations of the existing literature.

Theoretical perspectives on current account sustainability have evolved significantly over time. More recent approaches incorporate a broader set of variables, recognising that factors such as exchange rates, capital flows, and investor behaviour play crucial roles in determining current account sustainability.

Empirical studies have used various methodologies to assess current account sustainability, including econometric models, structural models, and more recently, portfolio balance models. These models often highlight the role of foreign investor behaviour, market confidence, and global economic conditions in influencing current account dynamics.

Despite these advancements, existing literature has notable caveats. Many models assume that investors have perfect information and rational expectations, which is often not the case in reality. The dynamic and interconnected nature of world economies further complicates the ability to predict future behaviours and outcomes accurately. Hence, quantifying uncertainty surrounding the current account forecasts is critical. However, There remains quite a few studies that attempt to forecast the current account balance.

The section first discusses the national accounting framework that links the current account balance with savings, investment, and budget balance. Second, discusses the existing frameworks that define and measure the sustainability. Third, we consider the empirical application of these frameworks. Ideally, we would largely focus the discussion on the literature that forecasts the current account balance, however, we are constrained by the limited availability of such studies. Fourth, we delineate the shortcomings of the intertemporal approach, highlighting those raised by the existing studies and those introduced by this thesis. The last subsection provides a conclusion.

2.2 National accounting framework

We first provide accounting identities to have a clear and intuitive framework for understanding the current account and its relationship to savings, investment, and the fiscal balance (Krugman, Obstfeld, and Melitz, 2018). In an open economy, the national income identity is given by :

$$Y_t = C_t + I_t + G_t + NX_t. \quad 1$$

Yt is Gross Domestic Product (GDP), Ct is household consumption, It is investment spending, Gt denotes government expenditure, and NXt are net exports.

The Current Account (CA) includes net exports (NX) plus net income from abroad and net current transfers, but for simplicity we can rewrite approximate CA as:

$$CA_t = X_t - M_t + NX_t \quad 2$$

Bt represents assets holdings at the beginning of period t , rt is the return on those assets and thus the term $rtBt$ is net income on foreign assets, which is the difference between the income received from domestic capital invested abroad and the income paid to foreign investors. However, focusing exclusively on net exports makes the intertemporal aspects of the current account less obvious, and thus we turn to the savings-investment identity. National savings are given by:

$$S_t = Y_t + r_t B_t - C_t - G_t \quad 3$$

substituting national savings into equation (1), then combining equations (1) and (2), and rearranging leads us to:

$$CA_t = S_t - I_t. \quad 4$$

This equation says current account surplus means a country is saving more than it is investing, while a deficit means it is investing more than it is saving—financed by borrowing from abroad.

To explore the relationship between the current account and the government budget deficit it is important to distinguish between the private and the public sector saving decisions to reflect how fiscal policy (government decisions) and private behaviour (household and business decisions) interact to influence the external balance. The private sector saving are given by:

$$S_t^p = DI_t + r_t B_t - T_t - C_t. \qquad 5$$

S_t^p is the private sector savings, defined as the part of disposable income (DI_t) plus net income from foreign assets ($r_t B_t$) less taxes (T_t) and consumption(C_t).

Government saving is defined as the difference between revenue generated through taxes (T_t) and expenditure (G_t);

$$S_t^G = T_t - G_t. \qquad 6$$

With equation substitution and rearranging, the national savings becomes:

$$S_t = (DI_t + r_t B_t - T_t - C_t) + (T_t - G_t) = S_t^p + S_t^G = I_t + CA_t. \qquad 7$$

Then the CA identity becomes:

$$CAt = S_t^p - I_t - (G_t - T_t). \qquad 8$$

$T_t - G_t$ is the government budget deficit.

Intuitively, these equations tells us that a current account deficit can result from low private saving, high investment, and a government budget deficit. While a surplus indicates the opposite.

2.3 Defining and measuring the (un)sustainability of the current account balance

Mann (1999) defines the current account as being sustainable when it does not generate economic forces that will change its path. This means that a current account balance is sustainable when the continuation of the current policy stance will not require an abrupt or a sudden stop action (e.g., a sudden contraction of monetary and fiscal policy, causing a significant

recession) or lead to a crisis (e.g., rapid rise in interest rates, a sudden and sharp decline of the international reserves, or an exchange rate collapse). For instance, a large and persistent current account deficit may cause a shift in investor confidence, leading to a reversal of international capital flows due to rising market perceptions that debt will not be repaid.

Similar to Mann (1999), Milesi-Ferretti, and Razin (1996) and Yilanci (2014) discuss two issues that must be considered to give a meaningful definition of current account sustainability. The first is the "policy shift." Suppose external borrowing is growing without bound under the current policy, for example. In that case, the expectations of private agents will reflect the anticipation of a policy reversal, which could take the form of a debt default, a significant devaluation, or a fiscal adjustment leading to capital outflows. The second issue relates to the "trigger" that could give rise to policy reversals. An example of the "trigger" is the political economy situation, which will affect the government's ability to implement radical changes in policy without causing unrest. Milesi-Ferretti and Razin (1996) argue that ignoring these expectations and their reflections on private-sector behaviour could lead to forecasting errors.

Most studies define the sustainability of the current account in terms of intertemporal solvency (Trehan and Walsh, 1991, Husted, 1992, Roubini and Wachtel, 1998, Obstfeld and Rogoff, 1994, Hudson and Stennett, 2003 and Durgler, 2016). In general, solvency refers to an ability to repay long-term debt and other financial obligations. In the context of sustainability, Roubini and Wachtel (1998) posit that a country could sustain large and persistent current account deficit and remain solvent as long as there are surpluses at some point in the future. However, historical experiences challenge the sufficiency of the notion of solvency as the basis of examining the sustainability of the current account. Some Asian and Latin American countries experienced financial crisis under the watch of solvency (Milesi-Ferretti and Razin, 1996 and Opoku-Afari, 2007). The key assumptions of the intertemporal approach models are that individual decision-makers have perfect foresight and complete information about their economic environment.

The following is a description of the models that have been used to define and measure sustainability. The first two models are intertemporal models. The rest are the other approaches that have been applied in the literature of current account sustainability.

2.3.1 Intertemporal budget constraint (IBC) model

The IBC refers to the country's ability to generate future trade surpluses, whose present value equals the present value of the existing foreign debt, if the limit of debt at infinity converges to zero (Husted, 1992). That is, the country is able to meet its intertemporal budget constraint under the current policy stance. According to this model, a country is running a sustainable current account deficit if it satisfies the IBC in the long-run without a drastic change in government policy and/or in private-sector behaviour. Whereas unsustainability implies that the country fails to satisfy its IBC. The IBC model to examine current account sustainability is adapted from Husted (1992).

Husted provides an intertemporal solvency framework which considers a representative consumer, exhibiting rational expectations in a small open economy without liquidity constraints (the individual consumer can borrow and lend in international markets) and with no government. The individual consumer faces world interest rate and is assumed to maximize lifetime utility function subject to budget constraint. The agent's resources are composed of endowments of output and redistributed profits from firms. These resources are used for consumption and savings. In the current period the individual faces a budget constraint given as:

$$C_t = Y_t + B_t - I_t - (1 + r_t)B_{t-1} \qquad 9$$

Where C_t denotes consumption, Y_t indicates income, B_t represents net borrowing, I_t symbolises investment, r_t is interest rate, all at time t denoting current period. The term B_{t-1} is net debt from the previous period. The accounting identity in equation 9 holds in every period. These period-to-period budget constraints can be combined to form the economy's intertemporal budget constraint. Iterating (3), gives:

$$B_t = \sum_{i=1}^{\infty} \vartheta_t [Y_{t+i} - C_{t+i} - I_{t+i}] + \lim_{n\to\infty} \vartheta_n B_{t+n} \qquad 10$$

Where ϑ_t is the discount factor. Since income in this model is defined as the sum of consumption, investment and net exports ($Y_t = C_t + I_t + X_t - M_t$), equation 10 implies that the amount a country borrows or lends in international markets is equal to the present value of future trade surpluses or deficits, assuming the limit term $\lim_{n\to\infty} \vartheta_n B_{t+n}$ is equal to zero. If this limit term is not equal to zero and net borrowing (B_t) is positive, this implies "bubble financing"

or "Ponzi-scheme". In other words, the country depends on future borrowings to repay the existing debt.

Since trade balance is the difference between exports (X) and imports (M), equation 9 can be rewritten as follows;

$$X_t - M_t = Y_t - C_t - I_t = -B_t + (1 + r_t)B_{t-1} \quad 11$$

Assuming that the global interest rate is stationary with unconditional mean of r, Husted (1992) adds and subtracts rB_{t-1} and rewrite equation 11 to obtain,

$$M_t + (1 + r_t)B_{t-1} + rB_{t-1} - rB_{t-1} = X_t + B_t \quad 12$$

Finally, equation 10 can be rewritten as the following:

$$Z_t + (1 + r)B_{t-1} = X_t + B_t \quad 13$$

Where $Z_t = M_t + (r_t - r)B_{t-1}$

Husted (1992) iterates equation 13 by forward substitution and obtain the following expression;

Where $\vartheta = \frac{1}{(1+r)}$ and Δ is the first difference operator. Note that the current account can be

$$M_t + r_t B_{t-1} = X_t + \sum_{j=0}^{\infty} \vartheta^{j-1} \left(\Delta X_{t+j} - \Delta Z_{t+j}\right) + \lim_{t\to\infty} \vartheta^{t+j} B_{t+j} \quad 14$$

obtained from equation 14 by subtracting X_t and multiply by (-1) from both sides of the equation. This gives: $X_t - M_t - r_t B_{t-1} = CA_t$.

Husted (1992) assumes that X_t and Z_t are random walks with a drift such that,

$X_t = \alpha_1 + X_{t-1} + \varepsilon_{1t}$

And

$Z_t = \alpha_2 + Z_{t-1} + \varepsilon_{2t}$, such that equation14 can be expressed as

$$M_t + r_t B_{t-1} = X_t + \frac{(1+r)^2(\alpha_1 - \alpha_2)}{r} + \sum_{j=1}^{\infty} \vartheta^{j-1}(\varepsilon_{1t} - \varepsilon_{2t}) + \lim_{n\to\infty} \vartheta^{n+j} B_{t+n} \quad 15$$

Equation15 can be rewritten as;

$$X_t = \alpha + MM_t - \lim_{j\to\infty} \vartheta^{t+j} B_{t+j} + \varepsilon_t \quad 16$$

Where $\alpha = \frac{(1+r)^2(\alpha_2 - \alpha_1)}{r}$, $MM_t = M_t + r_t B_{t-1}$ and $\varepsilon_t = \sum_{j=0}^{\infty} \vartheta^{j-1}(\varepsilon_{2t} - \varepsilon_{1t})$.

MM_t is the sum of goods and service imports plus interest payments on foreign debt. Assuming the limit term in equation 16 is equal to zero, then 16 can be transformed into a standard regression:

$$X_t = \alpha + \beta MM_t + e_t \qquad 17$$

A cointegration between exports (X_t) and import+ (MM_t) implies that the IBC is satisfied. For a null hypothesis that a country is satisfying its intertemporal budget constraint, β_t would be expected to be equal to one, and by definition, the error term would be expected to be stationary. The concern with this equation is that no restrictions are imposed on (α). In summary, the model examines the long-run relation between exports and imports+. The literature has not recognised that cointegration between exports and imports+ (assuming both are integrated of order one) in itself does not imply the sustainability of the current account deficit (see subsection 2.6 for detailed discussion on these concerns).

2.3.2 Intertemporal model of optimal benchmark

This model was initially developed by Obstfeld and Rogoff (1994). In this framework, the sustainability of the current account deficit is determined by equality of the predicted optimal current account series (set as benchmark) and the actual current account balance (Hudson and Stennett, 2003). This model employs the same framework assumptions as in IBC model above[1].

It is assumed that along the optimal path, private consumption is driven mainly by net wealth, which in turn is influenced by the present discounted value of the expected future stream of cash flow and the stock of assets and/or liabilities. This assumption gives the actual consumption smoothing current account balance is:

$$ca_t^* = y_t - i_t - g_t - \varphi c_t^* \qquad 18$$

Where y_{it} is the real gross national income, i_t is the real investment, g_t represents real government spending, c_t^* denotes optimal level of consumption and φ represents consumption equilibrating parameter.[2] In this case, this parameter can be interpreted as the adjustment

[1] Considering this setup, the expected intertemporal utility function of a representative consumer is given as: $U = E_t\{\sum_{t=r}^{\infty} \beta^{t-r}[U(C_t)]\}, U'(C_t) > 0\ ; U''(C_t) < 0\ ; 0 < \beta < 1$ subject to a budget constraint given as: $\Delta b_{t+1} = rb_t - (y_t - c_t - i_t - g_t)$. This optimization problem is solved with the assumption that there are no Ponzi games, and all the transversality conditions are met.

[2] $c_t^* = \left(\frac{r}{\varphi}\right)\left[-b + (1+r)^{-1} E_t(\sum_{j=0}^{\infty}(1+r)^{-j} z_{t+j})\right]$ is the optimal level of consumption; $z_t = y_t - i_t - g_t$ represents the net national cash flow. The lower case indicates that the variables have been adjusted for inflation. $\varphi = \frac{\beta r(1+r)}{\beta(1+r)^2}[\forall \varphi > 0]$, assuming a quadratic utility function. For more detailed description see Opoku-Afari (2007).

parameter that moves the short-run dynamics in consumption to be consistent with the long-run equilibrium cashflow. Finally, a few steps of algebra on the budget constraint and incorporating those results into the optimal level of consumption yields an actual optimal consumption smoothing component of the current account given as (Campbell and Schiller, 1987):

$$ca_t^* = -E_t\left(\sum_{j=0}^{\infty}(1+r)^{-j}\,\Delta z_{t+j}\right) \qquad 19$$

Where E_t is the expectations operator, r is the interest in the country's foreign debt and z_t represents net national cashflow (output minus investment minus government spending). Equation 19 implies that a country will run a current account surplus today if it expects its net cashflow to be falling temporarily in the future, and vice-versa.

The consumption smoothening component of the current accounts is estimated using the methodology provided by Campbell and Schiller (1987). The key insight of this methodology is that as long as the information set used does not contain all the information available to the private sector, then past values of the current account contain useful information to construct estimates of private agent's expectations of future values of net national cashflow or output, z. The application of this methodology entails estimating an unrestricted Vector Autoregressive (VAR) of the form:

$$\begin{bmatrix}\Delta z_t \\ CA_t\end{bmatrix} = \begin{bmatrix}\varphi_{11} & \varphi_{12} \\ \varphi_{21} & \varphi_{22}\end{bmatrix}\begin{bmatrix}\Delta z_{t-1} \\ CA_{t-2}\end{bmatrix} + \begin{bmatrix}\varepsilon_{1t} \\ \varepsilon_{2t}\end{bmatrix} \qquad 20$$

where CA_t is the current account series, Δz_t is the changes in net cashflow, ε_{1t} and ε_{2t} are error terms. In this case, the (un)sustainability can be tested based on whether the predicted optimal current account series equals the actual current account balance. This implies that $\varphi_{11} = \varphi_{21}$ and $\varphi_{12} - \varphi_{22} = (1+r)$.

According to Obstfeld and Rogoff (1994), to arrive at predicted optimal current account balance ($\widehat{CA_t}$), equation 20 is used to forecast the expected value of net cash flows (Δz) in equation 19. Taking the expectations of equation 20 yields:

$$E_t\begin{bmatrix}\Delta z_t \\ CA_t\end{bmatrix} = \begin{bmatrix}\varphi_{11} & \varphi_{12} \\ \varphi_{21} & \varphi_{22}\end{bmatrix}^{t-\tau}\begin{bmatrix}\Delta z_t \\ CA_t\end{bmatrix} \qquad 21$$

If $E_t[X_{t+j}] = \Psi^j X$; $E(\varepsilon_{1t}) = E(\varepsilon_{2t}) = 0$; and $\Psi = matrix[\varphi_{ij}]$. Pre-multiplying equation 20 by the $1x2$ vector $[1 \quad 0]$ gives:

$$E_t \Delta z_t = [1 \quad 0] \begin{bmatrix} \varphi_{11} & \varphi_{12} \\ \varphi_{21} & \varphi_{22} \end{bmatrix}^{t-\tau} \begin{bmatrix} \Delta z_t \\ CA_t \end{bmatrix} \qquad 22$$

Substituting 20 into19 yields the predicted optimal current account balance, ($\widehat{CA_t}$), if $\boldsymbol{I}$ is allowed to be a $2X2$ identity matrix:

$$\widehat{CA_t} = -[1 \quad 0][\,(1+r)^{-1}\,\Psi][\,\boldsymbol{I} - (1+r)^{-1}\Psi]^{-1} \begin{bmatrix} \Delta z_t \\ CA_t \end{bmatrix} \qquad 23$$

$$\equiv [\emptyset_{\Delta z} \quad \emptyset_{CA}] \begin{bmatrix} \Delta_{zt} \\ CA_t \end{bmatrix}$$

Once the optimal current account series has been predicted, the (un)sustainability of the current account can be tested, by comparing this series with the actual current account.

A counter view is that the benchmark series can be used to evaluate how close a given path of the current account imbalance is to (un)sustainability, but it cannot be directly used to determine (un)sustainability (Milesi-Ferretti and Razin, 1996). This is because it relies on the assumption that the capital markets are perfect. Such that deviations from the benchmark may simply reflect the existence of liquidity constraints or other financial market constraints.

2.3.3 IMF External Balance Assessment Methodology (EBA-CA)

This model is somewhat similar to the "intertemporal benchmark model" as its main focus is to establish whether the current account is excessive or not. However, the set-up in the EBA-CA model is much broader, and more complex. Over the years, the IMF has made great strides to improve the assessment of the external sector (see Cubeddu *et al.*, 2019). The current account model (EBA-CAB) of the IMF is based on the extensive literature on the macroeconomic determinants of savings and investment decisions. More often the analysis of current account only focuses on macroeconomic fundamentals, but this particular current account model considers structural variables, including demographic factors such as old-age dependency ratio and share of working-age population or prime-age savers.

The IMF methodology mainly determines the excessiveness of the current account deficit by calculating the current account gap, which is the difference between the cyclically adjusted current account and cyclically-adjusted current account norm. After estimating the current

account model, the IMF uses these estimates to establish norms and gaps.[3] More specifically, the EBA-CA regression is given by:

$$\frac{CA}{GDP} = \alpha + X^{cyc'}\beta^{cyc} + X'\beta + P'\hat{\gamma} + e \qquad 24$$

Where X^{cyc} represents the cyclical factors (output gap and commodity terms of trade gap), X is a vector of all fundamentals (macroeconomics and structural), and the vector P denotes the policy variables.

Using coefficient estimates of the independent variables, the predicted values for the current account balance as percent of GDP are given by:

$$\widehat{\frac{CA}{GDP}} = \hat{\alpha} + X^{cyc'}\widehat{\beta^{cyc}} + X'\hat{\beta} + P'\hat{\gamma} \qquad 25$$

The predicted current account can be further decomposed into three components; the cyclically-adjusted "CA norm," the cyclical component, and the policy gaps:

$$\widehat{\frac{CA}{GDP}} = \underbrace{\hat{\alpha} + X'\hat{\beta} + P^{*\prime}\hat{\gamma}}_{cyclically-adjsuted\ CA\ norm} + \underbrace{X^{cyc'}\widehat{\beta^{cyc}}}_{cyclical\ component} + \underbrace{(P - P^{*})'\hat{\gamma}}_{policy\ gap} \qquad 26$$

According to the IMF the cyclically-adjusted "CA norm" is the current account balance implied by all the underlying macroeconomic fundamentals at their actual level, assuming all policy variables are set at their medium-term desirable level P^{*}, and excluding the cyclical effects. While the policy gap measures by how much deviations in policy variables from their desirable level contribute to the deviation of the predicted current account balance from its norm.

The cyclically-adjusted current account is defined as follows:

$$\frac{CA^{cyc.adj}}{GDP} = \frac{CA}{GDP} - X^{cyc\prime}\widehat{\beta^{cyc}}$$

Using equations, A and C, the following expression is derived

$$\frac{CA^{cyc.adj}}{GDP} = cyclically\ adjusted\ CA + total\ EBA\ gap$$

[3] The dependent variable is the **CA-to-GDP ratio**. Independent variables are grouped into ***cyclical factors*** (Output gap and commodity terms of trade), ***macroeconomic fundamentals*** (Net foreign asset, expected real GDP growth, output per worker and reserve currency), ***structural factors*** (population growth, share of prime-aged savers, old-age dependency ratio, life expectancy), and ***policy variables*** (Fiscal policy, Health spending, credit gap, and capital controls).

$= cyclically\ adjusted\ CA norm + policy\ gaps + regression\ residuals$

Finally, the EBA-CA gap is given by:

$$The\ total\ EBA\ CA\ gap\ = cyclically\ adjusted\ CA - cyclical\ adjusted\ CA\ norm$$

The current account gap can be either; (i) substantially stronger (>4%), (ii) stronger [2%,4%], (iii) moderately stronger [1%,2%], (iv) broadly in line with macroeconomic fundamentals and desirable policy setting [-1%,1%], (v) moderately weaker [-2%,-1%], weaker [-4%, -2%], and substantially weaker [-4%].

The following caveats were noted in this IMF methodology. First, the IMF (2018) concedes that the key challenge to the EBA current account model is that it still does not explain a sizeable portion of the current account gap. These large residuals possibly reflect a combination of structural distortions, measurement biases, and country fundamentals that are not explicitly modelled. Second, it remains not clear how the multilateral consistency adjustment is performed in this IMF methodology. In theory, current account balances should add up to zero at the global level. However, it is not surprising that the current account balances do not sum up to zero over the selected country sample of 31 countries (accounting for 90% of global GDP), because of the existence of global statistical discrepancy at the world level and because 10% of countries in terms of GDP is not included, some of which are large commodity exporters. In the 2025 IMF External Sector Report, the IMF Board of Directors also note the limitations of the EBA methodology and expressed the need to further enhance the current framework.

2.3.4 Accounting approach

This model defines a sustainable current account as the one that does not generate increases in the debt-to-GDP ratio (Hudson and Stennett, 2003). This is drawn from the understanding that a nation's foreign indebtedness evolves from trade balance as well as the interest payments, if the income (other than interest) balance, the current transfers balance, and foreign direct investment financing are disregarded. Similar to the IBC model, the accounting approach defines the external financing constraint as:

$$B_t = (1 + r_t)B_{t-1} - (X_t - M_t) \qquad 27$$

Equation 27 implies that if trade is balanced ($X_t - M_t = 0$), the country's net foreign indebtedness would grow exactly as the rate of interest (r_t). This means a trade deficit leads to debt stock growth rate that exceeds the interest rate. Following this logic, the (un)sustainability condition is derived by setting the equation above in growth terms by diving by gross domestic product (Y_t) on the assumption that $\frac{Y_t}{Y_{t-1}} = (1 + g_t)$, where g_t is the growth rate of gross domestic product (GDP). This leads to the following equation, expressed in ratio terms:

$$b_t = \left[\frac{1 + i_t}{1 + g_t}\right] b_{t-1} - (x_t - m_t) \qquad 28$$

Subtracting b_{t-1} from both sides finally gives the following condition for sustainability of the current account:

$$\Delta b_t = \left[\frac{i_t - g_t}{1 + g_t}\right] b_{t-1} - (x - m)_t = 0 \qquad 29$$

Equation 29 implies that if trade is balanced, the change in the debt-to-GDP ratio would be determined by the difference between interest payments on foreign debt and the growth rate of GDP. That is, if the interest rate exceeds (below) the growth rate of GDP, the debt to GDP ratio would increase (decrease). Since the model defines the current account sustainability as the one that does not generate an increase in debt-to-GDP ratio, it implies that trade must generate surpluses that are sufficient to offset a positive gap between interest rate and growth rate. Should the trade balance be negative, the financing of the current account deficit would lead to an increase in debt stock, thereby increasing the potential risk of the unsustainability of current account deficit. However, this model implicitly assumes equality between interest rate and growth rate, which is unlikely in the real world given endogenous factors that influence interest rate (Searle and Mama, 2010).

2.4 Empirical literature

2.4.1 Empirical literature on current account sustainability

The empirical literature on current account sustainability predominantly employs the intertemporal budget constraint (IBC) framework (Table 1), yielding mixed evidence, particularly for the United States (U.S). While Husted (1992) finds the U.S current account sustainable, Fountas *et al.* (1998) and Hatzinikolaou and Simos (2013) report unsustainability,

especially when accounting for structural breaks and alternative debt valuation methods.

Dülger (2016) applies cointegration techniques to 28 countries, finding that 20 exhibited sustainability, primarily among developed economies, while unsustainable cases were confined to emerging markets. Similarly, Donoso *et al.* (2014) employs both linear and nonlinear unit root tests, for a sample of eighteen Latin American countries. The results show a sustainable current account deficit for most of the sample except for Argentina, Brazil, Chile, and Paraguay. In an African context, Yol (2009) examines the sustainability of the current account for Egypt, Morocco, and Tunisia for the period 1972-2005. The author finds evidence of sustainability only for one country (Tunisia), while Egypt and Morocco are found running unsustainable deficits.

Studies incorporating structural breaks (e.g., Narayan & Srianantha kumar, 2020; Singh, 2019; Baharumshah *et al.,* 2003) emphasize the role of economic shocks. These studies reveal heterogeneous outcomes, with countries like France, the U.S., and China consistently failing solvency tests, while others such as Bangladesh and Mexico show sustainability. Singh (2019) attributes sustainable current account balances for OECD countries to effective macroeconomic stabilization.

Alternative approaches include the Optimal Benchmark model (e.g., Hudson & Stennet, 2003; Khundrakpam and Ranjan, 2008) and the Accounting Approach (e.g., Trehan & Walsh, 1991; Opoku-Afari, 2007), both yielding mixed findings across regions. Applying the Accounting Approach, Trehan and Walsh (1991) assess the sustainability of the current account for the United States and find that the country is running a sustainable deficit. Opoku-Afari (2007) also uses this approach and finds that the Ghanaian current account deficit is excessive and fragile. Other studies that have employed this approach include Liu and Tanner (2001), Holmes (2004), Chortareas *et al.* (2004), Dülger and Ozdemir (2005), Christopoulos and Leon-Ledesma (2010) and Cigdem (2017).

A notable critique in the literature is the assumption of linearity in current account dynamics. Hasdemir et al. (2019) and others demonstrate that nonlinear models, such as NARDL and AESTAR, offer more accurate assessments. These studies find asymmetric and nonlinear behaviour, particularly in BRICS and emerging markets, with sustainability varying by country and method.

2.4.2 Empirical literature on current account forecasting

Despite extensive modelling efforts, empirical studies specifically focused on forecasting the current account—particularly its sustainability—remain limited (Table 2). Jlassi (2025) develops a forecasting framework for Tunisia's current account deficit using both direct and indirect approaches. The direct method employs an error correction model to capture short-run dynamics. However, the study does not study the question of sustainability, focusing instead on identifying key determinants at a disaggregated level.

Aromí (2021) investigates whether large current account deficits are adequately reflected in forecasts. The study finds that such deficits are often underestimated, revealing a systematic bias and highlighting neglected macroeconomic vulnerabilities. It also shows that simple historical models can outperform expert forecasts, challenging the assumption of forecast superiority. While this paper provides useful insights on forecast bias, it focuses more on growth forecast than current account balance.

Lee and Milesi-Ferretti (2006) estimate medium-term current account "norms" using panel regressions based on macroeconomic fundamentals. Their approach is indirect, as forecasts are derived from projected fundamentals rather than direct modeling of the current account. While the Lee and Milesi-Ferretti approach is valuable for assessing structural imbalances and normative benchmarks, it is less effective for forecasting in volatile or rapidly changing environments. A hybrid approach—combining direct modeling with fundamentals—can often yield better predictive performance (Schorfheide and Song, 2021). Stützel (1976) offers a practical perspective on forecasting current account balances in small countries. He emphasises the use of approaches such as elasticity, income, and macro-absorption models over purely theoretical models. Timmermann (2007) evaluates the IMF's World Economic Outlook (WEO) forecasts by comparing them with Consensus forecasts across G-7, Latin American, and Asian economies. He finds that WEO forecasts generally perform well, especially for current-year projections. The study also identifies some predictability in forecast errors using global indicators like U.S. and German GDP, underscoring the role of global spillovers.

Overall, the previous studies have made good contribution in examining the sustainability of the current account balance from an intertemporal perspective. On the other hand, it is only a handful of studies that have attempted current account forecasting in general. While existing

studies contribute valuable insights into current account forecasting, they fall short of addressing sustainability in a probabilistic or uncertainty-based framework. Therefore, there is still a gap. To date, no study has attempted to forecast the sustainability of the current account under multi-factor uncertainty—a gap this thesis aims to narrow.

Table 1:Empirical literature review on current account sustainability

Author(s)	Methodology/Model	Country/Region	Main Findings
Husted (1992)	IBC	United States	Sustainable
Fountas et al. (1998)	Engle-Granger cointegration tests	United States	Unsustainable
Hatzinikolaou and Simos (2013)	IBC	United States	Unsustainable
Dulger (2016)	cointegration test and Gregory and Hansen cointegration	18 developed and 10 emerging and developing countries.	Sustainable 20 out of 28 countries Unsustainable – mostly merging markets
Donoso et al. (2014)	linear and nonlinear unit root tests	18 Latin American countries	Sustainable current account deficit for most countries Unsustainable - Argentina; Brazil; Chile; Paraguay.
Yol (2009)	IBC	Egypt, Morocco, and Tunisia	Sustainable- Tunisia Unsustainable- Egypt; Morocco
Narayan and Srianantha kumar (2020)	IBC with structural breaks	16 developed and developing countries	Sustainable current account – Bangladesh; Australia; Ecuador; Honduras; Mexico; New Zealand; Venezuela; Peru; South Africa Unsustainable – Chile; Paraguay; United States; France, the Philippines,
Singh (2015)	IBC	India	Sustainable
Singh (2019)	IBC	24 OECD countries	Sustainable
Baharumshah et al. (2003)	unit root and cointegration tests, including structural breaks	ASEAN countries	Unsustainable for all countries, except Malaysia.
Hudson and Stennet (2003)	IBC	Jamaican	Sustainable
Trehan and Walsh (1991)	Accounting Approach	United States	Sustainable
Opoku-Afari (2007)	Accounting Approach	Ghanaian	Unsustainable
Tastan and Aric (2016)	asymmetric ESTAR unit root test.	BRICS countries	Sustainable -South Africa Unsustainable - Brazil and India

Source: Author's work

Table 2: Comparison of current account forecasting methodologies

Study	**Lee & Milesi-Ferretti (2006)**	**Aromí (2021)**	**Jlassi (2015)**	**Stützel (1976)**	**Timmermann (2007)**
Focus	Medium-term current account "norm" based on fundamentals	Forecast errors after large deficits	Forecasting Tunisia's current account deficit	Forecasting and explaining current account balances of small countries	Evaluation of WEO forecasts, including current account balances
Approach	Structural panel regression (Macroeconomic Balance)	Event study + panel regressions on forecast errors	Direct (ECM) vs. Indirect forecasting	Micro-Absorption Approach as a refinement of the Traditional Portfolio Approach	Statistical assessment of forecast accuracy, bias, revisions, and predictability
Forecasting Technique	Cross-country regression using economic fundamentals	Empirical evaluation of WEO and private forecast errors	Direct: ECM; Indirect: Forecasting components	Focus on individual agents' portfolio decisions and their macroeconomic implications	Comparison of WEO and Consensus forecasts, predictability tests
Forecast Horizon	Medium term (3–5 years)	Short to medium term (1–5 years)	Medium term	Not specified	Current-year and medium-term projections
Country Coverage	50+ countries	50 countries	Tunisia only	Small open economies	G-7, Latin American, and Asian economies
Key Variables	Fiscal balance, demographics, NFA, income, oil balance	GDP growth, current accounts, sentiment, asset returns	CAD, trade balance, capital flows, macro indicators	Individual portfolio behavior, external constraints, capital mobility	GDP forecasts, oil prices, global current account discrepancies

Source: Author's work

2.5 Shortcomings of the Intertemporal Approach to Current Account Balance

2.5.1 Shortcomings raised by other studies

(a) *Perfect foresight and complete information (Obstfeld and Rogoff, 1994, and Milesi-Ferretti and Razin,1996)*

As mentioned earlier the intertemporal solvency framework assumes that individual decision-makers have perfect foresight and complete information about their economic environment. This assumption does not consider the influence of economic uncertainties on government policy, domestic private sector, and foreign investor decisions. For example, allowing frequent and sudden changes in the leadership of key institutions such as the national treasury or the central bank. This situation raises questions about the continuity of the economic policy stance. In the case of a central bank, a frequent change of governors may raise concerns about maintaining prudent banking supervision and regulation, which in turn may raise concerns about the health of the banking system going forward. These circumstances may change financial market perceptions about the nation's ability to meet financial obligations, such that the creditors would not want to lend at current terms or to lend at all[4].

(b) *Willingness to pay and lend (Milesi-Ferretti and Razin,1996)*

The intertemporal solvency framework considers only the ability to pay, not the willingness to pay and to lend (Milesi-Ferretti and Razin, 1996). Regarding 'willingness to lend', the authors argue that the intertemporal solvency approach relies on the assumption that foreign investors are willing to lend to the borrower on current terms (Milesi-Ferretti and Razin, 1996). In this respect, the authors argue that the assumption is unrealistic, especially when foreign investors are uncertain about the country's willingness to repay or its ability to do so in the face of an external shock. The case for willingness to pay is already presented in the previous section (subsection 3.4).

(c) *Role of asymmetric information (Milesi-Ferretti and Razin, 1996)*

The intertemporal solvency framework suffers from the presence of information

[4] There are several papers that study about the association of central bank leadership and financial markets, for example, Mish ra and Reshef (2019), Moser (2010), Lybek (2004) and many more.

asymmetries in international financial markets, and this often leads to a problem of moral hazard. The behaviour of borrowers and lenders may be affected by the existence of bailout guarantees. This implies that financial-market variables may fail to reflect fully the risks of external crisis (Milesi-Ferretti and Razin, 1996). For example, excessive borrowing by the commercial banks can be prompted by expectations of a government rescue to prevent a banking crisis. As noted by Stiglitz and Weiss (1981) in the context of bank lending, credit rationing can occur when borrowers are better informed than international investors about the riskiness of projects.

(d) *Portfolio Allocation theory*

Milesi-Ferretti and Razin (1996), Ades and Kaune (1997), and Edwards (2002) introduce the Portfolio Allocation theory into the intertemporal solvency model. The aim is to capture changes in portfolio investment allocations and their association with current account sustainability. Their analysis underscores our argument that assuming the absence of drastic change in the behaviour of foreign investors is far from reality. Edwards (2002) emphasises that even small changes in foreigners' demand for the country's liabilities may generate complex equilibrium adjustment paths for the current account. To attract new capital inflows, these current account adjustments will have to move in such a way that sustainability is maintained.

(e) *Critique by Debelle and Galati (2005)*

Debelle and Galati (2005) posit that the intertemporal approach to the current account is a standard framework for analysis (see other studies such as Sachs,1982, Razin,1994, and Obstfeld and Rogoff,1994), but it is not particularly well suited for assessing current account sustainability. In the intertemporal framework, the current account balance is the outcome of forward-looking savings and investment decisions by optimising agents and hence by definition, the current account would be sustainable under this framework. Moreover, the authors assert that the empirical support for this framework for sustainability exercise is at best mixed (see Ghosh and Ostry 1995, Nason and Rogers 2003). Debelle and Galati (2005) find the approach by Milesi-Ferretti and Razin (1996) to be a more direct approach to examining sustainability. Debelle and Galati (2005) refer to existing approaches as ex ante assessments of current account sustainability. While those studies that are examining episodes of current account reversals, their approach can be characterised

as ex post assessments.

(f) *Gräf (2007) asks "When is the current account deficit sustainable in the long term?"*

According to Gräf (2007), a current account deficit is considered sustainable in the long term if it does not induce permanent changes in the behavior of economic agents, whether domestically or externally. More importantly, Gräf (2007) highlights the issue of sustainability thresholds, noting that the question of current account sustainability lacks a definitive answer. This ambiguity arises because the thresholds for a sustainable current account balance vary depending on the perspective and determining factors chosen by the researcher. Gräf (2007) further highlights the significance of economic cycles in determining current account sustainability. Gräf (2007) concludes that while the portfolio approach is a convincing determinant of U.S. current account sustainability, the challenge lies in predicting the future behaviour of portfolio managers to determine a sustainable level of current account deficit in the long term. There remains no clear consensus on the level of current account deficit that could trigger unsustainability.

2.5.2 Concerns raised in the current thesis

(g) A model that does not consider uncertainty has a limited potential to explain real-world phenomena. For instance, depending on economic conditions, the presence of uncertainty may influence firms to increase or decrease investment, creditors maybe eager or reluctant to lend, households may increase or decrease their consumption, and government may keep or change the policy stance (Bloom, 2014 and Anzuini, *et al*, 2020). Therefore, measuring the sustainability of the current account raises questions such as to what extent and by what mechanisms does uncertainty influence saving and investment decisions of economic agents. The response to "what extent" is certainly not zero (Anzuini *et al.*, 2020).

(h) To examine deficit sustainability, the cornerstone of the intertemporal budget constraint model is that future trade surpluses would be sufficient to meet foreign debt obligations, if, at an infinite period, debt limit converges to zero. However, it is not necessary for a country to achieve a debt limit equal to zero if it maintains its access to international resources, or it is able to grow its economy at the same (or higher) rate as the interest rate on foreign debt.

(i) While the literature heavily relies on the international budget constraint (IBC) model (i.e., equation 11) to study the sustainability of the current account deficit, we find this equation to be problematic because it does not apply an appropriate restriction on (α). A sufficiently large negative (α) parameter would imply that in the long-run equilibrium situation, the trade balance is negative and thus the condition that sometime in the future the trade balance will have to turn positive would not be satisfied. Notably, earlier research did not recognise that an appropriate condition must hold for (α).

2.6 Conclusion

Even in the most rudimentary forms, the intertemporal approach to the current account has proved valuable for analysing a host of current account dynamics. It provides a valuable framework for thinking about the current account. However, ignoring the limitations and concerns listed above could lead to misleading interpretations and empirical applications of the intertemporal models. Moreover, the shortcomings raised indicate that the question of sustainability is much more complicated than what could be answered with a simplified model of intertemporal solvency. The main novelty of this thesis is to propose an empirical approach that examines the sustainability of the current account deficit in a probabilistic way using density forecast to make allowance for real world economic uncertainties.

"*A theory of current account determination that makes no allowance for the uncertainty about the future underlying consumption and investment decisions cannot be fully satisfactory*," Obstfeld and Rogoff (1994).

CHAPTER 3
STYLIZED FACTS ABOUT CURRENT ACCOUNTADJUSTMENTS AND THE PROBABILITY OF CURRENT ACCOUNT REVERSALS

3.1 Introduction

Researchers and policymakers often seek answers after significant events. Following the 2008 global financial crisis (GFC), studies revealed that large and persistent current account imbalances contributed to the crisis (Allen *et al*., 2023). Analysts argue that global financial imbalances, particularly between the US (deficit) and China (surplus), were fundamental causes of the GFC (Aizenman and Jinjarak, 2009; Obstfeld and Rogoff, 2009; Portes, 2009). This has renewed interest in current account dynamics.

In this chapter we address two research questions: What are the main stylized facts about historical current account adjustment? How do various economic factors contribute to the probability of a reversal?

The key contributions this chapter seeks to make:

i. *Historical and Comparative Analysis*

Provides a historical overview of current account adjustment patterns and compares countries that experienced crises with those that sustained persistent deficits without crises.

ii. *Empirical Focus on Reversals and Non-Reversals*

Offers a comprehensive empirical analysis of both reversal and non-reversal episodes—an area with limited recent research, particularly in the post-GFC period.

iii. *Extension of Existing Methodologies*

Refines the reversal identification criteria proposed by Milesi-Ferretti and Razin (1996, 1998, 2000) by:

a. Excluding statistical outliers.
b. Including only episodes preceded by current account deficits.
c. Introducing a parallel characterisation of non-reversal episodes.

iv. *Stylised Facts and Determinants of Reversals*

Identifies key stylized facts and employs a multivariate probit model to analyse the

economic factors influencing the likelihood of a reversal.

v. *Global Scope and Income Group Analysis*

Utilises data from 196 countries to examine reversal frequency across income groups and over time, offering a broad and inclusive perspective.

vi. *Incorporation of Post-GFC Data*

Updates the literature by incorporating data beyond the 2008 crisis, addressing a gap in recent empirical studies on current account reversals.

vii. *Policy-Relevant Insights*

By characterising the macroeconomic environment surrounding both reversal and non-reversal episodes, the chapter provides insights relevant to assessing the sustainability of current account deficits and informing policy responses.

3.2 Historical current account adjustments: comparative analysis

Comparing countries in the sample is complex due to varying crisis periods and durations. Table *3* presents current account sustainability indicators averaged over 5 years before crisis episodes.

Current account balance (% of GDP)

The CA/GDP ratio helps explain why some deficit countries experienced crises. Hungary and Mexico had deficits above 5% of GDP before their crises, while India had deficits below 5% but still faced a balance of payments crisis. South Africa maintained a -3.3% deficit for over two decades without a crisis. The 5% threshold is generally supported, except for India. Roubini and Wachtel (1998) argued that current account deficits resulting from large trade deficits are more unsustainable than those from negative net income balances. In our sample, only India had a trade-driven deficit and experienced a crisis. Hungary and Mexico had deficits driven by net income balances, suggesting that such deficits do not make emerging markets less prone to crises (see Appendix A).

Real effective exchange rate

Persistent current account deficits are more likely to result in crises when accompanied by an appreciated real exchange rate. Hungary, India, and Mexico all had sustained real exchange rate appreciation before their crises, leading to expensive exports and loss of competitiveness. South Africa maintained trade competitiveness with a relatively stable exchange rate.

Exports (% to GDP)

Countries with persistent current account deficits and low export bases are more prone to crises, except Hungary. India and Mexico had export-to-GDP ratios below 25% before their crises while Hungary had a high ratio of 66%. South Africa's export ratio was above 20%, reflecting sustained trade competitiveness.

Table 3: Indicators of current account sustainability

Table 1: Indicators of current account sustainability

	Hungary Currency Crisis 2008-2010	India BOP Crisis 1991 BOP Crisis 2012-2013	Mexico Debt crisis 1982 Currency Crisis 1994	South Africa No crisis 2003-2019 2003-2007 2007-2011
Current account balance/GDP	-8.0	-2.2 -2.7	-5.8 -6.7	-3.3 -3.0 -3.1
Savings/GDP	17.6	18.5 36.1	25.7 18.8	15.6 17.6 16.8
Investment /GDP	25.3	21.8 39.8	25.8 23.2	17.9 17.5 19.2
Real Effective Exchange Rate (% change)	3.4	-7.3 1.6	13.8 7.0	0.7 4.7 1.0
Gross External Debt/GDP	92.8	21.8 18.2	29.9 36.4	30.9 18.5 24.7
Short-term debt (% of Gross External debt)	18.6	10.6 19.6	30.0 16.4	30.9 18.5 24.7
Total Debt Service /GNI	8.8	2.1 2.0	5.6 5.4	2.6 1.9 1.6
Net portfolio flows/GDP	-0.2	.. 1.0	.. 1.3	1.5 2.6 1.1
Net FDI flows/GDP	-2.3	.. -1.2	1.1 1.5	-0.4 -0.2 -1.7
Exports/GDP	66.0	6.2 22.4	10.0 16.4	26.9 24.9 27.7
Gross International Reserves (% of total external debt)	2.5	15.6 110.6	6.8 13.8	37.4 39.3 44.9
Fiscal Balance/GDP	-6.8	-3.0 -2.5	-2.0 -8.6	-3.2 -0.5 -2.8
GDP growth rate	3.5	3.7 5.0	6.3 1.9	1.1 3.5 1.2

Source: World Bank, International Monetary Fund, International Financial Statistics, and Bank of International Settlements. Notes: Table 1 presents 5-year period averages before the crisis. For India and Mexico, the second row of data captures the 5-year averages preceding their second round of crises. In the case of South Africa, the first row of data is the averages for the 2003 -2019 period. The second and third rows present 5-year averages, which correspond to the Hungarian (2008-2010) and Indian (2012-2013) crises, respectively. For India, the Net portfolio and FDI data are available from 1991. The Net FDI flows are available from 1989 for Mexico.

Savings and investment (% of GDP)

Countries that experienced crises had high savings and investment ratios. South Africa, with lower ratios, did not experience a crisis. Seemingly, high savings and investment do not

guarantee protection against crises. The distinction between public and private savings is important, as low public savings correlate with higher fiscal deficits.

Fiscal balance (% of GDP)

The evidence from our sample suggests that a 'large' fiscal deficit can be associated with the unsustainability of current account deficits and high vulnerability to external crises. Hungary and Mexico (1982) are cases in point (Table *3*)[5]. Hungary and Mexico had a current account deficit above 5 percent, accompanied by a fiscal deficit above 3 percent on average in the five years before the crisis episodes. South Africa maintained a deficit around 3%, avoiding crises. The fiscal balance alone does not fully explain crisis occurrences.

External debt (% of GDP)

All countries except Hungary had external debt below 50% of GDP, suggesting that low external debt and debt service payments do not guarantee sustainability. India and Mexico had lower external debt than South Africa but still faced crises. South Africa maintained a low debt service ratio.

External financing: portfolio investments and FDI

Our data shows that in five years before crisis episodes, Hungary and India (2012-2013 crisis episode) experienced a significant decline in foreign liabilities, albeit from a shallow base of capital flows (*Table 3* Table *3*). Mexico saw capital inflows, thereby suggesting the availability of financing for the country's large current account deficit. While portfolio flows pose a greater threat to sustainability than FDI, Hungary experienced outflows in both portfolio and FDI before its crisis. Although South Africa predominantly used debt-dominated portfolio flows to finance its current account deficit, the advantage is that the local currency, the Rand, dominates these borrowings.

Gross international reserves (% of total foreign debt)

Low foreign reserves are linked to crisis vulnerability. Hungary, India (1991), and Mexico had low reserves before crises. India's reserves covered external debt in 2012 -2013 but were insufficient to prevent a crisis due to widening current account deficits.

[5] While there is no official definition for what is a "large" fiscal deficit, the two crisis countries in our sample in the five years before crisis episodes recorded fiscal deficits above emerging markets' average of about 3 percent of GDP, except for Mexico (1982) and India (International Financial Statistics Database G300 series). In addition, the magnitude of 3 percent has been a standard convergence measure used by regional groups such as the European Union and the Southern African Development Community (European Commission Convergence Report, 2020).

Gross Domestic Product (GDP) growth rate

Countries with crises had average growth rates of 4-5% before crises. Hungary had 3.5%, India 3.7%, and Mexico 6.3% (1982) and 5% (1994), suggesting that higher growth rates do not necessarily prevent crises. South Africa maintained a low growth rate (1.08 % from 2003 to 2020) without crises.

Political Instability, Policy Uncertainty, and Credibility

Milesi-Ferretti and Razin (1996) highlight that policy instability and uncertainty can significantly impact current account deficit sustainability. These factors are difficult to quantify and are not included in Table *3*. However, their role was evident in the crises of Hungary, India, and Mexico.

In Hungary, credibility issues arose due to large fiscal deficits and public debt. The government made several policy mistakes, including the false belief that Hungary would adopt the euro by 2012, leading to ineffective policies (Dapontas, 2011). India faced political instability from 1989 to 1991, with three coalition governments and three Prime Ministers, affecting decision-making during the balance of payments crisis (Sangvikar, Pawar, and Pahurkar, 2019). This instability led to a loss of confidence in the economy (Virmani, 2001). In Mexico, signs of crises were evident in both 1982 and 1994, but upcoming elections delayed necessary policy actions (Heckert, Ramos, and Wright, 1995).

Our small sample of four countries provides insights into current account sustainability indicators and why some deficit countries experienced crises while others, like South Africa, did not. The following indicators were correlated with crisis episodes: current account balance, real effective exchange rate, the ratio of exports to GDP, fiscal deficit, international reserves, policy uncertainty, political instability, and credibility. We did not identify a correlation between the crisis episodes and the indicators: national savings, domestic investment, external debt, debt service, foreign direct investment, portfolio investment, and GDP growth rate.

In conclusion, a combination of factors, rather than single variables, is necessary to gauge the sustainability of persistent imbalances. For example, South Africa's current account deficit is accompanied by fiscal discipline, a low investment/savings gap, and a slow appreciation of the real effective exchange rate, supporting high exports/GDP. Additionally, local currency-denominated external debt keeps debt servicing relatively low. Similar findings are reported by Milesi-Ferretti and Razin (1996) from seven deficit countries. Of course, crises can be induced by reasons other than those associated with current account imbalances. Our data supports the

connection between crises and current account imbalances.

3.3 From current account deficit to current account deficit reversals

To clarify concepts, we start by discussing current account reversals, including their definition and theoretical considerations. We explain why current account reversals matter, especially in examining current account sustainability.

3.3.1 Why do current account reversals matter?

Current account reversals, characterized by sharp reductions in current account deficits, are significant due to their potential economic implications. Literature and past experiences reveal that reversals can be disruptive, especially when associated with abrupt policy adjustments or external shocks.

For instance, Mexico's response to the 1982 debt crisis—marked by trade liberalization, wage cuts, and fiscal contraction—produced a sharp current account surplus at the cost of a 5% output contraction and a steep decline in national investment. Similarly, during the Latin America debt crisis of the 1980s, Uruguay's GDP growth fell from over 5% to -7%. Other disruptive episodes occurred in Ireland (1979 –1990), Israel (1982–1986), Malaysia (1991– 1995), South Korea (1978–1988), and Thailand (1998).

Empirical studies confirm the economic cost of reversals. Edwards (2004) found that reversals lower GDP growth by an average of four percentage points, with more open economies and flexible exchange rates suffering less severe impacts. Adalet and Eichengreen (2005) observed that reversals lead to slower growth in the immediate years, though recovery can follow. Calvo (2005) described a potential V-shaped recovery, while Komarek and Melecky (2008) estimated a one-percentage-point contraction in growth in the year after a reversal.

The impact on industrial economies has been particularly pronounced in the manufacturing sector (Craighead and Hineline, 2010). In cases of persistent deficits, studies like Edwards (2005) suggest that drying up of financing can lead to sharp declines in consumption and investment due to higher interest rates and falling asset values.

However, not all reversals are disruptive. Post-1970s, reversals have been less harmful compared to earlier periods. Adalet and Eichengreen (2005) attribute this to improved financial

systems and more flexible exchange rate regimes. Studies such as Debelle and Galati (2005), Freund, and Warnock (2007), and Pancaro (2013) found no significant adverse effects on output or productivity from reversals, regardless of magnitude or exchange rate regimes.

Reversal outcomes vary widely. Milesi-Ferretti and Razin (2000) found that median growth changes before and after reversals are negligible, indicating heterogeneity in responses. For example, Uruguay experienced a sharp contraction (-7%) during its reversal, while Malaysia's growth accelerated to 8% after its adjustment. De Mello, Padoan, and Rousová (2011) distinguished between "positive reversals" (e.g., income gains from better terms of trade) that support growth and "negative reversals" (e.g., capital outflows) that harm growth.

The relationship between reversals and currency crises is complex, with mixed evidence on causality. Milesi-Ferretti and Razin (1998) and Edwards (2002) showed that while reversals and crises can coincide, less than one-third of reversals are preceded by currency crises. Timing varies reversals can precede (India 1990), coincide with (Mexico 1994, Hungary 2008), or follow crises. Understanding this link is critical for designing effective policy responses to mitigate economic disruptions. However, this is not the primary focus of this chapter.

3.3.2 Definition of current account reversals

Generally, the literature defines current account reversals as episodes in which the current account adjusts sharply from a deficit to a surplus (Milesi-Ferretti and Razin, 1996, Freund, 2000, Edwards, 2002, 2004, 2005, 2007, Debelle and Galati, 2005, Adalet and Eichengreen, 2005, 2007, Freund, 2005, Freund and Warnock, 2005, Melecky, 2005, Behima and Havrylchyk, 2006, Freund and Warnock, 2007, Aßmann, 2007, Komarek and Melecky, 2008, and Bugamelli and Paterno,2006). To identify the reversal episodes, most studies have adopted criteria proposed by Milesi-Ferretti and Razin (1996).

Milesi-Ferretti and Razin (1996) set three conditions. First, an average reduction in the current account deficit of at least 3(5) percentage points of GDP between the three years preceding the reversal episode and the three years post-episode. Second, in three years post-reversal episode, the maximum deficit must be smaller than or equal to the minimum deficit in the three years preceding the episode. Third, the average current account balance must increase by at least one-third from the average of the three years preceding the reversal year to the subsequent three years. The first condition stipulates that a reversal was large. The second condition ensures persistence in the current account reversal. The first and second conditions help avoid sharp but temporary adjustments. The third condition ensures that a small improvement from a large

deficit will not count as a sharp upward adjustment.

Most studies, however, choose to use different thresholds. For instance, Freund (2001) sets an average reduction in the current account deficit of at least 2 percentage points of GDP between the three years preceding the reversal episode and the three years post-episode. The author uses a five-year period after reversal instead of three years for the second condition. Adalet and Eichengreen (2005) set an average reduction in the current account deficit of at least 2(3) percent of GDP between the first three and the second three years. Authors keep the rest of their conditions the same as in Milesi-Ferretti and Razin (1996).

Edwards (2004) provides a comprehensive analysis of the current account adjustments. The author uses two alternative definitions for reversals. First, a reversal is defined as a reduction in the current account deficit of at least 4 percent of GDP in one year. Second, a reversal is defined as a reduction in the current account deficit of at least 6 percent of GDP in three years. Similarly, Edwards (2002) and Melecky (2005) consider a reduction of 3 percent in the current account deficit in one year. Aßmann (2007) uses several ad hoc identification schemes. The author adds that the current account deficit must not exceed 10 percent in post-reversal episodes. Craighead and Hineline (2010) impose even stricter conditions as follows; (i) the deficit must initially exceed 2% of GDP; (ii) the fall in the deficit must be above 2 percentage points of GDP; (iii) the deficit must have fallen by at least a 1/3 three years after the reversal, and (iv) the deficit must not go back above the peak level in the four years after the reversal.

We find Milesi-Ferretti and Razin's (1996) criteria in need of reconsideration. Since we are interested in analysing current account deficit reversals, setting a threshold on the maximum level of the preceding current account balance is necessary. This condition is even more necessary in our case, as we characterise non-reversal episodes. We check the sensitivity of the results to the threshold selection, especially the probit results. Another condition is the exclusion of extremely large current account deficits. For example, three years before Kuwait's 1994 reversal, the current account balance was -242 percent of GDP. Three years before Sudan's 1993 reversal, the balance was -98 percent of GDP. Such extreme values could distort the results and, thus, are discarded.

Therefore, we used the following criteria to identify reversal episodes:

1. *Initial CA balance condition*: the maximum value of the current account balance on average in the three years before the reversal is set at zero[6].

[6] Note that when we talk about the balance: the sign of a deficit is negative, and the sign of a surplus is positive.

2. *Current account increase condition*: An average increase in the current account balance of at least 3 or 5 percentage points of GDP between the three years preceding the reversal episode, and the four years post episode[7].

3. *Each year condition:* In each of four years post-reversal episode, the current account balance must be higher than the three years preceding the episode.

4. *Minimum share improvement condition*: the average current account balance must increase by at least one-third from the average of the three years preceding the reversal year to the subsequent four years.

5. *Excluding extreme current account deficits*: the minimum current account balance in the first three years must be larger than -25 percent.

A 3 percent of GDP cut-off in condition (2) is expected to indicate more reversals than a 5 percent cut-off. As noted by Milesi-Ferretti and Razin (2000), this definition for current account reversals suggests that the reversals can occur in consecutive years, thus not making these episodes mutually exclusive. To deal with this situation, we exclude reversals occurring within three years of the previous one.

One of our contributions to the literature is that we identify a proper control group for non-reversal episodes, which is an issue that has been neglected in the literature. A proper control group to which reversal episodes are compared to should not be composed of every year that does not meet the criteria for a reversal episode. For example, consider two episodes that satisfy criteria 1, 3, 4 and 5, but criterion 2 is satisfied by only the one of the episodes with a 3.0 percentage points improvement in the current account balance, while the other does not satisfy it with a 2.9 percentage point increase. Such two episodes could share similarities and would not allow a proper comparison of reversals and non-reversals. Moreover, the experiences of countries with current account surpluses are not relevant in this context. To disregard 'near-reversal' episodes and cases with current account surpluses, we use the following criteria to identify the control group of non-reversal episodes:

1. *Initial CA balance condition*: the maximum value of the current account balance on average in the three years before the reversal is set at zero

2. *The maximum increase in the current account balance* is set at 1.5 (when condition (2) for reversals requires a minimum 3 percentage points increase) or 2.5 (when condition

[7] Note that the four years post-episode include the reversal year.

(2) for reversals requires a minimum 5 percentage points increase) percentage points of GDP between the three years preceding the non-reversal episode and the four years post-episode.

3. *Excluding extreme current account deficits*: the minimum current account balance in the first three years must be larger than -25 percent.

The implication of our definition of non-reversal episodes is that not every year that does not meet the criteria for a reversal episode will automatically qualify as a non-reversal year. Conditions 1 and 3 are the same as in the case of reversal episodes. Similar to reversals, we exclude the non-reversals within three years of the last non-reversal episode. Bagnai and Manzocchi (1998) highlights that reversal thresholds and reference periods are set arbitrarily. This approach can lead to mistaking the cyclical deviations of the current account balance as permanent reversals. However, our second and third conditions are precisely set to avoid such problems.

To correctly identify episodes, we avoid overlaps between reversal and non -reversal years. First, we avoided overlaps between the year in question and the conditioning years. Based on our definition of reversals, the preceding three years and the following four years of the reversal episode are the conditioning years. Therefore, these years cannot be used as non -reversals years due to overlaps. Instead, these conditioning years should be understood as developments in pre- and post-reversal episodes. For example, if 1994 is a reversal year for Mexico, we cannot use 1991-1993 and 1994-1997 as non-reversal years[8]. Similarly, if we set 1990 as a non- reversal year, we cannot use 1987, 1988, and 1989 as non-reversal years because that would overlap with the three years preceding the 1990 non-reversal year.

The literature on current account reversals does not explicitly discuss the issue of overlaps. However, others consider this issue. In their study of exchange rate devaluation episodes, Eichengreen *et al.* (1995) exclude from the control group all the observations within a two-sided, one-quarter window of each event and crisis to avoid double counting[9]. Overall, we classify episodes into three categories: the reversal episodes, the non-reversal episodes, and the

[8] Suppose we set 1993 as a non-reversal year and use the 1990-1992 average to calculate the pre-non-reversal values of the current account. Then due to the considerable overlap with the 1991-1993 pre-reversal conditioning period for the 1994 reversal year, we essentially use pre-reversal year developments for the pre-non-reversal year.

[9] Eichengreen *et al.* (1995) uses a devaluation dummy equals one if exchange rate devaluation occurs and zero if otherwise.

years that are neither. We are the first paper in the literature on current account reversals to discuss the problem of overlaps explicitly.

3.3.3 Theoretical considerations of current account reversals

In the literature, the intertemporal models of current account determination have been used to provide a variety of channels through which temporary shocks can adjust the current account balance (see The Handbook of International Economics by Obstfeld and Rogoff, 1996). A sharp improvement in the current account can be a result of a positive income shock, such as an improvement in terms of trade. In some cases, the improvement might be due to the effects of a negative income shock die out (Kraay and Ventura, 1997). Kraay and Ventura (1997) argue that a debtor country may reduce its current account deficit in response to a negative transitory income shock, as the reduction in wealth leads to a reduction in the share of wealth allocated in foreign assets (which is negative in a debtor country).

Net capital inflows primarily finance current account deficits because the stock of reserves constrains financing of deficits from depleting official reserves. When foreign financing starts to dry up, a reversal may be necessary to ensure that the country remains solvent – a concept we define below. For instance, Edwards (2004) uses regional data with about 3400 observations and provides evidence that reversal incidence coincided with sudden stops. Capital outflows may result from a deterioration of market sentiment about the country's ability to meet foreign obligations. The worsening of the fundamentals can induce a loss of confidence in the ability to repay liabilities.

The reduction in international reserves below a certain threshold or an increase in the external debt above a certain threshold can be seen as events that trigger such a loss of confidence, hence inducing the current account reversal (Edwards, 2002). Sometimes unavailability of foreign financing can be due to exogenous factors such as high yields elsewhere. Financing dry-up can also be due to increased risk aversion due to global crises, as happened during the global financial crisis of 2008 (Dapontas, 2011). Thus, it becomes essential to remember that foreign financing behaves differently toward middle-income and high-income economies (Freund, 2000; Debelle and Galati, 2005). Investors view high-income countries as more stable and 'safe heaven' during times of high uncertainty (Freund, 2000). Consequently, current account imbalances can be primarily driven by foreign investors' willingness to lend and other external factors, which can be more important in middle-income than high-income economies.

The accounting approach to examine the sustainability of the current account deficit suggests

that a simple sufficient condition for solvency is stabilizing the ratio of foreign debt to GDP (see Chapter 2). Hence it makes sense to quantify the size of the upward adjustment in the current account deficit needed for stabilized foreign debt-to-GDP. We use a simple expression from Milesi-Ferretti and Razin (1998):

$$\Delta cad = cad^* - cad = (r^* - g^* - \epsilon^*)k - tb = [(r^* - r) - g^* - \epsilon^*]k - (s - i) \quad (30)$$

where cad is the ratio of the current account deficit to GDP before a reversal event, and $cad*$ is the current account deficit to GDP needed to stabilize the ratio of external debt to GDP. The pre-and post-reversal real interest rate level on external debt is denoted by r and $r*$,respectively. The $g*$ presents the economic growth rate after the reversal, $\epsilon*$ is the rate of real exchange appreciation post-reversal. The ratio of external debt to GDP is denoted by k and s, and i are the national savings and Investment ratios to GDP. As long as the real interest rate exceeds the economic growth rate, the foreign debt-to-GDP ratio stabilization requires a current account surplus. Intuitively, the larger the initial current account deficit, the larger the adjustment is expected. Therefore, for a given level of current account deficit, the magnitude of reversal is increasing in the level of external debt and interest rate and decreasing in the economic growth rate.

About the real interest rate, suppose the world interest rate increases; the interest rate differential would raise the magnitude of the reversal needed in the current account deficit for stabilization of the external debt-to-GDP ratio. For some countries, a reversal might be a strategy to lower risk premiums, thereby lowering the actual size of the current account deficit needed for foreign debt stability. Therefore, any shock that affects the real interest rate and economic growth rate alters the country's intertemporal budget constraint and may therefore require a reversal in the current account deficit. The reversal in the current account deficit may be generated by real exchange rate depreciation, bearing in mind the effect of the *j*-curve[10].

We argue that current account imbalances reflect interactions between savings and investment decisions of government and domestic private sector agents and investor lending decisions. These interactions can be influenced by macroeconomic, financial, and fiscal uncertainty. For example, if government foreign borrowing is increasing rapidly under its current policy, foreign investors' perceptions may arise on whether the debt can be repaid. Such perceptions may lead to expectations that an abrupt policy reversal might occur, taking the form of a debt default, a

[10] The *j*-curve is when the current account deficit will initially worsen after currency depreciation due to delayed response in export volumes. After that, it improves sharply as export volumes adjust.

significant currency devaluation, or a fiscal adjustment. In such cases, even if the country is solvent, it may face severe liquidity constraints due to sudden capital outflows. Similarly, Milesi-Ferretti and Razin (1998) argue that sudden stops are more prevalent in a world economy with problems such as asymmetric information, moral hazard, and adverse selection among borrowers. Therefore, indicators of a country's vulnerability to sudden stops in capital flows, such as the composition of financing of the current account and the nature of currency (reserve or not), can provide information regarding the likelihood of a current account reversal.

So far, our discussion from section 3.2 suggests that current account reversals are more likely in cases where there is a large ratio of current account deficit to GDP, appreciation of the real exchange rate, enormous fiscal deficit, low reserves, low ratio of exports to GDP, and policy uncertainty, political instability, and credibility. These indicators can be viewed as ex-ante assessments of current account sustainability. Now we turn to ex-post assessments, that is, examining episodes of sizeable current account adjustment.

3.4 The data and country sample

We use annual data from the World Bank WDI Database, International Monetary Fund-World Economic Outlook (IMF-WEO), and Bruegel (see Appendix B for detailed data description). We consider the period 1980 to 2022 for 196 countries[11]. Since we define reversal episodes based on three-year averages before the reversal year, we use other data sources to extend the time series backwards to 1977 so that reversals can be identified starting from 1980[12].

We selected countries with a population above one million in the year of reversal or non-reversal to exclude small countries potentially subject to large economic swings. We classify countries into three categories based on their income level: low, middle, and high. The World Bank classifies countries into these categories based on the current price of Gross National Income (GNI) per capita and revises the income thresholds every year[13]. These annual income thresholds are unavailable from 1980, our first possible year of reversals, and GNI data has more gaps than GDP data. To overcome these problems, we use GDP per capita measured at

[11] The length of the sample period varies across countries. For instance, some countries were formerly part of the Soviet Union and did not exist as independent states during the 1980s. Consequently, their individual data series starts only from 1992.
[12] Based on our definition of reversals; to identify the reversals for 2020 and 2021, we use the IMF current account forecasts up to 2024.
[13] The 2022 World Bank country classification by income level is available at:

https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2021-2022

constant price Purchasing Power Parity (PPP) to define unchanged thresholds for the entire sample period.

To translate the World Bank's thresholds for current price GNI data to constant price GDP data, we consider the countries that were +/-15 percent from the 2022 current price GNI/capita thresholds of the World Bank. There were eleven such countries for the threshold between low- and middle-income countries and thirteen for the threshold between middle- and high-income countries. For these countries, we calculate the ratio between the 2022 value of GDP per capita at constant 2017 price PPP and the 2022 value of GNI per capita at current prices. We then calculate the average of these ratios across the countries and multiply the GNI per capita current price thresholds of the World Bank with these ratios. These calculations show that the 2022 USD 1,085 GNI/capita current price threshold for low-income countries corresponds to USD 2,911 GDP per capita measured at constant 2017 price PPP values. The USD 13,205 GNI/capita current price threshold for high-income countries corresponds to USD 26,227 GDP per capita measured at constant 2017 price PPP values.

Consequently, measured at constant 2017 price PPP values, our low-income countries have a GDP per capita below USD 2,911. Middle-income countries have a GDP per capita between USD 2,911 and USD 26,227. The high-income countries are those with a GDP per capita above USD 26,227.

Our data on **explanatory variables** can be divided into four categories:

a. Domestic macroeconomic variables:

Gross domestic product, savings rate, investment rate, budget balance, and public debt. - -

- External Sector variables:

Current account balance, real effective exchange rate, trade openness, foreign reserves to imports, US real interest rate, and World GDP growth.

b. Composition of external debt and liabilities:

External debt, short-term external debt, interest payments, and net foreign direct investment

Dependent variable:

Reversal is our dependent binary variable, which takes the value of one for reversal episodes and zero for non-reversal episodes, as defined earlier.

3.5 Findings

3.5.1 The frequency of current account reversals and non-reversals

We can confirm that current account reversals are by no means rare. Over the period from 1980 to 2022, we find 200 episodes of current account reversal in 111 countries when the reversal threshold is set at 3 percent (condition 2 of the previous section)[14]. The corresponding number of non-reversal episodes is 867 in 138 countries. When the threshold is 5 percent, we find 139 reversal episodes in 90 countries and 966 non-reversal episodes in 139 countries. Our calculations show that middle-income countries have experienced more current account reversals than low- and high-income countries (Figure 1). At a 3 percent threshold, middle-income countries account for 115 reversal episodes (about 58% of total reversals; Panel A of Figure 1), while low- and high-income countries have experienced 43 and 42 reversal episodes, respectively.

Few reversals preceded the 1997/8 Asian crisis and the 2008 Global financial crisis (GFC) (Figures 1a and 1b). The current account deficits were large for most Asian countries pre-Asian crisis. Similarly, the GFC was preceded by years of unsustainable bubbles in some advanced countries and excess capital flows to emerging and developing countries. The significant upward adjustments in the current account balance in 2009/10 partly reflect the decline in global trade, rise in capital flow reversals, and global recession. This suggests that global factors sometimes play an essential role in reversals or lack thereof. Edwards (2004) finds that sudden stops in capital flows turn to precede current account reversals. Similar findings are reported by Milesi-Ferretti and Razin (2000).

Unsurprisingly, the episodes of few/many reversals correspond to many/few non-reversal episodes (Figure 1c and 1d). Furthermore, Figure 1 suggests clusters of current account reversals. Reversals were more frequent in the early 1980s after the Latin American debt crisis, in the late 1990s and early 2000s after the Asian crises and US economic slowdown, and in the late 2000s and early 2010s after the global financial crisis. History shows that these crises episodes tend to be preceded by large current account deficits. For instance, in 1982, Chile and Mexico

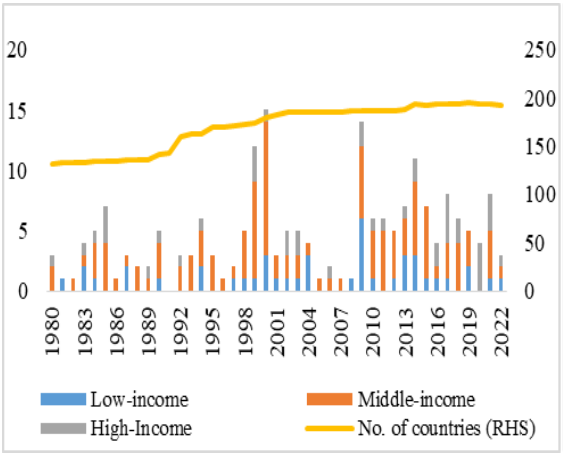
[14] We use annual data. See our data sources and definitions in the Appendix.

experienced debt crises that were preceded by large deficits (approximately 15% and 8% of GDP for Chile and Mexico, respectively). Other similar cases include Uruguay (1979-81 and 1982-84).

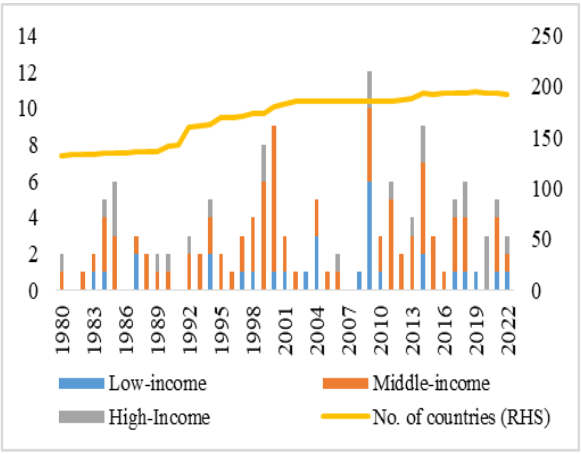
Figure *2*and 2b provide more insight on time distribution of reversals, showing that reversals were slightly more frequent in the 2000s/2010s than from the 1980s/ 1990s, after controlling for the number observations in each period. This result is consistent for both thresholds. The year 2000 faced headwinds of recession from developed economies, rising interest rates in the United States, and a stock market crash following the burst of the "dotcom" bubble. During this period, there is evidence of capital outflows and sudden stops toward middle-income countries in particular (Bank for International Settlements 2021, and Darvas *et al.* 2015). Consequently, several countries had to correct their current account deficits. A similar situation can be observed after the global financial crisis. These observations suggest that beyond domestic determinants of current account reversals, the international environment can also play a role. Thus, we control for this factor in our regressions to be presented in subsection 3.6.1.

Figure 1: Frequency of current account reversals and non-reversals by income group, 1980- 2022

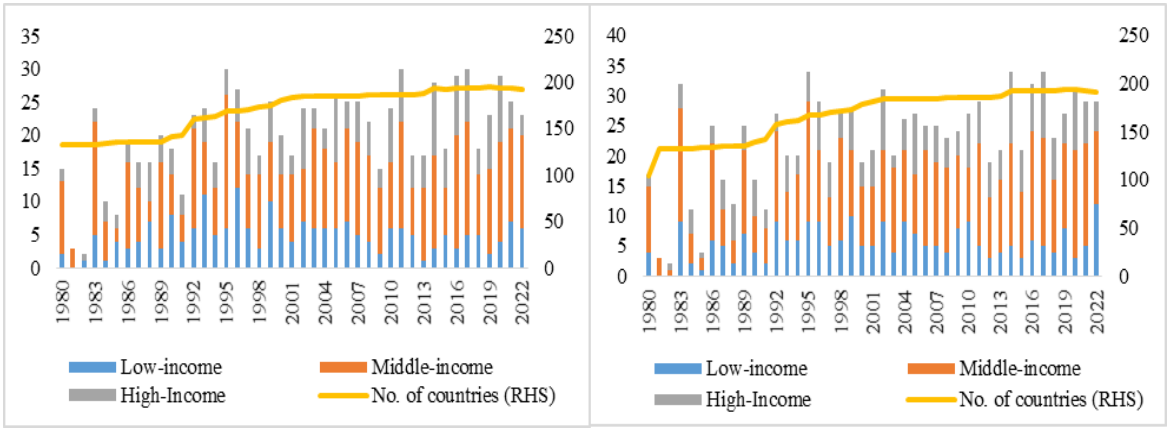
(a) Reversals at 3% threshold



(b) Reversals at 5% threshold



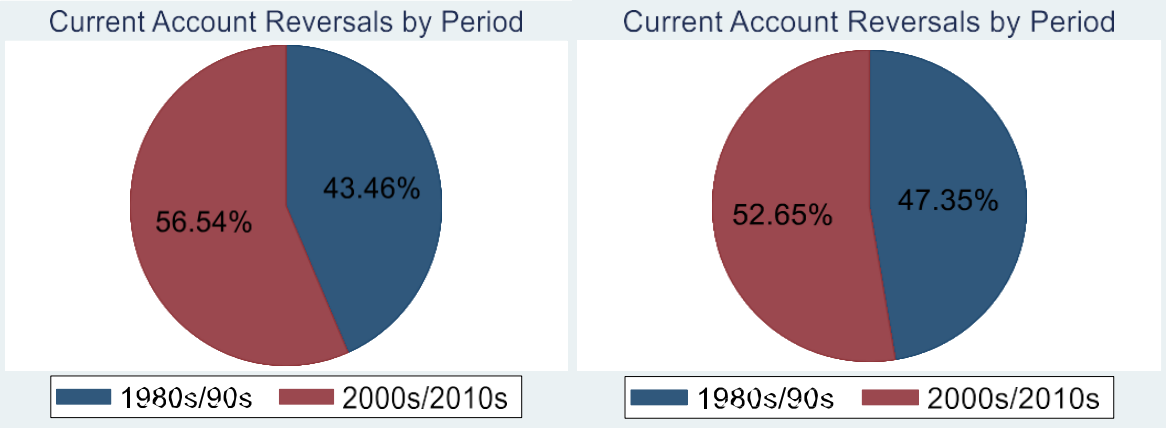
(c) Non-reversals at 1.5% non-reversal threshold (d) Non-reversals at 2.5% non-reversal threshold



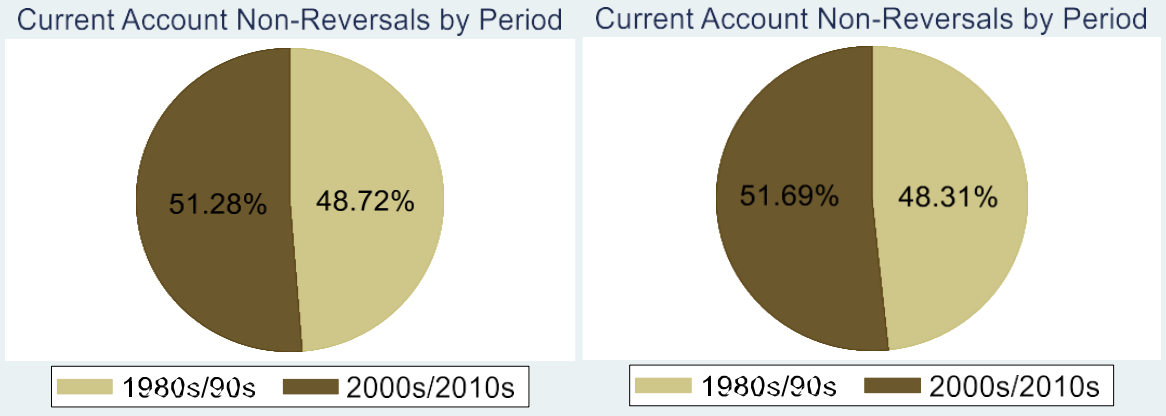
Source: Authors' calculations

Figure 2: Frequency of current account reversals and non-reversals by time period, 1980-2022

(a) At 3% threshold (b) At 5% threshold



(c) At 1.5% non-reversal threshold (d) At 2.5% non-reversal threshold



Source: Authors' calculations.

Our statistical test (Chi-squared) indicates that the frequency of reversals per country is relatively stable over time. Despite increased global trade and financial flows from the 1980s

to the GFC, we do not observe a statistically significant increase in reversals over time (see Appendix C) Therefore, we cannot draw strong conclusions from the slight differences in frequencies depicted by Figures 2a and 2b. Moreover, trade openness increased from 56.2% in the 1980s/1990s to 72.5% in the 2000s, indicating greater access to international markets. However, this increased openness did not significantly affect the frequency of current account reversals. This suggests that economic openness does not have a substantial influence on the occurrence of current account reversals.

Figures 2c and 2d show similar results for non-reversals, with small, statistically insignificant differences over time (see Appendix C). This suggests that the occurrence of both reversal and non-reversal episodes is independent of the time period considered.

3.5.2 Macroeconomic implications of current account reversals and non-reversals

We analyse the implications of reversal episodes on the average performance of macroeconomic variables by calculating the mean values of various indicators across countries for the three years before and after reversal, as well as non-reversal episodes, following Eichengreen *et al.,* (1995).

Reversal episodes are preceded by current account deficits of around 8 percent of GDP on average when the current account balance increase condition requires an increase of at least 3 percentage points of GDP (

Figure *3*a). The average deficit before reversals was around 10 of GDP when the condition requires an increase of at least 5 percentage points (

Figure *3*b). By definition, non-reversal episodes are not characterised by upward shifts in the current account balance, but by persistent current account deficit, which has even deteriorated somewhat on average. It is important to highlight that there are more non-reversals (294 cases) than reversals (141 cases) which were preceded by more than 5 percent of GDP current account deficit in our sample, which challenges the findings of studies which reported that above 5 percent current account deficits tend to reverse (Freund, 2000; Chinn and Prasad, 2003; Debelle and Galati, 2005).

Savings were broadly similar before reversals and non-reversals and increased sharply only after reversals. Investments were much higher before reversals than before non-reversals and

were reduced sharply only after reversals – to a level similar to non-reversal investment levels. These developments are consistent with the path of the current account deficit for both reversal and non-reversal episodes.

Foreign financing in net foreign direct investment (FDI) inflows fell before the reversals occurred, while there was a steady increase in FDI inflows after non-reversal episodes. The foreign reserves/import ratio was on a downward trajectory before reversals and were followed by a sharp increase after reversals, while this ratio remained broadly stable after non-reversals. Short-term external debt was much higher before reversals than non-reversals and were falling prior reversals to levels similar of non-reversals. In contrast, while total external debt was also higher before reversals than non-reversals, it started to fall only after reversals and remained well-above non-reversal levels. The reversal episodes were accompanied by elevated but depreciating real effective exchange rates compared to non-reversals[15]. This is consistent with the argument that overvalued real effective exchange rates preceded sharp upward adjustments in the current account balance.

Compared to non-reversals, the reversal episodes are preceded by a high (but declining) inflation rate – though some high-inflation countries distort the averages. This behaviour can be associated with overheating economic growth. The high and rising budget balance, public debt, external debt, debt servicing, and government interest payment preceded reversal episodes. The path of trade openness suggests that reversals are more likely for open economies. The United States' real interest rate was high but fell in the build-up to both reversals and non-reversals. There is no clear pattern for OECD economic growth, though it was lower in the year before reversals compared to non-reversals. Intuitively, foreign growth translates to foreign demand for exports. Thus, high world economic growth would be expected to narrow the current account deficit.

Overall, economic growth rate declined before reversals, but not before non-reversals, and the development of most variables in the build-up to the reversal year is consistent with economic intuition. An overheated economy characterised by high investment, high inflation, rising budget deficit and, public debt and external debt, and an overvalued real exchange rate is more likely to experience a reversal than a country with a similar level of current account deficit but without such domestic vulnerabilities. A reversal is accompanied by a decline in FDI inflows

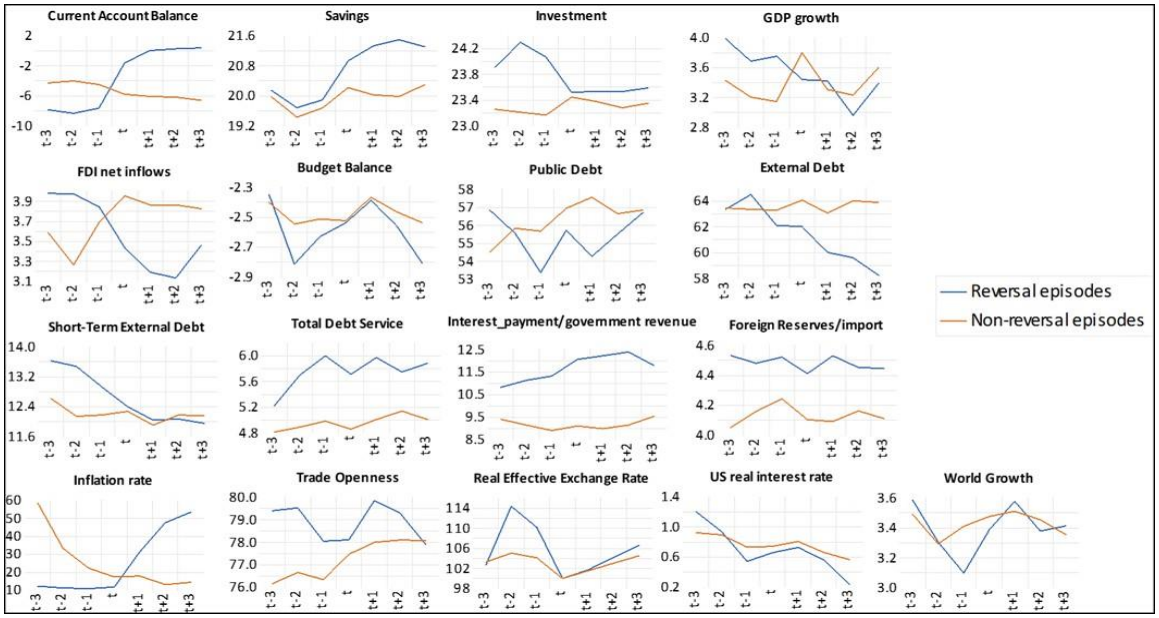
[15] For the CPI-based Real Effective Exchange Rate Index (reversal year=100), an increase (decrease) represents appreciation (depreciation).

and a decline in real GDP growth, and is followed by a decline in investment, an increase in savings, a reduction in external debt, and ultimately (when major macroeconomic vulnerabilities are adjusted) an accelerating economic growth.

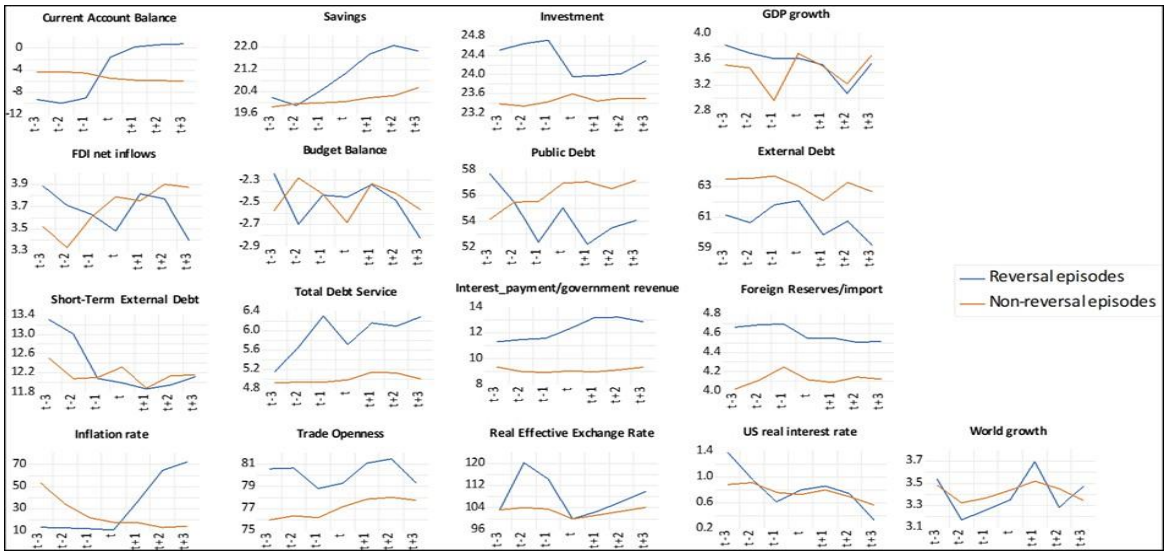
Figure *3*b depicts economic environment with increased capital inflows, economic activity, and inflation. The country's indebtedness is also low. The savings, world interest rate, trade openness, and real effective exchange rate also turn out to be lower pre-non-reversal episodes. We can see that most variables behave differently in the build-up to either reversal or non-reversal episodes. Intuitively, by observing the path of these macroeconomic variables, the analysts can speculate whether a reversal will occur on the horizon. We note that there are no significant differences between the plots from the full and middle-income sample groups. Our analysis mainly sheds light on what unfolds in the economy during periods of persistent current account deficit and reversals in the current account balance.

Figure 3: The association between current account reversals/non-reversals and macroeconomic variables

a) At least 3 percentage points of GDP minimum reduction in current account deficits



b) At least 5 percentage points of GDP minimum reduction in current account deficits



Source: Author's calculations. Notes: **Full Sample**. Reversal and non-reversal episodes (see definitions in Section 2) were identified in the sample from 1983-2022. The reversal and non-reversal years are denoted by *t*. The three years before reversal/non-reversal years are denoted as t-1, t-2, and t-3, while the three years after reversal/non-reversal years are denoted as t+1, t+2, and t+3). The plots depict the mean values across countries each year for each variable. The unit of measurement of each variable is defined in the Appendix. With at least 3 percentage point minimum adjustment requirement there are 200 reversal episodes in 111 countries and 867 non-reversal episodes in 138 countries. With the at least 5 percentage point minimum adjustment requirement thereare 139 reversal episodes in 90 countries and 966 non-reversal episodes in 139 countries.

The analysis so far does not show whether reversals might have different characteristics depending on whether domestic or external factors caused them. However, our results from the preceding sections provide some realisations. The years 1983, 1999, 2000, and 2009 had more reversals than other years in our sample period (see Figures 1a and 1b). The circumstances around these years suggest that the reversals were induced by global economic environment. The external driving factors include weak global growth, a decline in trade, capital outflows, a stock market crash, a decline in foreign demand, and a rise in US interest rates (1983 and 2000). Consequently, some countries were forced to narrow their current account deficits in such a global economic environment.

The year 1983, however, had unique features of increased protectionism and capital controls (World Economic and Social Survey Report, 1983). This environment partly explains why low-income countries few reversals in 1983 had compared to 2000 (Figure 1b). Domestic factors such as constrained growth and retrenchment of bank lending also played a role in the reversals of 1983. In addition, due to the highly unsynchronised recovery in developed economies, the recovery in export earnings was weak. Thus, the developing countries were forced to cut back on imports to improve their external position.

Our graphical evidence shows that the upward adjustment in the current account does coincide with other domestic imbalances, such as budget balance. Although for most of our variables, there is an apparent coincidence between their behaviour and current account adjustments, for now, we cannot categorically claim evidence on the direction of causality. Strong evidence on causality would require empirical exercise. Debelle and Galati (2005) find that the current account adjustments are largely caused by global factors such as world economic growth and US real interest rate. Later we present probit results that suggest global factors play a more significant role, than domestic factors.

Key takeaways:

First, by looking at frequency of reversals, we find that reversals are not a rare occurrence, but with no significant increase over the years.

Second, by using data analysis, we find macroeconomic conditions around reversal and non-reversal episodes are characterised by:

- *Pre-reversal episodes:* Macroeconomic fundamentals are dwindling, potentially necessitating the correction in the CA deficit.
- *Post- reversal episodes:* the economy undergoes significant adjustment, and it takes about a year for the economy to rebound, with increasing economic growth and FDI inflows, and falling external debt.
- *Non-reversal episodes* are associated with lower current account deficit; a growing economy and low Fiscal deficit. Macroeconomic fundamentals appear generally stronger after this episode.

Table 4:Comparison of macroeconomic indicators before and after reversal and non-reversal episodes

Indicator	Before Reversal	After Reversal	Non-Reversal Comparison to Reversal
Current Account Deficit	~8% of GDP	Improves	Persistent but lower deficit
Savings	Lower	Increase sharply	Stable, and similar to reversals
Investment	Higher	Declines sharply	Stable, and lower than reversals
FDI Inflows	Decline	slow recovery	Steady increase
Foreign Reserves/Imports Ratio	Decline	Sharp increase	Stable
Short-term External Debt	High, declining	Stabilizes	Lower, stable
Total External Debt	High	Declines slowly	Lower
Real Effective Exchange Rate	Overvalued	Depreciates	Stable
Inflation	High, declining	Stabilizes	Lower
Budget Balance	No clear path	No clear path	Higher
Public Debt	Rising	Adjusts downward	Lower
Trade Openness	Higher	Adjusts downward	Lower
US Real Interest Rate	High, declining	Declines	Similar trend
World Growth	Lower	Recovers	Higher
GDP Growth	Declines	Recovers	Stable

Source: Author's work

3.6 Predicting the probability of current account reversals

We use multivariate probit analysis to estimate the probability of a current account reversal, using the variables identified for our analysis from stylised facts and the literature. More specifically, we predict the probability of reversal occurring at time t as a function of the average of macroeconomic variables from time $t-3$ to $t-1$.

These variables include the current account balance, real gross domestic product, real effective exchange rate, investment, foreign direct investment net inflows, budget balance, interest payments, and trade openness. We also add external variables: World GDP growth, the United States of America real interest rate. Since we identify a reversal as a reduction in the current account deficit from three years before the reversal year, we use the explanatory variables over three years before the reversal year (i.e., over the period $t-3$ to $t-1$) to predict the probability of a reversal in year t. Additionally, we also include an indicator measuring the intensity of reversals (defined as the number of reversals in a year divided by the sum of reversals and non- reversals in that year).

The probit equation is illustrated as follows:

$$Prob(reversal_i = 1|X_i) = \Phi(\beta X_i) = \int_{\to\infty}^{\beta X_i} \frac{1}{\sqrt{2\pi}} e^{-t^{2/2}} dt, \qquad 31$$

where: $reversal_i = \begin{cases} 1 & if\ reversal\ episode \\ 0 & if\ non-reversal\ episode \end{cases}$;

Φ is the cumulative distribution function of the standard normal distribution;

β is the vector of unknown coefficients;

X_i is the set of explanatory variables, averaged over three years preceding the reversal and non-reversal dates;

$i = 1,2,3 \ldots N$ denotes the episodes of reversals and non-reversals.

The reversal variable is a binary dependent variable, which takes the value of 1 if a current account reversal occurs in a certain year and zero if there is no reversal, as defined in Section 2. In other words, reversal is our treatment group, and non-reversal is the control group. The term βX_i is an information set of lagged macroeconomic regressors and exogenous variables. The function $\Phi(.)$ is defined in this chapter as the cumulative distribution of the standard normal distribution, which constrains the probability to be between zero and one. The interpretation of the estimated coefficients (β) is complicated by the non-linear nature of the probit model specification. The marginal effect of a variable $x_j \subset Xi$ can be calculated as a derivative: $\partial P(reversal_i = 1|X_i) / \partial x_j = \phi(\beta X_i)\, \beta_j$, where $\phi(.)$ is the density function of the standard normal distribution and $\beta_j \subset \beta$ is the estimated coefficient of x_j. Thus, the marginal effect depends on the value of the right-hand side variables. The sign of the impact of each independent variable (x_j) on the predicted probability of a reversal occurring at time t is the same as the sign of the estimated β_j parameter.

We have applied a probit model, one of the most popular methods used in the literature to predict current account reversals. We estimated our model using the maximum likelihood estimation technique. Some pioneering studies that have used this probit methodology include Milesi-Ferretti and Razin (2002), Adalet and Eichengreen, (2005), and Edwards (2002).

3.6.1 Probit results

Table 5 presents the results from the probit regressions estimating the likelihood of current account reversals. In addition to the baseline model, we also introduce a country dummy variable to capture possible country heterogeneity and time dummy as the globalisation has evolved significantly overtime, particularly trade liberalisation.

Notably, the findings indicate that domestic macroeconomic variables do not systematically predict current account reversals, across different country samples and model specifications. This aligns with findings from earlier studies by Milesi-Ferretti and Razin (2002) and Debele and Galati (2006).

For instance, while the lagged GDP growth and the real effective exchange rate exhibit the expected signs in the low- and middle-income country sample, their coefficients are statistically insignificant. In the high-income sample, the negative coefficient on GDP growth may suggest that strong domestic growth does not necessarily trigger reversals when deficits are structural—such as persistent savings-investment imbalances observed in countries like the United States. However, this interpretation should be approached with caution given the lack of statistical significance. Similarly, lagged domestic investment, savings and trade openness do not have a systematic or robust effect on the probability of current account reversals across any of the country groups.

In contrast, the lagged budget balance variable exhibits a statistically significant and negative coefficient in the high-income country sample. This suggests that higher budget balances (i.e., fiscal surpluses) reduce the probability of a current account reversal, consistent with the twin deficits hypothesis. The effect is more pronounced when country-specific dummy variables are included, indicating that controlling for structural heterogeneity strengthens the relationship. The lack of significance in the full sample may reflect heterogeneity in how fiscal policy interacts with external balances across income groups. Similarly, the higher FDI inflows are associated with a lower probability of a current account reversal in high-income countries – an effect detected after including country and year-dummies. These inflows can support the current account by boosting exports or reducing reliance on volatile portfolio flows.

The coefficient on the lagged interest payments (measured as a share of government revenue) is also negative and statistically significant for high-income countries. While this may appear counterintuitive, it likely reflects the institutional strength, stable financing structures, and credible fiscal frameworks in these economies. High-income countries often finance debt domestically or through stable capital inflows, which reduces the pressure for abrupt external

adjustments.

The lagged current account balance consistently shows a negative and statistically significant coefficient. This implies that larger current account deficits increase the likelihood of a reversal, a finding that is both intuitive and consistent with graphical evidence presented in Section 3.5. This result contrasts with Debele and Galati (2006), whose model specification excluded country dummies and only over covered advanced economies.

Table 5: Multivariate probit estimation

	Without dummy variables			With dummy variables		
	Full Sample	**Low and Middle-Income Countries**	**High-Income countries**	**Full Sample**	**Low and Middle-Income Countries**	**High-Income countries**
CURRENT ACCOUNT_LAG	-0.1043***	-0.1124***	-0.1176***	-0.1509***	-0.1673***	-0.5846***
	(0.013)	(0.016)	(0.032)	(0.018)	(0.023)	(0.149)
WORLD GROWTH_LAG	-0.1433*	-0.0891	-0.4428**	-0.3467**	-0.3627*	-1.1483**
	(0.075)	(0.089)	(0.198)	(0.154)	(0.203)	(0.497)
REAL INTEREST RATE USA_LAG	0.0502	0.0739*	0.0004	0.1062	0.2691*	0.7270**
	(0.032)	(0.042)	(0.074)	(0.106)	(0.146)	(0.347)
FDI NET INFLOWS_LAG	-0.0061	0.0049	-0.0265	-0.0135	0.0039	-0.1349**
	(0.014)	(0.021)	(0.027)	(0.018)	(0.028)	(0.065)
REAL EFFECTIVE EXCHANGE RATE_LAG	0.0026	0.0739	-0.0067	0.0016	0.0023	-0.0126
	(0.004)	(0.042)	(0.028)	(0.004)	(0.005)	(0.055)
GDP GROWTH_LAG	0.0013	-0.0036	0.0733	0.0150	0.0209	-0.0205
	(0.021)	(0.025)	(0.096)	(0.030)	(0.035)	(0.206)
BUDGET BALANCE_LAG	0.0053	-0.0003	-0.1037**	0.0155	-0.0152	-0.3468**
	(0.014)	(0.019)	(0.049)	(0.019)	(0.025)	(0.159)
INVESTMENTS_LAG	0.0154	0.0129	-0.0603	0.0200	0.0185	-0.0733
	(0.011)	(0.015)	(0.049)	(0.015)	(0.020)	(0.169)
TRADE OPENNESS_LAG	-0.0008	0.0004	-0.0045	-0.0005	-0.0016	-0.0056
	(0.001)	(0.003)	(0.003)	(0.002)	(0.005)	(0.015)
SAVINGS_LAG	-0.0063	-0.0042	0.0750**	-0.0036	-0.0040	0.2733**
	(0.009)	(0.013)	0.036)	(0.0123)	(0.016)	(0.117)
*INTEREST PAYMENT_LAG						-0.2514**
						(0.110)
C	-1.3897**	-1.7510**	0.5160	-1.8923**	-2.4220***	-3.4584
	(0.544)	(0.592)	(2.987)	(0.747)	(0.877)	(6.672)
YEAR DUMMIES	No	No	No	Yes	Yes	Yes
COUNTRY DUMMIES	No	No	No	Yes	Yes	Yes
R^2	0.11	0.12	0.18	0.29	0.33	0.58
N	679	465	166	679	465	166
Obs with dependent var = 0	548	370	139	548	370	139
Obs with dependent var = 1	131	95	27	131	95	27

Notes: 'Reversal' is a dependent variable that takes the value 1 for reversal episodes and 0 for non -reversal episodes, as define in the main text; N represents the total number of observations, capturing both reversal (=1) and non-reversal (=0) episodes included in the regression. The coefficients are reported. The (-)/(+) sign indicates (decrease)/(increase) in the probability of reversal. Standard errors in parentheses; *** $p < 0.001$, ** $p < 0.05$, * $p < 0.01$. The *INTEREST PAYMENTS VARIABLE (on external debt) is excluded from the full and, low- and middle-income country samples because including them—especially when adding country dummies—triggers an error due to large data gaps in that variable. However, this issue does not arise in the high-income sample because the data for interest payments is more complete there.

Global factors exhibit more systematic predictive power. The lagged world growth variable is negative and statistically significant, particularly for low- and middle-income countries. This suggests that strong global growth reduces the probability of reversals, likely by boosting export demand. Similarly, the lagged U.S real interest rate is positively and significantly associated with reversal, especially in low- and middle-income countries. This is consistent with the notion that higher U.S. interest rates lead investors to reallocate capital toward safer, higher-yield assets, increasing external vulnerability in emerging markets. The inclusion of country dummies strengthens these effects across both income groups. These results highlight the importance of global conditions in driving external adjustments, particularly for emerging and developing economies.

The full sample results underscore the limited predictive power of domestic macroeconomic indicators for current account reversals. Global factors and the initial current account position are more reliable predictors. The findings reinforce the need for disaggregated analysis by income group to uncover more nuanced relationships. We further explore whether the exchange rate regimes do matter for current account reversals. We used the data and categorisation from Ilzetzki, Reinhart and Rogoff (2021). The exchange rate regimes are grouped into four broad categories: *Fixed exchange rate regime* (combines the first 11 subcategories ranging from No Separate Legal Tender to Moving band that is narrower than or equal to +/-2%); *Managed regime; Freely floating regime; Freely falling regime* and *Dual market* regime.

We find that most of the reversal and non-reversal episodes occurred under fixed exchange rate regimes. For instance, of the 200 reversal episodes (, 169 occurred under the fixed exchange rate regime, and the least occurred under flexible (6) and dual market (6) regimes. Similarly, of the 867 non-reversal episodes, 664 took place under a fixed exchange rate regime. These numbers suggest that with or without a fixed exchange rate regime both reversal and non-reversal may still occur with the highest likelihood. Similar to finding by Pancaro (2013). Therefore, the exchange rate regime appears to not matter for current account reversal analysis, and thus excluded from the final results.

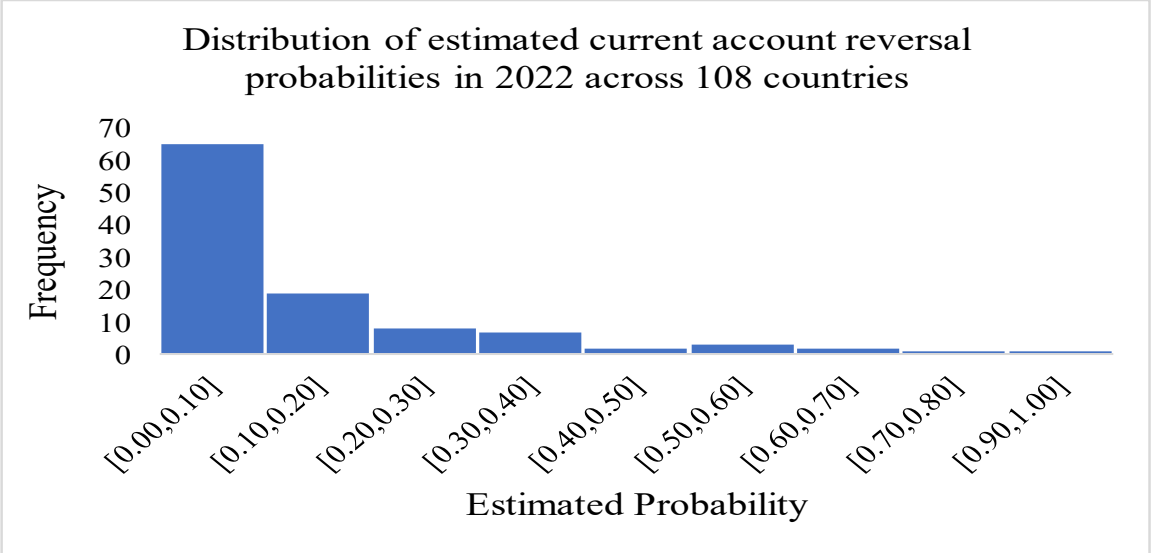
3.6.2 Distribution of Estimated Probabilities

We predict the probability of a country experiencing a current account reversal in the near future $(t + 1)$. To do this, we use the latest values of the variables from our multivariate regression in Table 5 above. We calculate these probabilities using the full-sample and show their distribution across country samples (see Figure 4).

Figure 4 depicts a histogram skewed to the right, indicating that few countries have a high probability of experiencing reversals soon. Specifically, fewer than ten countries fall in the probability range of [0.50, 1.00], including Moldova, Burundi, Mongolia, and Cambodia. These countries have large current account deficits, ranging from 8% to 23% of GDP on 3-year averages in 2022.

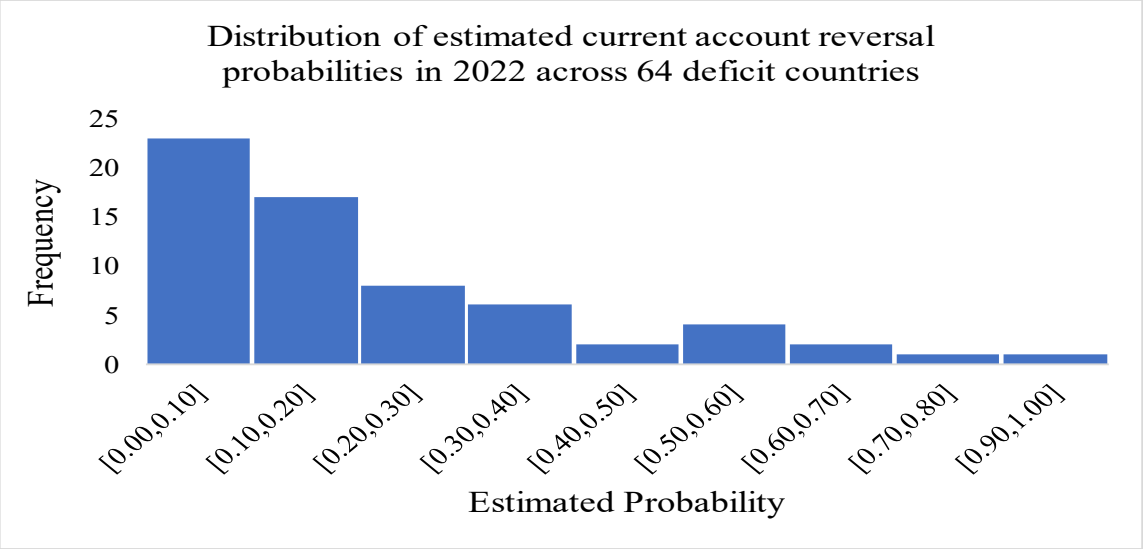
In contrast, the distribution of reversal probabilities across 64 deficit countries shows that those with the lowest probability of reversals have smaller current account deficits, ranging from 0.35% to 4.30% of GDP (Figure 5). Most high-income deficit countries, such as France, the United Kingdom, Portugal, Canada, Hungary, Türkiye, Peru, Colombia, Indonesia, and India, fall in the lowest probability range [0.00, 0.10] (Figure 5). Figure 6 shows the distribution of reversal probabilities for countries with current account deficits equal to or above 5% of GDP in 2022. For these countries, there is at least a 0.10 to 0.20 probability of a reversal. For countries with extreme deficits, like Cambodia with deficit of 23%, the probability of a reversal is almost inevitable, ranging from 0.90 to 1.00.

Figure 4: Distribution of current account reversal probabilities



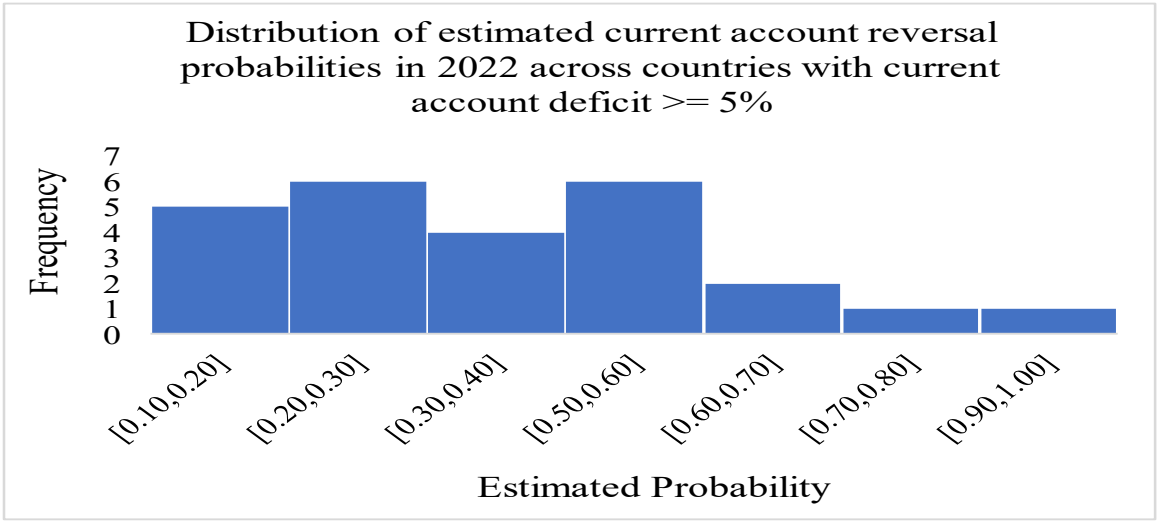
Source: Author's calculations. Note: These probabilities are calculated at 3 percent threshold for reversals.

Figure 5: Distribution of current account reversal probabilities – deficit countries[16]



Source: Author's calculations. Note: These probabilities are calculated at 3 percent threshold for reversals.

Figure 6: Distribution of current account reversal probabilities – current account deficits >=5%



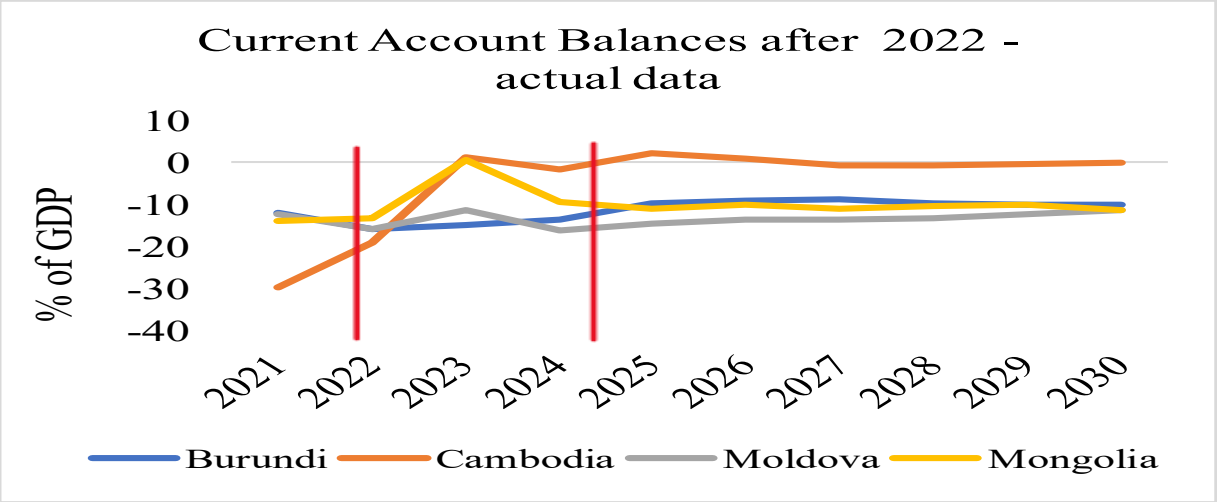
Source: Author's calculations. Note: These probabilities are calculated at 3 percent threshold for reversals.

For deficits smaller than 8%, the probability of a reversal is below 0.40. In summary, larger deficits are generally associated with a higher likelihood of a reversal. This relationship is

[16] Deficit countries – These are the 64 countries with a 3-year average negative current account balance in 2021. These 72 countries are Albania, Algeria, Armenia, Bangladesh, Bolivia, Bosnia and Herzegovina, Brazil, Burundi, , Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, Colombia, Comoros, Costa Rica, , Democratic Republic of the Congo, Dominican Republic, Egypt, Equatorial, Guinea, Estonia, Ethiopia, France, Gabon, Ghana, Greece, Honduras, Hungary, India, Indonesia, Ireland, Jamaica, Jordan, Kenya, Latvia, Madagascar, Mali, Mauritius, Moldova, Mongolia, Montenegro, Morocco, Namibia, Nepal, Niger, Pakistan, Peru, Portugal, Romania, Rwanda, Senegal, Serbia, Slovak Republic, Sri Lanka, , Tanzania, , The Gambia, Togo, Tunisia, Türkiye, Uganda, Ukraine, United Kingdom and Uzbekistan.

underscored by the upward revisions to actual current account balances after 2022 for selected countries that had substantial deficits in 2022, along with correspondingly high probabilities of reversal in the subsequent years, particularly Cambodia and Mongolia (see Figure 7).

Figure 7: Actual current account balances after 2022 for selected large deficit countries



Source: IMF – World Economic Outlook, April 2025 data

3.6.3 Probit analysis: were post-GFC reversals different from pre-GFC reversals?

The predictability of reversals remains broadly the same across different time periods. In both pre- and post-GFC periods, countries with high current account balance are less likely to experience reversal (Appendix F). The world growth and U.S real interest remain significant predictors of reversals, particularly for low- and middle-income countries. The domestic macroeconomic variables remain poor predictors of reversals across different time periods. The budget balance variable, however, is consistently a statistically significant predictor for high income countries. These results offer some insights into external sector dynamics and vulnerability to current account reversals, especially in the context of low- and middle-income countries. For instance, the fact that predictability remains broadly the same pre- and post-GFC suggests that the structural drivers of reversals are persistent. This implies that external vulnerabilities are not necessarily cyclical, but rather tied to deeper macroeconomic and global linkages. Second, impact of global conditions is much more pronounced for low- and middle-income countries, signalling higher external dependence and increased exposure to shocks, and

potentially less able to rely on domestic fundamentals to stabilise their external accounts.

Graphical evidence shows slight differences in the behaviour of some variables including current account, savings, FDI net inflows, US real interest rate, real effective exchange rate, and budget balance (Appendix F and G). For example, post- GFC, the current account shows considerable upward adjustment, but compared to pre -GFC period, the current account balance remains in negative territory in the 3 -years after a reversal episode. Similarly, in comparison, post-GFC the increase in savings is suddenly flat in one year after a reversal.

Considering both domestic and global level, GDP growth is lower than pre-GFC levels. Moreover, the recovery of GDP growth is much slower (U-shape) after a reversal episode in the post-GFC period (Appendix F). Despite heightened global uncertainty post-GFC, the foreign direct investment held up reasonably well. Emerging Asia stands out as one group that saw sustained increase in capital flows after the global financial crisis (Bank for International Settlements, 2021). In fact, higher financial integration may dampen the negative effects induced by global uncertainty on capital flows (Darvas *et al.*, 2015).

3.6.4 The economic growth implications of current account reversals

In this section, we explore the determinants of post-reversal economic growth, focusing on how reversals impact growth. Our analysis covers three periods: the full sample (1983 -2022), pre-GFC (1980-2007), and post-GFC (2008-2022). We use multivariate regressions, controlling for crisis episodes and country heterogeneity[17]. We regress the gap between post- and pre-reversal GDP growth rates on a range of selected macroeconomic variables. Our basic specification is the following:

$$y_{gap} = c + \beta_1 \vec{X}_{pre-reversal} + \beta_2 Rev_intensity_t + \beta_3 D_Crisis_t + \beta_4 D_country + \varepsilon_t, \qquad 32$$

where y_{gap} is the difference between post- and pre-reversal GDP growth rate. $\vec{X}_{pre_reversal}$ is the vector of the individual explanatory variables, averaged over 3 years

[17] The crisis dummy variable entails banking, currency or balance of payment, and financial crisis episodes.

pre-reversal (Table 6). $Rev_intensity_t$ captures the effect of reversal intensity on economic growth. D_Crisis_t denote currency crisis. Country dummy variable is added. ε_t is the error term.

Table 6: Post-reversal economic growth – multivariate estimation

	Full-Sample without dummies	**Full-Sample** with dummies	**Pre-GFC: 1980-2007**	**Post-GFC: 2008-2022**
	0.0300	0.0604	0.0470	-0.0139
CA_PRE_REVERSAL	(0.045)	(0.071)	(0.073)	(0.063)
	-0.0282	-0.0600	0.0214	-0.0708*
INVESTMENTS_PRE_REVERSAL	(0.030)	(0.043)	(0.053)	(0.039)
	0.0300*	0.0149	0.0303*	0.0304
REER_ZD_PRE_REVERSAL	(0.018)	(0.026)	(0.015)	(0.038)
	-0.0398	-0.0383	0.2571**	-0.0869
FDI_NET_INFLOWS_PRE_REVERSAL	(0.055)	(0.110)	(0.124)	(0.068)
	0.0058	0.0037	0.0049	0.0068
TRADE_OPENNESS_PRE_REVERSAL	(0.005)	(0.010)	(0.011)	(0.006)
	-0.0893*	-0.1095	-0.1618	-0.0762
BUDGET_BALANCE_PRE_REVERSAL	(0.049)	(0.068)	(0.110)	(0.059)
	-0.4386***	-0.4932***	-0.5327***	-0.3418**
GDP_GROWTH_PRE_REVERSAL	(0.092)	(0.139)	(0.124)	(0.151)
	-0.0039	-0.1127	-0.2980	-0.3945
WORLD_GROWTH_PRE_REVERSAL	(0.370)	(0.554)	(0.615)	(0.531)
	1.0584***	1.1839***	1.1627**	0.7632*
WORLD_GROWTH_GAP	(0.253)	(0.377)	(0.490)	(0.385)
	-0.0630	0.0206	0.2185	-0.3433
REAL_INTEREST_RATE_USA_PRE_REVERSAL	(0.116)	(0.178)	(0.234)	(0.529)
	-5.2011*	-8.7266*	-12.4738**	-4.1948
REVERSAL_INTENSITY_PRE_REVERSAL	(3.105)	(4.618)	(5.636)	(9.214)
	-1.5412***	-2.3358**	-0.9167	0.2896
CRISIS	(0.584)	(0.921)	(0.821)	(0.763)
	-0.1685	3.9410	-6.8423	0.7227
C	(2.583)	(3.981)	(4.280)	(4.458)
Country dummies	No	Yes	No	No
R^2	0.47	0.67	0.60	0.44
N	197	197	104	93

Source: Author's calculations. Notes: GDP growth GAP is the dependent variable. This dependent variable is defined as the difference between post and pre-reversal GDP growth. The coefficients are reported. The (-)/(+) sign indicates (decrease)/(increase) in the probability of reversal. Standard errors in parentheses; *** $p < 0.001$, ** $p < 0.05$, * $p < 0.01$. Attempting to include year dummies alongside country dummies and other regressors led to near-singular matrix errors due to perfect or near-perfect multicollinearity. Similarly, the subsample periods reduce time variation, thus time dummies are excluded and avoids multicollinearity.

Table 6 shows that most domestic variables do not have strong effect on post-reversal GDP growth, except for budget balance and the real effective exchange rate . For instance, the current account balance as an insignificant determinant of post-reversal economic growth, despite an expected positive coefficient. Table 6 further indicates that most domestic variables have

limited influence on post-reversal GDP growth, with the exception of the budget balance and the real effective exchange rate (REER). Notably, the current account balance—despite an expected positive coefficient—emerges as an insignificant determinant of post-reversal economic performance. Similarly, other domestic indicators such as investment, FDI net inflows, and trade openness lack predictive power in this context.

In contrast, the REER displays a positive and statistically significant coefficient, suggesting that a stronger currency prior to the reversal may facilitate economic recovery afterward. Conversely, the budget balance shows a negative and significant coefficient, which appears counterintuitive, as a healthier fiscal position would typically be expected to support growth. This anomaly may reflect underlying structural or cyclical dynamics that warrant further investigation.

Importantly, the level of pre-reversal GDP growth appears to play critical role in shaping post-reversal outcomes. The coefficient for pre-reversal growth is negative and significant, implying that economies experiencing rapid expansion before a reversal may be overheated. This interpretation aligns with the graphical evidence presented in Section 3.5.2, which shows that reversal episodes are often preceded by high but declining growth rates.

Moreover, global economic conditions significantly influence domestic growth both before and after reversal episodes. The positive and significant impact of world growth underscores the importance of external demand, particularly in sustaining export performance during periods of domestic and external adjustment. Finally, the intensity of the reversal is associated with a sharp decline in post-reversal growth. This finding highlights the economic costs of severe reversals, especially when compounded by crisis events, which appear to exacerbate the challenges of adjustment and recovery. Notably, the inclusion of country dummy variable in the full sample period did not necessarily improve the result.

Furthermore, we find fewer variables are statistically significant determinants of post-reversal GDP growth in the post-GFC period compared to the pre-GFC period. This result could indicate a structural shift in the global economy. The 2008 Global Financial Crisis (GFC) led to major structural changes in financial markets, trade dynamics, and global capital flows. These changes may have weakened the traditional transmission mechanisms through which domestic variables like FDI, and exchange rates influenced growth. Real effective exchange rate was a meaningful predictor of post-reversal growth before the GFC, suggesting that a stronger currency supported recovery. Post-GFC, its influence diminished, possibly due to structural changes in global trade or exchange rate dynamics. Additionally, post-GFC, economies have faced higher macroeconomic uncertainty, including frequent shocks (e.g. pandemics, geopolitical tensions).

This can reduce the predictive power of standard economic indicators, as growth outcomes become more sensitive to unpredictable external factors.

The consistent significance of the world growth gap across both periods suggests that external demand and global conditions have become more dominant in shaping domestic growth. Domestic policies and fundamentals may have become much less influential in a more interconnected and volatile global environment. For instance, while pre-reversal domestic GDP growth remains significant post-GFC, the effect is less pronounced compared to pre-GFC era. However, it is important to highlight that the post-GFC sample is shorter and includes fewer observations, which can affect statistical significance, thus any interpretation should be taken with caution.

3.6.5 Reversals, non-reversals, and the IMF current account norm[18]

It seems logical to expect that significant corrections in the current account balance (i.e., reversals) would align the balance more closely with its "norm." The norm represents a level of current account balance consistent with a country's macroeconomic fundamentals and policy settings. When a country corrects a significant imbalance, these measures should ideally bring the current account closer to its norm.

Our analysis approach is two-fold. First, we undertake an immediate comparison; to understand if the current account value during the reversal year is below, within or above the norm. Second, we compare the norm with post-reversal current account values. This comparison provides insight into whether the post-reversal current account balance tend to align with the norm.

From immediate comparison, we find that in most cases, the current account value during the reversal year remains below the IMF norm. Reversals often involve short-term adjustments, such as sudden changes in exchange rates or capital flows, which may not have a lasting impact on the fundamental determinants of the current account. Structural reforms, global economic conditions, policy implementation lags, and the moving target nature of the norm can all contribute to this misalignment (Appendix H).

Additionally, the adjustment dynamics, economic stress and vulnerability to external shocks are

[18] The IMF current account norm (IMF EBA-CA Norm) is defined as the level of current account balance that is "in-line" with individual country's macroeconomic fundamentals and economic policies and excluding cyclical factors such as output gap.

other conditions that can make it challenging for countries to achieve current account balances in-line with the IMF normative levels during reversal episodes.

Interestingly, in post-reversal years, our intuitive expectation holds true for most countries. Specifically, we find that the current account balances post-reversals are more closely aligned with the IMF EBA-CA Norm, particularly 2 to 3 years after the reversal. This suggests that the adjustments made during reversal episodes may lead to a convergence towards the IMF normative levels over time, reflecting a stabilisation and normalisation of the current account balances. Overall, the reversals may not be a complete measure to shift the current account balance to its norm, especially in the short-term. Instead, structural reforms, consistent policy implementation, and other fundamentals, as stipulated in the IMF External Balance Assessment Methodology update 2022, are essential for achieving a current account balance that aligns with macroeconomic fundamentals and desired policy.

On the other hand, we find that, in most cases, non-reversal episodes are associated with current account balances below the norm, suggesting that countries can maintain sustainable deficits through strong economic fundamentals, effective policies, favourable global conditions, and buffer mechanisms (Appendix H). These factors collectively help avoid current account reversals even when balances are below the normative levels suggested by the IMF. This result and subsequent inferences are consistent with our results from Section 3.5.2. We saw that non-reversal episodes are correlated with sustainable deficits, access to foreign finance, and favourable global economic conditions.

By comparing both immediate and subsequent years' values of reversal and non -reversal episodes to the IMF Current Account Norm, provides a comprehensive understanding of the alignment between current account balances and the norm during different phases of economic adjustments. This approach helps us identify whether countries effectively move towards or maintain the current account balance within normative levels over time, providing deeper insights into the dynamics of reversals and non-reversals.

3.6.6 Robustness checks

We check the sensitivity of our multivariate probit results in five ways. First, we change the initial current account balance from zero to -3%. Second, we change the minimum increase in the current account balance to qualify for a reversal. Our baseline multivariate probit models use a 3% threshold. We changed the threshold to 2%, 4%, and 5%. These are some of the thresholds that have been used by other studies, such as Edwards (2002) and Adalet and

Eichengreen (2005). Third, we add to our sample all the countries with extreme current account deficits. We had used an ad hoc threshold of -25% to define extreme deficits. Our baseline model treats such countries as outliers and thus were excluded. Fourth, we estimate a multivariate probit model with robust standard errors (also known as the Huber-White method). Finally, we compare our results from Probit model to Logit model results. Broadly, the results remain unchanged.

Key takeaways:

- We find that global factors such and global growth play a significant role in predicting current reversals.
- The predictability of reversals remains consistent pre- and post-global financial crisis. For instance, countries with high current account balance are less likely to experience reversal. The world growth and U.S real interest remains significant predictors of reversals, particularly for low- and middle-income countries.
- The fact that predictability of reversals remains broadly the same across time implies that external vulnerabilities are not necessarily cyclical but rather tied to deeper macroeconomic and global linkages.
- The impact of current account reversals on growth largely depends on prior domestic and global growth conditions, as well as the soundness of real effective exchange rate and fiscal discipline pre-reversal.
- The growth effects of reversals reflect structural shifts in the global economy and the rising influence of global conditions on domestic growth. In this context, domestic policies and fundamentals may have become much less influential in a more interconnected and volatile global environment. For instance, while pre-reversal domestic GDP growth remains significant post-GFC, the effect is less pronounced compared to pre-GFC era.
- Reversals that coincide with crisis periods tend to amplify negative effects, and frequent reversals are particularly harmful to growth.

3.2 Conclusion

This chapter employed four analytical approaches to deepen understanding of current account adjustments: sustainability indicators, reversal frequency by income and time, macroeconomic performance around reversal episodes, and probit models to estimate reversal probabilities. We also assessed the growth implications of reversals.

Sustainability indicators such as the current account balance, exchange rate, export ratio, fiscal deficit, reserves, and political factors effectively distinguish crisis-prone deficit countries from

more resilient ones. In contrast, variables like savings, investment, and external debt offer less clarity. Our findings underscore the importance of a multi-variable approach in assessing the sustainability of persistent imbalances.

Reversals are relatively common but have not increased over time, suggesting that globalisation has not led to more frequent large adjustments despite heightened exposure to external shocks. Pre-reversal periods are marked by deteriorating macroeconomic fundamentals, while post-reversal phases show economic recovery within a year—characterised by rising growth, FDI inflows, and declining external debt. Non-reversal episodes, however, maintain stable deficits and growth.

We use Multivariate Probit Analysis to estimate the probability of current account reversals, considering macroeconomic variables averaged 3 years before reversal. Similarly to most of the existing literature, the probability of reversals is predicted to be higher in countries with large current account deficits, and global conditions tend to play more impactful role.

Based on our results we can conclude that the growth impact of reversals depends on preceding domestic conditions and vulnerability to global demand. Our study sheds some light on growth effects of reversals, as existing studies such as Debelle and Guy (2005) fail to detect a systematic pattern through which output growth, and the exchange rate are affected during current account adjustments.

Importantly, reversals that coincide with crisis periods tend to amplify negative effects, and frequent reversals are potential detrimental to growth. While reversal predictability remains stable across periods (pre- Vs post-GFC), their growth effects reflect structural shifts in the global economy and the growing influence of external factors. From a policy standpoint, global conditions serve as key early warning signals.

The results presented so far have to be interpreted considering the fact that the empirical analysis aggregates reversal events that have quite different features; it includes such full- fledged balance-of-payments crises as, say, India 1991 and improvements in the current account spurred by favourable terms-of-trade developments or timely corrections in macroeconomic policy (e.g., Mexico 1982). Future research could further distinguish between positive and negative current account reversals and their impact on economic growth.

CHAPTER 4
CURRENT ACCOUNT SUSTAINABILITY: THEORETICAL CONSIDERATIONS AND METHODOLOGY

4.1 Introduction

The intertemporal approach has been the standard framework for analysing current account balances (Sachs, 1985; Obstfeld and Rogoff, 1996). It assumes that economic agents have perfect foresight, complete information, and face no abrupt changes in behaviour. Consequently, economic uncertainty is treated as a secondary consideration. Obstfeld and Rogoff (1996) provide a comprehensive review of intertemporal models. While these models lack realism in some dimensions, they serve two very useful purposes. First, they capture important aspects of current account balance to better understand external sector dynamics. Second, they provide a reference point for evaluating more complex stochastic models. Hence, a strand of economic literature has utilised intertemporal models to assess current account sustainability (see Chapter 2).

Economic agents operate in an environment characterised by change and uncertainty. Thus, we contend that the forward-looking behaviour of agents is inherently exposed to economic uncertainty. Consequently, treating uncertainty as a secondary consideration, as in the intertemporal framework, undermines the analysis. For instance, the global financial crisis demonstrated heightened risk aversion in financial markets and a decline in capital flows, partly due to increased uncertainty (Bank for International Settlements, 2021). Severe shocks can lead to significant and permanent shifts in agent behaviour, disrupting current account trajectories.

Thus, we challenge the assumptions of perfect foresight, complete information, and behavioural stability. Economic uncertainty weakens the intertemporal solvency theories' realism and their applicability to sustainability assessments.

We contribute to the literature by proposing an empirical approach that quantifies uncertainty surrounding future current account balances. This is achieved through probability density forecasts. Therefore, while we highlight the theoretical shortcomings of the intertemporal models, the nature of our contribution is an empirical forecasting exercise to contribute to the conceptualisation and modelling of current account sustainability.

The subsequent sections of this Chapter discuss the link between economic uncertainty and current account sustainability, the use of density forecasts as well as the methodology.

4.2 Conceptualisation of economic uncertainty and current account sustainability

Uncertainty, defined as the lack of clarity about the future, is an inherent feature of economic analysis. While statistical tools like confidence intervals attempt to account for uncertainty, it remains challenging to measure and differentiate various types of uncertainty—macroeconomic, financial, fiscal, or policy-related. Global uncertainty, driven by globalisation in trade and financial markets, has led to significant fluctuations in asset prices and financial flows (Rey, 2013). Increased globalisation has induced growing concerns about the spillover effects of economic and policy uncertainty from one economy to another.

Our focus, however, is to integrate the impact of economic uncertainty into the models used for assessing current account sustainability, rather than directly measuring the economic effects of uncertainty itself. This approach acknowledges the influence of uncertainty on the behaviour of economic agents and the overall sustainability of the current account.

For example, rising government foreign borrowing may raise concerns about repayment capacity, triggering expectations of abrupt adjustments such as defaults, currency devaluation, or fiscal reforms (Milesi-Ferretti and Razin, 1996). Similarly, revised expectations for real GDP growth can alter investor confidence and influence government policy and the behaviour of the domestic private sector. For instance, higher than expected output growth is likely to lead to higher investment in anticipation of higher returns to capital and higher consumption. In this context, any sudden changes that create an uncertain economic environment, such that expectations on real GDP growth are revised substantially downward, would influence the confidence of economic participants, threatening current account sustainability.
Cyclical factors, such as commodity price fluctuations, also affect current account balances. Disruptions in oil supply in 2022, for instance, led to dissaving by net oil importers and exporters, impacting global current account dynamics. These dynamics suggest that current account sustainability should be treated as a stochastic process influenced by multi-factor uncertainty. For each period ahead $t + h$, the state of the economy is unknown, warranting a probabilistic approach to assess sustainability.

Few studies have incorporated uncertainty into current account sustainability analysis. For instance, Milesi-Ferretti and Razin (1996), Edwards (2002), and others adapt portfolio allocation theories to intertemporal models, highlighting that even small shifts in foreign demand for

liabilities can require complex adjustments to maintain sustainability. Empirical studies, such as Deutsche Bank Research (2007), show that reduced capital inflows can undermine sustainability, emphasising the need to account for uncertainty. The challenge with the portfolio allocation theories is that you need to know how the portfolio manager will behave in the future to determine what is sustainable in the long term. In Chapter 2, other technical concerns were discussed concerning the limitations of the intertemporal models.

Overall, integrating economic uncertainty into sustainability models moves beyond the binary assessment of whether the current account is sustainable or not, offering a more realistic framework for understanding current account dynamics under changing economic conditions.

4.3 Incorporating uncertainty using density forecasts

4.3.1 Defining density forecasting

Density forecasting estimates the probability distribution of the future values of a variable, offering a complete probabilistic description and quantification of uncertainty (Timmermann, 2000; Tay and Wallis, 2000). For example, inflation over the next four quarters might be forecasted as normally distributed with a mean of 2% and a standard deviation of 0.3%. Unlike point forecasts, density forecasts provide insights into the uncertainty surrounding predictions, making them valuable for decision-makers (Clements, 2004; Galvão, Garratt and Mitchell, 2021).

4.3.2 Decision theory framework

Using decision theory (Wallis, 2004), density forecasts allow decision-makers to minimize expected loss $\boldsymbol{E}[\boldsymbol{L}(\boldsymbol{a}, \boldsymbol{b})]$ by leveraging the complete probability distribution of future variables. Unlike point forecasts, which rely on quadratic loss assumptions, density forecasts address diverse decision contexts, particularly when specific loss functions are unknown. This broader utility has driven growing interest in density forecasting among policymakers and researchers.

To illustrate the incorporation of uncertainty using the density forecast into the current account sustainability notion, we borrow from the decision theory framework from Wallis (2004). The framework uses a loss function to describe the consequences of deciding today if the future state variable has the given value:

$$\boldsymbol{L}(\boldsymbol{a}, \boldsymbol{b}),$$

where $\boldsymbol{a}$ represents policy decisions or economic actions taken today, and $\boldsymbol{b}$ represents future states of the current account balance. If the future is known, then the optimal decision would be the one that has the lowest value of $\boldsymbol{L}$. However, in the presence of uncertainty, the goal is to minimise the expected loss given by:

$$E[\boldsymbol{L}(\boldsymbol{a}, \boldsymbol{b})],$$

which requires understanding the complete probability distribution of future current account balances in our context.

Density forecasts allow us to capture the full range of possible future states of the current account balance, rather than relying on a single point estimate. This approach acknowledges the inherent uncertainty in economic conditions. With the probabilistic approach, we treat the current account sustainability as a stochastic process influenced by multiple factors, such as changes in global trade, capital flows, and domestic economic policies.

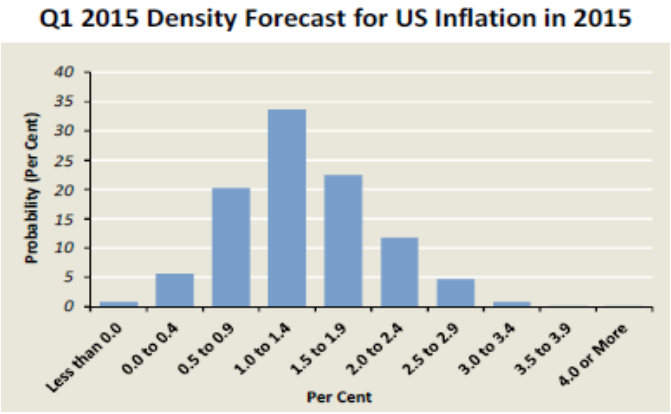
By integrating economic uncertainty into sustainability models through the use of density forecasts and a probabilistic approach, policymakers can better understand and manage the risks associated with current account imbalances.

4.3.3 Application of density forecast in practice

Pioneered by the joint work of the Business and Economics Statistics Section of the American Statistical Association (ASA) and the National Bureau of Economic Research (NBER), and later the Federal Reserve's Survey of Professional Forecasters (SPF), density forecasting gained traction in the 1990s. Institutions like the Bank of England (BOE), National Institute of Economic and Social Research (NIESR) and the South African Reserve Bank (SARB) adopted methods like fan charts to communicate forecast uncertainty for inflation and GDP growth. These tools have significantly improved discussions of future economic prospects (Wallis, 2004).

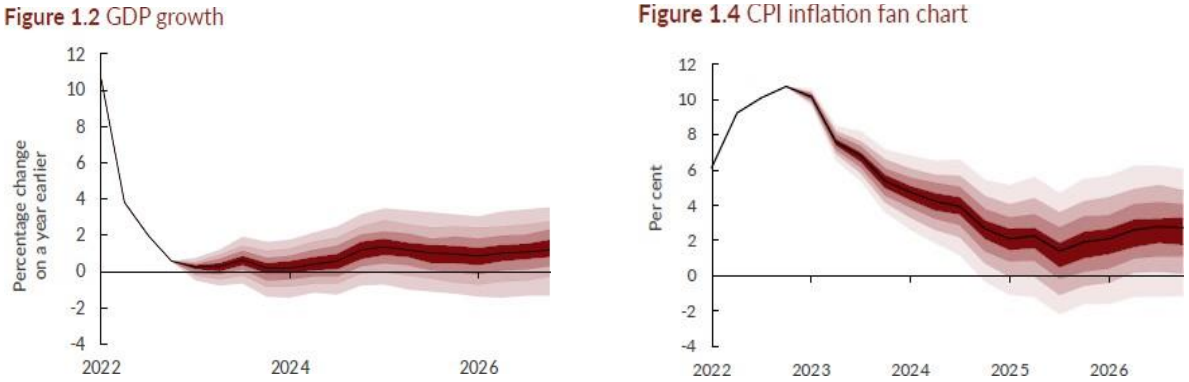
For instance, the SPF collects point forecasts for a range of macroeconomic variables but also asks for probability density forecasts for inflation and GDP growth. The forecasts were presented in the form of histograms (see Tay, 2015). Basically, the forecast experts are given a

set of intervals and asked to assign probabilities to each interval. These probabilities are then averaged over all respondents as shown in the chart below:



Source: Tay (2015)

In 1996, the Bank of England (BOE) and the National Institute of Economic and Social Research (NIESR) started publishing density forecasts of inflation (see Wallis 2004). From November 1997, the BOE started publishing fan charts for GDP growth as well (Wallis, 2004). Currently, the NEIR also uses fan charts for its GDP growth and inflation forecasts (see Spring UK Economic Outlook Report 2021):



Source: Extracted from National Institute UK Economic Outlook – Spring 2021

These advances in quantifying and communicating uncertainty surrounding forecasts of macroeconomic variables have contributed to a better-informed discussion of future economic prospects (Wallis, 2004). Moreover, policymakers are growingly showing interest in density forecast over point forecast (Rosi, 2014; Salisu *et al.* 2021).

There is a considerable amount of literature that has empirically evaluated the usefulness of

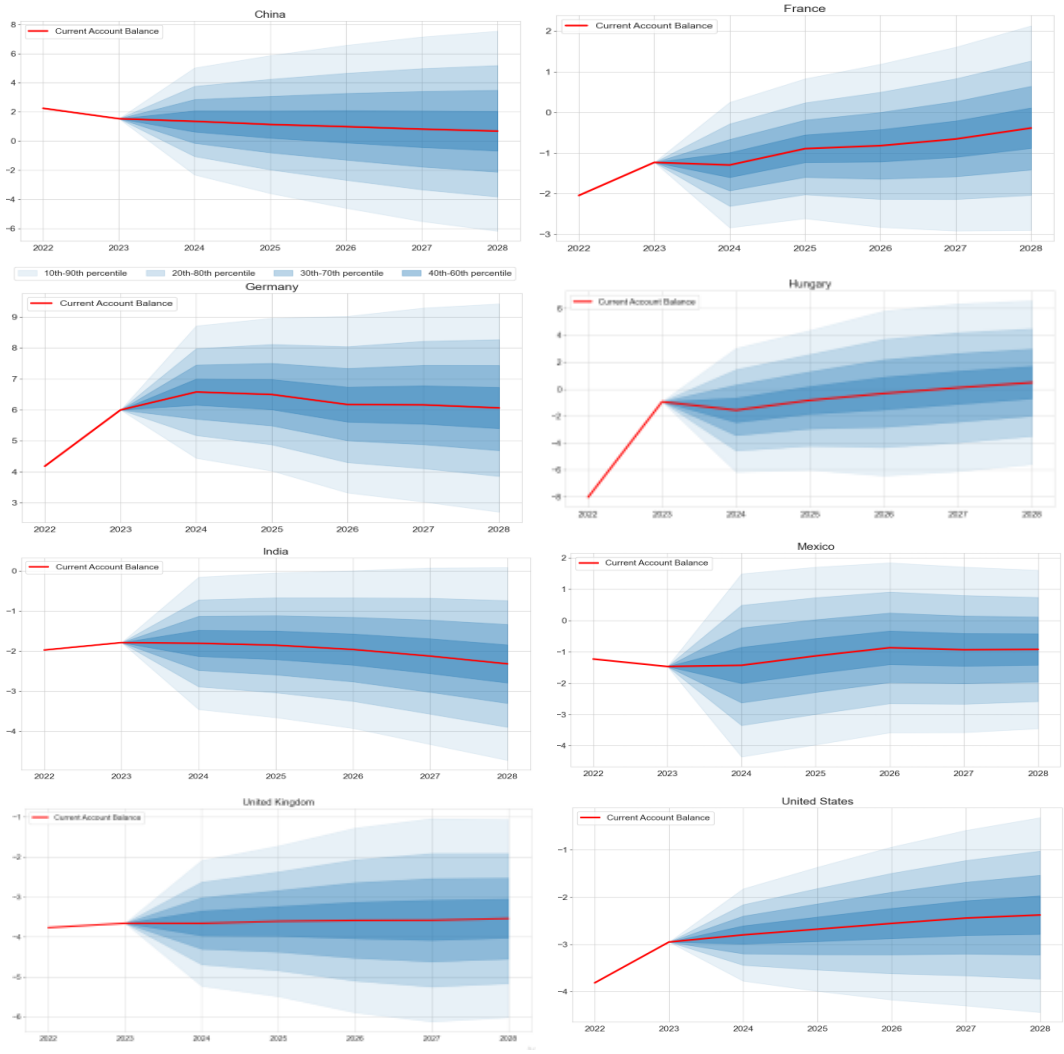
density forecast in macroeconomics. Recent studies underscore the usefulness of density forecasts. Salisu *et al.* (2021) show that macroeconomic uncertainty is forecastable, challenging the view that uncertainty is purely exogenous. Interestingly, Clements (2018) assesses whether macroeconomic density forecasts are informative. The author highlights the limitations of short-horizon density forecasts, suggesting forecaster biases. Comparisons between SPF-based and statistical model-based forecasts reveal superior accuracy for the latter (Galvao *et al.*, 2021; Fawcett *et al.*, 2015).

The direction of the recent research is impressive because Tay (2015) lamented that density forecasts from fully specified macroeconomic models are rare. The author further argued that the real benefit of density forecasting, however, will probably only be realised with the development of models that allow for time- varying conditions, perhaps driven by data on expectations and sentiments.

The preceding literature shows that the need to consider density forecast of a time series, rather than, say its conditional mean or variance has long been recognised in a decision-theory and macroeconomics. According to our knowledge, however, this is the first research work to apply density forecasting in examining current account balance sustainability. We argue that capturing the uncertainty surrounding future values is crucial for a more comprehensive analysis of current account sustainability. In this regard, our research acknowledges that economic uncertainty cannot be treated solely as an exogenous factor, even in the context of current account sustainability. Given the dynamic interplay between economic agents' decisions and global conditions, understanding this uncertainty is essential for assessing sustainability.

4.4 Quantifying uncertainty using a probability density forecast: an application to current account sustainability

Figure 8: Visualising the uncertainty around current account balance forecasts



Source: International Monetary Fund – World Economic Outlook October 2023 and author's own calculations.

We use current account forecasts from the IMF-World Economic Outlook to illustrate uncertainty around these forecasts for selected advanced and emerging economies over a 5-year period (*Figure 8*Figure 8). Fan charts illustrate forecast uncertainty by depicting percentile ranges. For Figure 8, these ranges were derived from the historical distribution of IMF forecast errors, assumed to follow a standard normal distribution with a zero mean. The narrower percentile ranges indicate higher forecast confidence, while broader ranges highlight greater uncertainty.

One-period ahead forecast errors for country i at time t are defined as $e_{i,t} = ca_{i,t} - ca^{f}_{i,t|t-1}$, where $ca_{i,t}$ is the actual current account value and $ca^{f}_{i,t|t-1}$ is its forecast using the information

set available at time $t-1$. Fan charts thus capture the range of possible future outcomes under uncertain economic conditions.

The concept of current account sustainability focuses on the future trajectory of the current account balance. Figure 8 shows in each time period ahead the current account values are surrounded by some degree of uncertainty. For instance, consider a scenario in $t-1$ (e.g., 2022), where economic agents base their decisions on available information and the assumption of a stable economic environment. Say, at time $t-1$, the current account deficit is expected to remain at a specific magnitude. However, by t (e.g., 2023), unexpected domestic or external economic developments could arise, leading to a larger deficit. Such an increase may alter market sentiment, as discussed in Chapters 2 and 3. A substantial current account deficit can prompt shifts in investor confidence and market behaviour, necessitating policy adjustments to address the imbalance and maintain external stability.

Current account sustainability depends on future balances that avoid abrupt adjustments caused by economic shocks. As past studies (e. Edwards, 2002) show, shocks can disrupt foreign capital flows, necessitate policy shifts, and increase borrowing costs. Our results from Chapter 3 suggest that large deficits (e.g., >8% of GDP) often reduce net foreign direct investment, with these flows taking about 12 months post-reversal.

To date, beyond my work that is based on this thesis (Ndzama, 2024), no empirical studies have attempted to conceptualise and examine the sustainability of the current account using a probabilistic approach. Thus, this research introduces an empirical framework to examine sustainability by estimating the probability distribution of future current account balances at each horizon $(h), t+1, t+2, t+3 \ldots . t+h)$. Longer horizons generally exhibit higher uncertainty unless the series is stationary. By quantifying forecast uncertainty, this approach provides a novel method to assess whether current account balances are on a sustainable path.

4.5 Methodology

4.5.1 Autoregressive model

We illustrate how the density forecasts work in general. We do this using an autoregressive model (AR).

Let the current account balance at time "i" be denoted by y_t. The AR model is as follows:

$$y_i = \alpha + \beta y_{i-1} + e_i\,, \qquad i = 1,2,\dots\dots,t, \tag{33}$$

where e_i is an error term, the parameters α and β are unknown parameters, we estimate these parameters based on current account balance (y_i) and lagged observations of the current account balance (y_{i-1}).

Let the estimated parameters be denoted by $\hat{\alpha}$ and $\hat{\beta}$ and ϵ as residuals. Let the estimates be obtained using a full sample of data available up to the date before the forecast starts, that is, including the observations 1 to t. Then, the parameter is re-estimated recursively over time. The forecasted value of y_{t+1} based on the available information at time t will be obtained as:

$$y_{t+1|t} = \widehat{\alpha_t} + \hat{\beta}_t y_{t-1} \tag{34}$$

The forecast is generated over the given time horizon, which is 1 in the given example, but of course, the time horizon can be longer than 1.

A density forecast requires assuming the distribution of the residuals (e_i). When residuals are normally distributed (at least asymptotic), analytical expressions can be used to derive the density forecast. However, when this is not the case, bootstrapping techniques can be used to characterise the forecast distribution (e.g., MacKinnon, 2006). As a starting point, a typical assumption is that the error term would be normally distributed. It is typical for a researcher to use the estimated variance of the in-sample fitted errors to proxy the unknown variance of the forecast error (Rossi, 2014). Based on the AR model we used, the in-sample fitted error can be easily obtained as:

$$y_t - \widehat{\alpha_t} - \hat{\beta}_t y_{t-1}, \quad for \quad i = 1,2,\dots\dots,t, \tag{35}$$

Finally, the density forecast can be obtained as follows:

(a)Conditional information available at time t, the forecast $y_{t+1|t}$ is normally distributed with mean $\widehat{\alpha_t} + \hat{\beta}_t y_t$.

(b)The variance of this forecast is proxied by the estimated variance of the in-sample fitted errors.

While the illustration uses a simple AR model with normal distribution, this thesis employs several stochastic models, such as vector autoregression (VAR), vector error correction model (VECM), Bayesian VAR model (BVAR) and Bayesian Time-Varying Coefficient VAR model (BTVC-VAR), to provide comprehensive analysis. We measure the uncertainty surrounding the future values of the current account balance by deriving the probability distribution of those forecasts using these forecasting model. Probability density forecasting requires assuming the distribution of the residuals. We first employ the typical assumption that the error term would be normally distributed.

4.5.2 Vector autoregressive model (VAR)

Vector autoregression models are widely used in the literature to study the dynamic interdependence between macroeconomic variables, and numerous studies have employed this model to analyse current account dynamics (Blanchard and Perotti, 2002; Perotti, 2007; Giordano *et al.*, 2007 and Kayinci, 2012). In a VAR model, all variables are endogenous (Kennedy, 2003). A reduced-form VAR can be given as follows:

$$Y_t = c_0 + \sum_{i=1}^{p} B_i Y_{t-i} + \varepsilon_t \qquad 36$$

Where Y_t is the vector of all the endogenous variables in the system, these variables include the current account balance, gross domestic product, trade openness, real effective exchange rate, fiscal balance, and other control variables. These variables have a solid theoretical relationship with the current account balance (see Chapter 3). The symbol c_t represents a vector of constant terms, B_i are matrices of coefficients to be estimated, and the symbol ε_t denotes the vector of error terms. In practice, we model-related variables. Therefore, the error terms are likely to be contemporaneously correlated. This is an important issue for the identification of impulse-response functions but not an issue for forecasting. Once we have estimated our VAR model, we can make a density forecast for the probability distribution of future current account balances.

4.5.3 Vector error correction model (VECM)

We also model both the short-run dynamics and long equilibrium simultaneously. This model first requires an estimation of cointegration between the current account and the selected

explanatory variables. In estimating the VECM, the residuals (ξ_t)from the estimated cointegration equations are included as error-correction terms. If the coefficients of the error-correction terms are statistically significant, then the short-run adjustment process corrects any deviations from long-run equilibrium (Ansari, 2020). In contrast to the intertemporal budget constraint, instead of looking at the cointegration between exports and imports, we will test the cointegration of the current account balance with a set of macroeconomic variables. We do this using the VECM, commonly described as the restricted version of the VAR model. Then finally, make a density forecast.

Generally, the long-run cointegration relationship is given by:

$$\xi_t = y_t - \beta x_t \qquad 37$$

Where y_t is the vector process and stationary with matric $(r \times 1)$, x_{it} is a vector of other variables included in the model, and β is the vector of cointegrating coefficients. The vector error correction model is defined as:

$$\Delta y_t = \xi_1 \Delta y_{t-1} + \xi_2 \Delta y_{t-2} + \cdots + \xi_{p-1} \Delta y_{t-p+1} + \alpha ECT_{t-1} + \varepsilon_t\,, \qquad 38$$

where αECT_{t-1} is the error correction term.

4.5.4 Bayesian VAR model (BVAR)

The Bayesian VARs are commonly used in macroeconomic forecasting and scenario analysis at central banks due to their relatively better performance and easy implementation. Our BVAR model is specified as follows:

$$Y_{t+h}^h = c + B(L)Y_t + u_{t+h}, \qquad u_{t+h} \sim N(0, Z_t)\,; t = 1,2 \ldots \ldots T \qquad 39$$

where Y_{t+h}^h is the vector of variables in the VAR system. That is,

$$Y_{t+h}^h = [Y_{1,t+h}^h, X_{1,t+h}^h\,, \ldots, X_{1,t+h}^h, \ldots X_{k,t+h}^h, \ldots, X_{K,t+h}^h]'\,,$$

$Y_{1,t+h}^h$ are the h-period ahead values for the current account balance, $X_{1,t+h}^h, \ldots X_{k,t+h}^h, \ldots, X_{K,t+h}^h$ are the explanatory variables from variable 1 to K, where $X_{k,t+h}^h$ denotes the h-period ahead values for the k-th explanatory variable for $k = 1, \ldots, K$,

$$Y_t = \left[Y_{1,t}, X_{1,t}, \ldots X_{k,t}, \ldots X_{K,t}\right]',$$

$Y_{1,t}$ is current account balance values at time t, and the h-period ahead values for the error-term are denoted by u_{t+h}. The errors are Independently, Identically, and normally distributed (*i.i.d*). $B(L) = \sum_{j=0}^{p} B_j L^j$, where L is the lag operator and p is the number of lags selected using the Information Criteria. Similar to Rossi and Sekhposyan (2014) we assume that σ^2 is proxied by the sample variance of the respective series; $Z_t = diag(\hat{\sigma}_1^2, \ldots, \hat{\sigma}_{K+2}^2)$ over the respective estimation window. Thus, u_{t+h} is a $(K+2) \times 1$ error term, *i.i.d*. Finally, c and B are the vector intercept and coefficients, respectively.

The key feature of a BVAR is its ability to overcome the problem of overparameterization often found in the standard VAR model (Litterman, 1981, Doan *et al.*, 1984, Todd, 1984, Litterman, 1986, Spence, 1993, Gupta, 2006 and Rossi and Sekhposyan, 2014). The BVAR allows us to artificially increase the number of observations and degrees of freedom by one for each restriction imposed on the parameter estimates (Theils, 1971). Basically, Theils' (1971) estimation technique supplements the data with prior information on the distribution of the coefficients.

We impose a conditional prior on coefficient β:

$$\beta | Z_t \sim N(\bar{B}), Z_t \otimes \bar{\Omega}\, \lambda^2).$$

This condition imposes a restriction on regression coefficients from longer lags, by assuming that they are more likely to be zero (or nearer) than those from shorter lags. Centering ($\bar{\beta} = 0$) reflects the belief that all variables are stationary in nature, and thus often data gets transformed to first differences. The normal prior distributions are specified with mean equals zero (i.e $\mu = 0$) and small standard deviation (σ) for all regression coefficients with σ decreasing as lags increase. The restriction is popularly known as Minnesota prior after it was first introduced by scholars from University of Minnesota. This restriction, however, is not imposed on coefficient of first own-lag, that, βy_{t-1}, which already have a mean equal one (i.e. $\mu = 1$). Further, $\bar{\Omega}$ is set such that the coefficients of lagged variables are independent of each other. The covariance matrix for each lagged coefficient is parameterised as:

$$V\left(B_p\right)_{ij}) = \begin{cases} \dfrac{\lambda^2}{p^2}\,, & j = i \\ \dfrac{\lambda^2}{p^2}\dfrac{\hat{\sigma}_i^{\,2}}{\hat{\sigma}_j^{\,2}} \end{cases}$$

The variance (σ^2) is re-estimated over each rolling window, and λ^2 is the prior variance of the regression intercept. The prior variance is usually set at $\lambda^2 = 0.2$ for quarterly data (Sims and Zha, 1998 and Gupta). Baribura *et al.* (2021) argues that the overall degree of shrinkage is governed by the hyperparameter λ at the standard value of 0.2 and posit that prior for the intercept is non-informative.

According to Rossi and Sekhposyan (2014), if we know the variance matrix $[V(B_p)_{ij})]$ of the estimated error-term, then the conditional predictive density for an individual variable such as the current account balance can be written as:

$$\Phi_{t+h} = \Phi_{t+h}\left(Y_{t+h}^h \middle| Y_t' \hat{B}_i \, , Y_t' \hat{V}_i Y_t + \hat{\sigma}_i\right), \qquad i = 1, \dots, K+2 \tag{40}$$

where $\Phi_{t+h}(.)$ is the Cumulative Distribution Function of the normal distribution,

$$Y = \left[1_k Y_{p+1} \dots Y_T\right], Y_i^h = [Y_{i,p+1}^h \dots \; Y_{i,T}^h]$$

and

$$\hat{B}_i = (YY' + (\bar{\Omega}\,\lambda^2)^{-1})^{-1}(YY_i^{h\prime} + (\bar{\Omega}\,\lambda^2)^{-1}\bar{B}_i)$$

$$\hat{V}_i = \sigma_i \otimes (\, YY' + ((\bar{\Omega}\,\lambda^2)^{-1})^{-1}$$

The estimated variance relies on White Noise assumption to obtain a simple analytical solution for the predictive density.

4.5.5 Bayesian time-varying coefficient VAR model (BTVC-VAR)

The dynamics of the model's time-varying parameters can be specified as follows:

$$Y_t = c_t + \sum_{i=1}^{p} B_{i,t} Y_{t-i} + \varepsilon_t \, , \qquad \varepsilon_t \sim N(0, \Sigma_t) \tag{41}$$

$$c_t = c_{t-1} + \epsilon_t \, , \qquad \epsilon_t \sim N(0, U_t^c) \tag{42}$$

$$B_{i,t} = B_{i,t-1} + \vartheta_t \, , \qquad \vartheta_t \sim N(0, U_t^B) \tag{43}$$

All the time-varying regression coefficients ($B_{i,t}$) evolve as random walks (see Primiceri, 2005; Del Negro and Primiceri, 2015). According to Primiceri (2005) the random walk assumption presents the advantages of focusing on permanent shifts and reducing the number of parameters in the estimation procedure. All the innovations are assumed to be jointly normally distributed with mean equal zero, and the covariance matrix equal to V:

$$V = Var\left(\begin{bmatrix}\varepsilon_t \\ \epsilon_t \\ \vartheta_t\end{bmatrix}\right) = \begin{bmatrix}I_n & 0 & 0 \\ 0 & Q & 0 \\ 0 & 0 & S\end{bmatrix},$$

where I_n is a n dimensional identity matrix, Q and S are positive definite matrices. The structure of the covariance matrix is flexible, in a sense that all the zero blocks could be substituted for non-zero blocks, with only small modifications of the estimation procedure (see description in Primiceri, 2005). Primiceri (2005) provides two reasons to justify the structure of V given above. The first one is related to the overparameterisation of the model. Adding all the off-diagonal elements of V would probably require Bayesian approach or any other specification that would provide a sensible prior. The second reason is critical, and it relates to allowing for a completely generic correlation structure among different sources of uncertainty would preclude any structural interpretation of the innovations (see Primiceri, 2005). We further assume that the coefficients of the contemporaneous variables evolve independently of each equation. This assumption simplifies inferences and increases the efficiency of the Bayesian estimations.

The priors entail the following assumptions. First, the initial states for the coefficients are assumed to be independent of each other. Second, the $B_{i,t}$ are assumed to be normally distributed. These assumptions together with the dynamics of the model's time-varying parameters stated above, imply normal priors on the entire sequence of coefficience. In the context of VAR models similar priors are used (see Sims and Zha, 1998). Similar to Pimiceri (2005), the Ordinary Least Square (OLS) estimates can be used for the priors, mean and variance of B_0. For example:

$$B_0 \sim N(\hat{B}_{OLS}, 4.V(\hat{B}_{OLS})),$$

In this example, the mean and variance of B_0 are chosen to be the OLS point estimates and four times its variance in a time invariant VAR, estimated on the small initial subsample. Following the literature, the scale matrices, $\bar{Q}$ and $\bar{S}$, are chosen to be constant fractions of the variances corresponding OLS estimates on the initial subsample (Primiceri, 2005).

Following Fruhwirch-Schnatter (1994) and Carter and Kohn (1994), we can factor the density function $p(B^T|y^T, \Sigma^T, V)$ as follows:

$$p(B^T|y^T, \Sigma^T, V) = p(B_T|y^T, \Sigma^T, V)\prod_{t=1}^{T-1} p(B_t|B_{t+1}, y^t, \Sigma^T, V),$$

Where,

$$B_t|B_{t+1}, y^t, \Sigma^T, V \sim N(B_{t|t+1}, VV_{t|t+1}),$$

$$B_{t|t+1} = E(B_t|B_{t+1}, y^t, \Sigma^T, V),$$

$$VV_{t|t+1} = E(B_t|B_{t+1}, y^t, \Sigma^T, V).$$

$p(.)$ is used to denote a density function, and normally distributed. $B_{t|t+1}$ and $VV_{t|t+1}$ can be computed using the Kalman Filter algorithm (Primiceri, 2005).

4.5.6 Bootstrapping method

We do not know the true probability distribution of the future values/long term values of current account balance. So far, we have assumed that the residuals (e_i) are normally distributed. However, we do not know the distribution characteristics of the random variable. To allow such cases, bootstrapping techniques can be used to characterise the forecast distribution (MacKinnon, 2006). According to MacKinnon (2006), the bootstrapping method works well if the residuals are independent and identically distributed (*i.i.d*). The residual bootstrap works well because Least squares estimates, and test statistics are generally not very sensitive to the distribution of the error terms.

4.5.7 Current account forecasts and sustainability thresholds

We determine whether our current account forecasts suggest a sustainable path by calculating the probability that the future value of the current account balance will be lower than a specified threshold. When this probability is low, the current account deficit is unlikely to spiral, indicating sustainability. Conversely, a high probability throughout the forecast horizons, or a considerably increasing probability as the forecast horizon increases, indicates unsustainability.

We conducted an extensive exercise on current account reversals for 192 countries representing various income groups. Our findings suggest that current account reversal episodes are often preceded by significant current account deficits, averaging around -8% of GDP. In addition to this -8% threshold, we also include the -5% threshold which has been popular in the literature.

It is important to highlight that the use of an absolute value of the threshold, for example, -8% is simply a practical tool for illustrating our proposed probability approach. The key takeaway of our thesis is not the absolute value of the threshold itself, but the insights gained from understanding how probabilities change over the forecast horizon. Thus, the focus in this paper should remain on the proposed probability approach rather than the specific threshold used. We

would need country-specific thresholds if our focus is on the absolute value of the probability. We would also need a good justification for the selection of these thresholds, but this is not the case here, as this thesis focuses on how these probabilities evolve over different forecast horizons.

We calculate the probability that the current account forecast will be lower than the specified threshold:

$$\boldsymbol{P(\widehat{ca}_{t+i} < threshold) = \int_{-\infty}^{threshold} f_{t+i}(\widehat{ca})d\widehat{ca}} \qquad 44$$

Where $c\hat{a}_{t+i}$ denotes the current account forecast for year $t+i$, i=1, 2,.., 5 (measured in years) and $f_{t+i}(c\hat{a})$ denotes the probability density function of the current account balance forecast i periods ahead.

Instead of approximating the probability distribution of the forecasts with an analytical formula, which might be sensitive to whether the variables have unit roots or not[19], we derive forecast uncertainty from past forecast errors based on a recursive out-of-sample forecasting exercise. That is, we retain the first n years of the sample period for an initial estimation of the model, create forecasts up to 5 years ahead, and compare these forecasts to actual outcomes to calculate the forecast errors for $1, 2, \dots, 5$ years ahead. For example, for the analysis of the sustainability of the latest 2023 current account deficits, we first estimate the VAR model on 1980-2004 data and calculate forecasts for 2005 -2009.

Next, we increase the estimation period by one year (1980 -2005) and calculate forecasts and forecast errors for the subsequent five years ahead (2006-2010). And so on, we continue up to the last observation of the sample. We thus estimate a series of forecast errors for the variables included in the VAR model for the five forecast horizons, $1, 2, \dots, 5$ years, which we use to estimate the covariance matrices for these alternative forecast horizons. We then simulate one million random draws from the corresponding multivariate normal distribution, separately for each forecast horizon, and add these random draws to our point forecasts, to characterise the empirical density function of our forecasts[20]. We use these distributions to calculate the

[19] Note that vector autoregressive models can be estimated consistently, and used for forecasting, irrespective of whether the variables have unit roots or not; see Hamilton (1994).
[20] An alternative approach would be to bootstrap historical forecast errors.

probability that the current account balance will be lower than a specified threshold. To visualise these distributions, we plot the kernel density estimate for each forecast horizon. This process helps us to understand the distribution of possible future current account values and capture the level of uncertainty associated with our forecasts.

4.6 Conclusion

In this chapter, we have discussed the conceptualisation of economic uncertainty and its association with current account sustainability. Furthermore, we have detailed how uncertainty can be quantified and incorporated into sustainability assessments using density forecasts. Specifically, we define sustainability as a low probability of the current account balance falling below a specified threshold, while rising probabilities signal unsustainability. We believe this approach allows for a more comprehensive and realistic evaluation of current account dynamics. By integrating economic uncertainty into current account sustainability models, we move beyond simplistic binary assessments. Density forecasts provide a probabilistic framework that captures the full range of possible future outcomes, offering a better understanding of the risks and potential adjustments required to maintain sustainability. Overall, this chapter presents a robust framework for incorporating economic uncertainty into current account sustainability analysis, enhancing the accuracy and relevance of sustainability assessments in an uncertain economic environment. With that said, we are by no means claiming to make a substantial theoretical contribution, which is beyond the intended scope of this thesis.

CHAPTER 5
EMPIRICAL ANALYSIS AND DISCUSSION OF THE RESULTS

5.1 Introduction

After establishing the stylised facts in chapter three and describing the framework in chapter four, our probability approach is now tested on data from selected economies. In this chapter our empirical work studies three issues:

First, validates the proposed probability framework. We apply our method to selected historical episodes of current account deficits, some of which were followed by upward shifts in the current account, while others not. Specifically, we study whether our method would have predicted the subsequent path of the current account correctly in the past.

Second**,** provides the assessment of the latest current account data. By using the latest available 2023 data for selected countries, we evaluate whether the current account balances are sustainable.

Third**,** the sectoral (private versus public) drivers of the current account balance. The primary rationale for this analysis is that government-driven and private sector- driven deficits might adjust differently. Analysing sectoral contributions to the current account deficit would help draw inferences as to whether the current account deficit driven by the government sector is more likely to be sustainable compared to a case where the most significant contributor is the private sector.

Furthermore, this chapter addresses two main research questions; (i) What is the probability that future current account deficits will be sustainable? and (ii) Is a government-driven current account deficit less sustainable than one driven by the private sector?

The subsequent sections discuss our data, present our empirical analysis and discussion of results. The last section offers concluding remarks.

5.2 Data

We use annual data collected from the International Monetary Fund, World Bank, and Bruegel Institute. Our list of variables includes the current account balance (% of GDP), GDP growth rate, trade openness (% of GDP), CPI-based real effective exchange rate index, Budget Balance

(% of GDP), and old age dependency ratio. These variables were often used in the literature to understand current account dynamics.

Our data period spans from 1960 to 2023. We use a set of 10 countries for the historical validation of our method and the assessment of the latest data, while for the sector analysis, we are bound to use a different set of countries due to data availability.

For the historical validation of our method and the assessment of the latest data, we consider countries that in the past had persistent current account deficits, some of which adjusted, while others did not:

(i) Episodes in which sustained current account deficits have not triggered a sharp current account or policy reversal. This includes countries such as Australia (1981- 2018), Malaysia (1979-1986), South Africa (2003-2019), and the United States (1982 -2022, except 1991).

(ii) Episodes in which external or domestic factors have caused a sharp policy reversal to shield the current account balance but have not led to an external economic crisis. This includes experiences of countries such as Ireland (1979 -1990), and Korea (1978-1988).

(iii) Episodes in which persistent current account deficits have been followed by an external crisis, resulting in debt rescheduling, renegotiations, or a massive bailout. This includes countries such as Chile (1977–1982), Mexico (1991-1994), Hungary (2008-2010), and Greece (2010-2018).

Although the list may not be exhaustive, the selected economies constitute a diverse set of countries to study the sustainability of their historical and 2023 current account deficits.

To analyse the impacts of sectoral drivers of current account deficits, we had to use a different set of countries due to data availability at sectoral level. Due to the availability of net financial balance data at the sectoral level, we use the data from ten European Union countries that have had protracted current account deficits in the past. The annual data for these countries is

sourced from the Eurostat for the 1980-2023 period.

5.1.1 Descriptive statistics

In this section, we present the key insights from the correlations, which provide valuable information about the factors influencing current account sustainability for different countries.

Table 7 show that GDP growth rate (GDP) and real effective exchange rate (REER) tend to have negative correlations with the current account balance (CA), indicating that higher growth rates and stronger currencies might lead to current account deficits. Emerging and developing economies often run current account deficits due to higher investment needs and increased imports driven by strong domestic demand, as evidenced by relatively strong negative correlations of -0.45, -0.47, and -0.33 for Malaysia, Mexico, and Korea, respectively. The negative correlation values are even stronger in the case of the exchange rate, at over -0.50. Similarly, the United States shows a considerable negative correlation with the exchange rate (-0.30), reflecting that a stronger dollar reduces competitiveness and promotes stronger import demand, thus deteriorating the current account balance. More importantly, the growth rate plays a significant role in determining current account sustainability, as it influences a country's ability to finance deficits or maintain surpluses without creating imbalances that lead to macro-financial instability. In the case of the exchange rate, maintaining a competitive exchange rate is crucial to support export growth and manage import levels.

Trade openness (TO), Budget Balance (BB), and old age dependency ratio (OAD) often show positive correlations with the current account balance, suggesting that higher trade openness, better fiscal balance, and higher dependency ratios might support current account surpluses (Table 7). For trade openness, this is evident in countries like Australia, Chile, and Hungary with positive correlation values of 0.35, 0.51, and 0.46, respectively. Conversely, for the United States, trade openness shows a strong negative correlation with the current account balance (-0.64), likely due to high import demand outpacing export growth. Similarly, Greece (-0.35) and South Africa (-0.25) show negative correlations, largely due to a lack of export diversification, particularly for South Africa. These statistics highlight the varying impacts of trade openness on current account balances across different countries, emphasising the importance of tailored trade policies to ensure current account sustainability.

Moreover, trade openness can exacerbate deficits in the short term by increasing demand for imports. Over time, however, openness supports sustainability if it leads to export diversification and greater competitiveness.

Table 7: Correlation of the current account balance with selected variables

Variables	Australia	Chile	Greece	Hungary	Ireland	Korea	Malaysia	Mexico	South Africa	United States
	Current Account									
CA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GDP	-0.25	0.13	0.10	-0.30	0.39	-0.33	-0.45	-0.47	-0.12	-0.06
	[0.1052]	[0.3763]	[0.4872]	[0.1185]	[0.0087]	[0.0206]	[0.0071]	[0.0012]	[0.3305]	[0.6719]
TO	0.35	0.51	-0.35	0.46	0.23	0.42	0.37	0.11	-0.25	-0.64
	[0.0202]	[0.0002]	[0.0159]	[0.0113]	[0.1417]	[0.0028]	[0.0291]	[0.4744]	[0.0486]	[0.0000]
REER	0.27	-0.52	-0.51	0.38	-0.13	-0.53	-0.63	-0.51	0.05	-0.30
	[0.0790]	[0.0001]	[0.0002]	[0.0430]	[0.3837]	[0.0001]	[0.0001]	[0.0003]	[0.7213]	[0.0250]
BB	-0.51	0.27	0.23	0.60	0.32	0.03	-0.70	-0.53	-0.35	0.18
	[0.0004]	[0.0561]	[0.1194]	[0.0006]	[0.0356]	[0.8216]	[0.0000]	[0.0002]	[0.0046]	[0.1857]
OAD	0.64	0.20	-0.36	0.49	0.29	0.53	0.05	0.12	-0.13	-0.38
	[0.0000]	[0.1658]	[0.0134]	[0.0074]	[0.0572]	[0.0001]	[0.7974]	[0.4392]	[0.3048]	[0.0045]

Source: Author's calculations. Notes: p-values for statistical significance are presented in the brackets.

Fiscal health (surpluses) can support a sustainable current account, as a fiscal surplus can reduce domestic demand pressures and lower import demand. This is evident in Hungary and Ireland with strong positive correlations. However, the interplay between Budget Balance and current account sustainability can be complex, as countries like Malaysia (-70) and Mexico (- 0.53) depict strong negative correlations. The old age dependency ratio is a structural fundamental that has been used to understand the effect of demographic dynamics on the current account balances (see International Monetary Fund- External Balance Assessment Methodology 2018 Update). Higher old age dependency ratios can support current account surpluses by increasing savings and reducing consumption, as seen in Australia (0.64), Korea (0.53), and Hungary (0.49). These statistical insights help us to better understand how these economic variables interact with the current account balance and potentially influence sustainability.

5.3 Empirical results

5.3.1 The probability of current account sustainability

5.3.1.1 The validation of our probability approach method based on historical current account episodes

We apply two complementary methods to evaluate the performance of our approach using historical data. First, we identify seven episodes of current account reversals and, for each case, use only data up to one year before the reversal to assess the model's out-of-sample predictive accuracy. Second, we conduct a recursive out-of-sample exercise to track the evolution of estimated probabilities of falling below the threshold one and five years ahead, comparing these probabilities with the actual subsequent path of the current account balance.

5.3.1.1.1 Validation based on specific historical episodes

We analyse the historical episodes of current account imbalances for selected countries to test whether our methodology would have predicted the sustainability or unsustainability of current account deficits in subsequent years. For example, the United States had a persistent current account deficit for decades, which fluctuated little without any major upward movements, suggesting that the deficit was sustainable. On the contrary, the Greek current account underwent a major upward adjustment after 2010, suggesting that the earlier deficit was not sustainable.

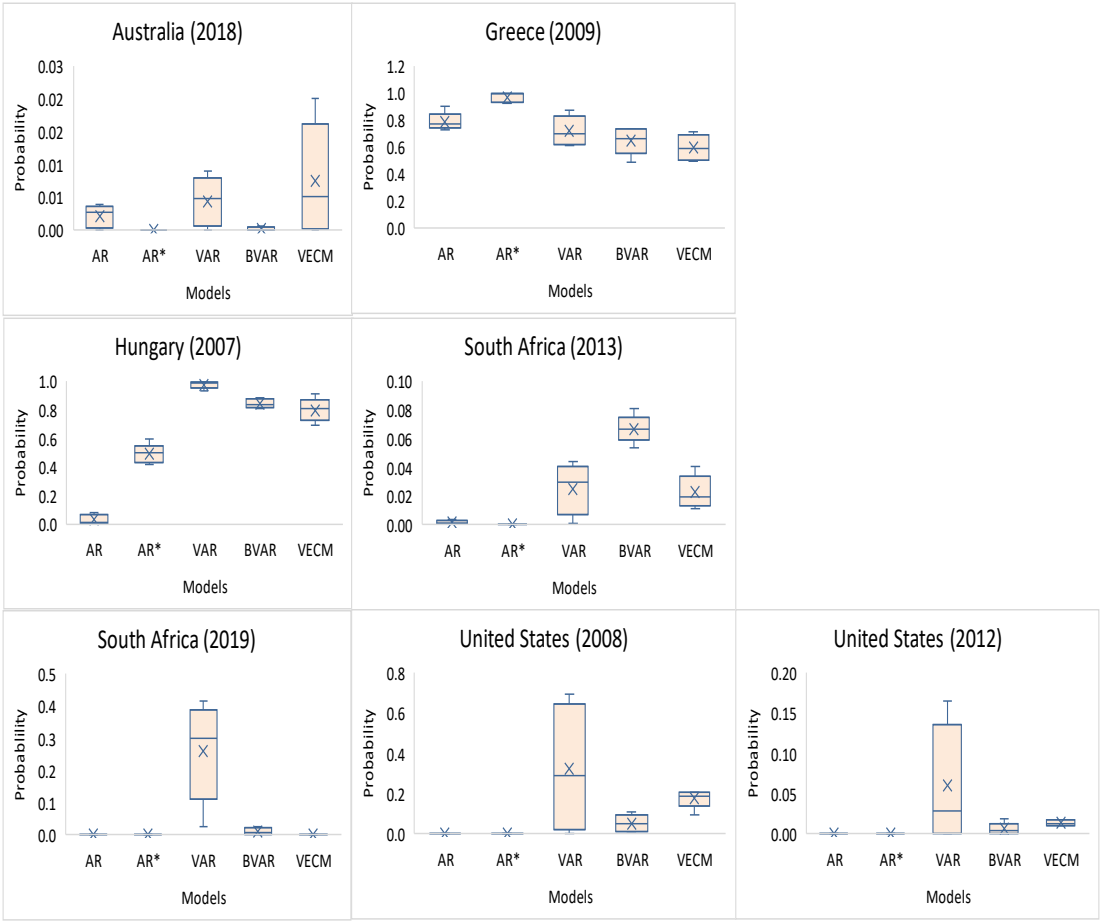
We therefore estimate our various models using data up to 2009 for Greece and calculate out-of-sample forecasts for 2010-2014. We quantify the uncertainty of these forecasts by calculating historical out-of-sample forecast errors for 1995-2009 and their covariance matrices. We use these covariance matrices to generate one million draws for each forecast horizon from one year to five years to quantify the uncertainty of our out-of-sample forecasts for 2010-2014. We then calculate the probability that the 2010-2014 current account balances will be lower than the threshold of -8%. If this probability is high, or if it is low for short forecast horizons but increases substantially at longer forecast horizons, then this indicates a high likelihood that the current account had to be adjusted. Conversely, our model would not indicate an adjustment need if the probability was low. We then examine whether the current account did indeed adjust after 2009 and if our model foresaw this adjustment accurately. This entire process is applied to all other countries in the sample, analysing their

respective episodes of current account imbalances.

Figure 9 depicts the results from five alternative models. Generally, the results reveal that Greece had over a 60% probability of their deficits falling below the threshold of -8% in the periods ahead, indicating unsustainability. Conversely, the rest of the countries exhibit relatively low probabilities across different episodes and forecast horizons, indicating sustainability. The stochastic models depict similar results (see Table 6).

Focusing on the adjustment of the selected historical episodes, we observe the following:

Figure 9: The probability that the current account balance will be lower than a threshold value: model validation



Source: Author's calculations. Notes: The boxplot display show the range of probabilities across different forecast horizons from 1-year ahead to 5-year ahead and model for each country. For each forecast horizon, we calculate the probabilities according to Equation 44. The years in the parenthesis represent the year for which we calculate the probability of the current account balance falling below the threshold of -8% in the subsequent years. The models assume normal distribution is forecast errors, and AR* applies bootstrapping. For Hungary, the VAR model excludes trade openness and the budget balance due to data limitations. Likewise, Chile, Ireland, Korea, Malaysia, and Mexico were excluded due to a lack of data availability pre-1980.

For Greece, the high probabilities generated by our models justify the subsequent significant adjustments in their current account deficit. Specifically, before 2009, Greece consistently

recorded large deficits, which adjusted sharply from -10.1% in 2011 to -2.5% in 2012. Between 2013 and 2014, the current account balance stabilized, ranging between -2.5% and -3%. The probabilities are higher when the distribution of forecast errors is bootstrapped, suggesting that the residuals may not strongly follow a normal. Similarly, Hungary's current account deficit reversed sharply from -7.4 in 2007 to -0.8% in 2009 and turned into a surplus between 2010 and 2012. Four of the five models suggest high probabilities for Hungary, the exception is the AR model when the forecast errors are assumed to be normally distributed under.

For South Africa, after 2013, there was a modest adjustment with the current account deficit declining from -5.3% in 2013 to -2.4% in 2017. Our models suggested a low probability of current account balance worsening and exceeding the threshold, so the upward adjustment is consistent with our model predictions. Similarly, throughout the different estimation models and forecast horizons, the probabilities were extremely low for 2019 current account balance of -2.6%. Consistent with our models' predictions, the balance flipped to a surplus of 1.9% and 3.7% in 2020 and 2021, respectively. Thereafter, it slipped back into a deficit of - 0.5% and -1.6% in 2022 and 2023, respectively, with a projection of -1.8% for 2024. The unexpected surplus in the current account balance in 2020-2021 period could have been explained by lower domestic demand resulting from the recession caused by the COVID-19 pandemic, an unpredictable event.

On the other hand, the easing of COVID-19 lockdown restrictions and the related rebound in global economic activity supported the bouncing back of South Africa's export volumes in 2021 (South African Reserve Bank Report 2021)[21]. In both the 2013 and 2019 episodes, the VAR model yields puzzling results (see Figure 9). For instance, under the assumption of normally distributed residuals, the model assigns much higher probabilities to a smaller deficit of 2.6 in 2019 compared to a larger deficit of -5.3 in 2013. After applying the bootstrapping method, the probabilities increase for 2013 but remain lower than those for 2019. This inconsistency underscores the need for careful assessment when the expected outcome does not materialise.

[21] South African Reserve Bank Report 2021: https://www.resbank.co.za/content/dam/sarb/publications/quarterly- bulletins/current-account/2021/Current%20account%20release%20September%202021.pdf

The United States' current account deficit persisted without significant adjustments, consistent with our low probabilities that the country's current account deficit may fall below the threshold of -8% in the near term, except possibly in the much longer term, such as 4 or 5 years ahead (60-70% for the 2008 episode, though only 11-16% for the 2012 episode under the VAR model, see the last two panels of Figure 9). The country recorded a deficit of -4.7% in 2008 and -2.6% in 2012. Since 2012, the deficit has remained around 2.5%.

5.3.1.1.2 Validation based on a recursive out-of-sample exercise

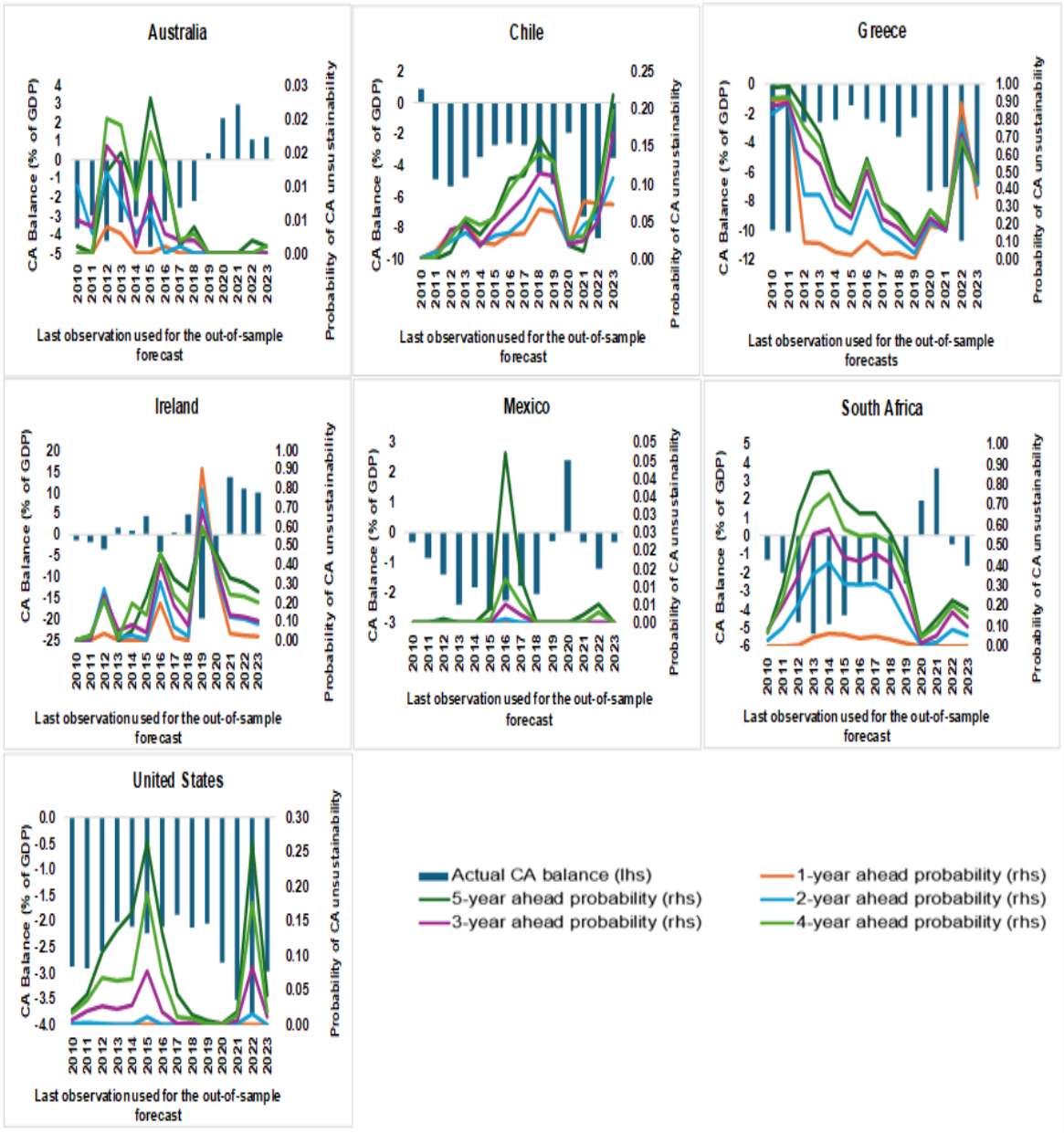
Our second validation exercise applies a recursive out-of-sample analysis for the 2010–2023 period across seven selected countries. Specifically, we begin by estimating the model using data up to 2010 and then generate out-of-sample forecasts and their distributions for 2011-2015. From these distributions, we compute the probabilities of the current account falling below the threshold over one- to five-year horizons, i.e. in 2011-2015. We then extend the estimation window to 2011 and produce forecasts and probabilities for 2012-2016, and so on. This validation follows a nested process: each step of the recursive validation incorporates an additional out-of-sample analysis to characterise forecast uncertainty, as outlined in section 5.3.1.1.1 above. For each year, we compare the estimated probabilities with the actual subsequent trajectory of the current account balance.

Australia recorded a current account deficit of around 4% of GDP during 2010-2016, after which the balance gradually shifted to a surplus. Our model indicated very low one-year-ahead probabilities of breaching the threshold during 2010-2016, but somewhat higher probabilities at the five-year horizon. The eventual adjustment to a surplus aligns with these estimates.

In Chile, the current account deficit narrowed from about 4% of GDP in 2010-2012 to around 3% in 2016-2017. However, our out-of-sample probabilities gradually increased during this period, signalling emerging risks. The deterioration of the deficit in 2018-2019 validated these concerns. After a temporary improvement in 2020, the deficit widened again in 2021-2022, when our model showed rising probabilities—followed by an actual correction in 2023.

Greece posted a current account deficit of roughly 10% of GDP in 2010-2011, with our model consistently signalling high probabilities across all horizons, indicating severe sustainability risks. The sharp adjustment in 2011 coincided with the escalation of Greece's sovereign debt crisis and its request for financial assistance from the EU and the IMF.

Figure 10: Recursive out-of-sample validation exercise



Source: Author's work. Note: the VAR model was used. The bars show the actual current account values, while the lines show the estimated probability of the current account falling below the threshold value in one, two, …, five years later, using data only up to the date indicated on the horizontal axis. The recursive out-of-sample evaluation was conducted in the 2010-2023 period.

Mexico experienced a gradual deterioration in its current account balance between 2010 and 2015. At the start of this period, our estimated probabilities were low, but the probabilities gradually increased by 2015 and even further by 2016. This rise preceded an adjustment in 2019 that brought the current account balance close to zero.

South Africa maintained a current account deficit of about 3-5% of GDP from 2012 to 2019. While our model suggested relatively low one-year-ahead probabilities, the five-year probabilities were significantly higher, anticipating the adjustment to a surplus observed in 2020–2021.

The United States recorded a steady deficit of 2–3.5% of GDP between 2010 and 2023, with some fluctuations. The rise in estimated probabilities around 2015 coincided with only a minor reduction in the deficit in the subsequent year, but the sharp probability increase in 2022 preceded a more substantial adjustment the following year.

Notably, when the current account deficit is exceptionally large—such as -19% for Ireland in 2019 and over -10% for Greece in 2022—the 1-year ahead forecast responds immediately and sharply, flagging high probabilities of unsustainability. This suggests that the model is highly sensitive to extreme imbalances, and short-term forecasts are capable of capturing acute external vulnerabilities when deficits reach critical thresholds. In contrast, for countries like Mexico, South Africa and the United States, where deficits are low to moderate (typically ranging between -1% and -5%) the 1-year ahead forecasts tend to remain low or muted. The medium- to long-term forecasts (2–5 years ahead) are more reflective of potential risks, gradually rising in response to persistent imbalances.

For most countries, 2022 shows a peak in unsustainability probabilities, likely reflecting the COVID-19 pandemic-related trade disruptions, fiscal imbalances, volatile capital flows and commodity price shocks. Altogether, these factors strained external balances globally, and the model responded with elevated risk signals. Ireland's probability of unsustainability remains flat in 2022 across all forecast horizons – likely reflecting strong underlying fundamentals. It may also be a result of lessons learned from the country's sharp correction of the current account balance in 2019–2020, which may have prompted structural adjustments that improved the country's external resilience.

The analyses in the section demonstrate the models' effectiveness in signalling potential adjustments in current account balances and underscore the importance of monitoring to inform policy decisions.

Bootstrapping approach

There are two key reasons why we use the bootstrapping method instead of solely relying on the assumption that errors are normally distributed. First, diagnostic tests following the linear VAR model estimation, suggest weak evidence of a normal distribution in the data generating process for most countries in our sample. Second, the literature reveals that abrupt adjustments in the current account are not rare (Adalet and Eichengreen, 2005). In this regard, assuming a Gaussian distribution may not be appropriate. To proceed we resample one million random draws using the forecast errors for each forecast horizon separately. These random draws are added to our point forecasts, to create a simulated series, which we then use to characterise the empirical density function of our forecasts. We then use these forecast distributions to calculate the probability that the future values of the current account balance will fall below a specified threshold.

5.3.1.2 The assessment of 2023 current account balances

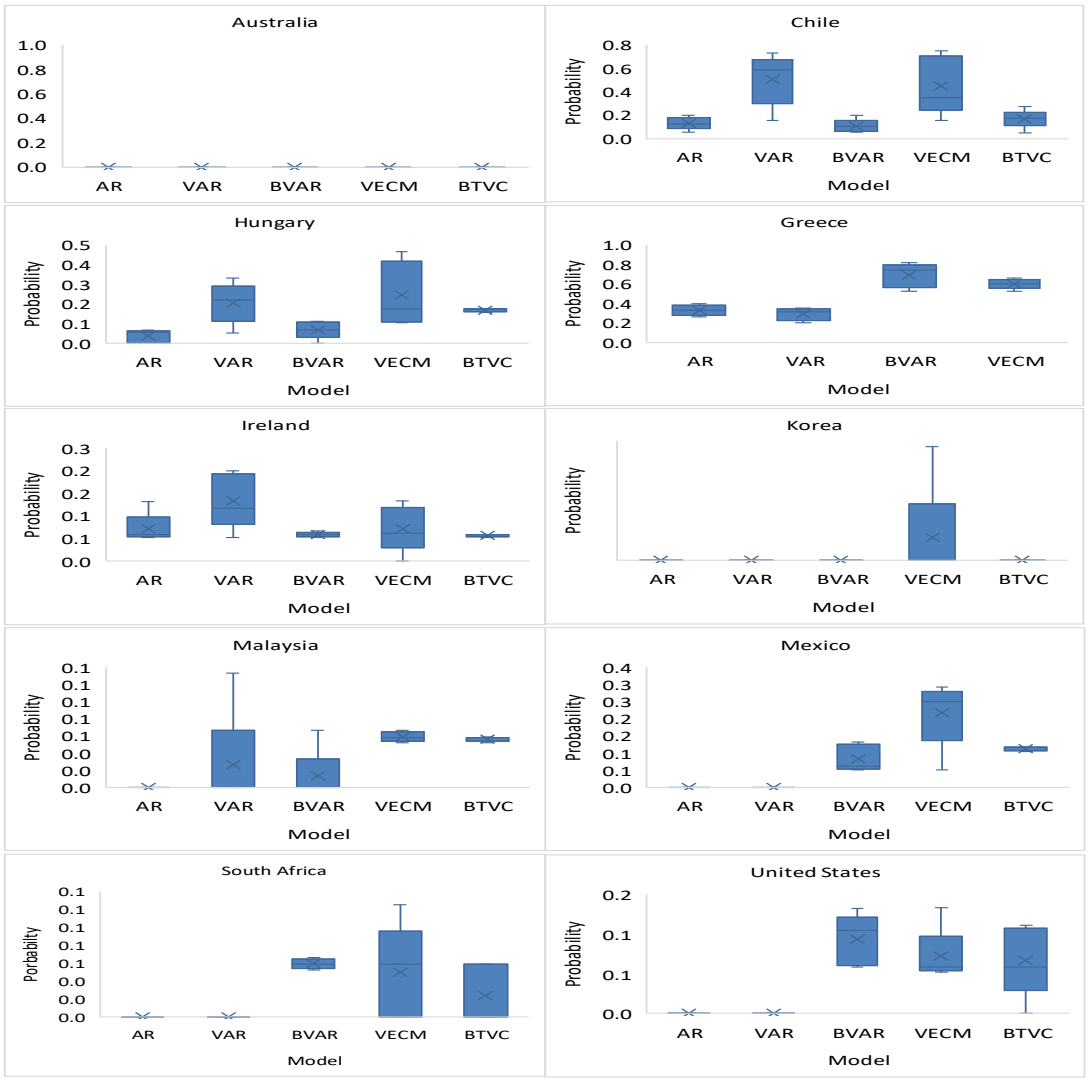
The kernel density estimates suggest considerable uncertainty regarding the future trajectory of current account balances and a large likelihood of continued deficits for the Greek, Hungarian, Mexican, and United States economies (see Appendix M).

Figure 11 display the current account (un)sustainability probabilities from various forecasting models using the bootstrapping method.

We find that for most countries in our sample, the probability that the current account deficit will fall below the threshold of 8 percent is low, except for Greece (Figure 11). For instance, Australia has practically zero probability (rounded to four digits after the decimal) that the country's current account balance will be lower than the threshold throughout the forecast horizons. This is not surprising as since 1980 the country's deficit has hovered around 6% (which is above the threshold of 8%) for over three decades before switching to a surplus in 2019. In 2023, the current account had a surplus of 1.2% and thus it is extremely unlikely that it will fall below -8%. Some of the main characteristics of the Australian external position may explain the low probability of the country's current account balance falling below the threshold. Australia's external debt has been denominated by domestic currency, the Australian dollar. Thereby creating a buffer against fluctuations in the exchange rate and shielding the economy from a balance of payment crisis. In addition, the data shows that in the last two decades, foreign direct investment has been stronger than portfolio flows,

thereby making the Australian economy less prone to external risks.

Figure 11: The probability that the current account balance will be lower than a threshold value– 2023 CA balances



Source: Author's calculations. Notes: The boxplot display show the range of probabilities across different forecast horizons from 1-year ahead to 5-year ahead and model for each country. For each forecast horizon, we calculate the probabilities according to Equation 44.

Korea and Malaysia also have zero probability that their respective current account balances of 2.07% and -0.32 will fall below an 8% deficit. Similarly, in each forecast horizon, the United States has a low probability of falling below the threshold of -8. This result suggests that the current account balances for Australia, Ireland, Korea, Malaysia, United States and South Africa are on sustainable paths. It can be argued that the salient features of the US economy including the reserve currency status, and the size of the economy play a role in sustaining the deficit. In addition, the savings-investment gap has been relatively small and steady. Over the period 1982 to 2020, both investment and savings averaged 22 and 21

percent of GDP, respectively. This gap shrank even further post-the-global financial crisis period. For Australia and Korea, even when considering a relatively lower threshold of a -5% current account deficit, the probabilities remain low. In the case of Mexico, the less sophisticated models (AR and VAR) indicate a zero percent probability across all forecast horizons. More advanced models, such as the BVAR, suggest a probability of less than 15%, while the VECM results exhibit some volatility, averaging around 20%.

In stark contrast, Greece has over a 60% probability that its current account balance will fall below the -8% threshold in all forecast horizons. Although these results suggest a high probability of Greece experiencing unsustainable deficits, this probability appears to be gradually declining over the forecast horizon across the different models (except VECM). This indicates that Greece's current account balance might improve in the years ahead, a trend supported by the recent projections reported in the IMF-World Economic Outlook in April 2024. However, it is also clear that high probabilities of unsustainability are observed for countries with large current account deficits, such as Greece. We also note increasing probabilities of unsustainability over the forecast horizon for countries like Chile and Hungary, indicating potential external vulnerabilities in years ahead.

Notably, the VECM model frequently exhibits a wider range of forecast probabilities across most countries, particularly over longer horizons. This pattern suggests heightened uncertainty or variability in the likelihood of breaching the threshold compared to other models. In the cases of Chile and South Africa, this dispersion may stem from overfitting to long-run dynamics, especially when the underlying data characteristics—such as integration order or weak cointegration—challenge the model's assumptions. For Hungary, the broader forecast range could reflect the presence of structural breaks, notably the policy shifts between 2011 and 2013. Since cointegration tests are sensitive to such breaks, the resulting model may capture unstable long-run relationships, thereby amplifying forecast uncertainty.

In summary, it is evident that in the short to medium term, sustainability tends to hold, but not in longer forecast horizons, for example, 5 years ahead. The negative association between the level of the current account deficit and the probability of its sustainability is also evident.

5.3.1.3 Extended country sample: the assessment of 2023 current account balances

To gain further insight, we expanded our analysis to a broader sample of 94 countries, consisting of low-, middle-, and high-income economies[22]. **Error! Reference source not found.** Figure 12 demonstrates that most of these countries are unlikely to experience an unsustainable current account balance across all forecast horizons. Notably, a significant portion of these countries are high - and middle-income economies, including major advanced and emerging economies such as Denmark, Netherlands, Germany, Brazil, Argentina, and South Africa.

However, a notable minority—approximately 13% of the sample is more likely to face unsustainable current account deficits. This subset is predominantly composed of low-income countries like Senegal and Sudan, both of which show a 100% probability of their current account balances falling below the threshold through the end of the forecast horizon (Figure 12). Namibia, Rwanda, , and Ukraine also exhibit extremely high probabilities of unsustainability, exceeding 90% over the longer forecast periods (Figure 12). These results indicate that, based on the latest current account data and forecasted trends—assuming economic conditions and policy positions remain unchanged—these economies are at high risk of experiencing unsustainability.

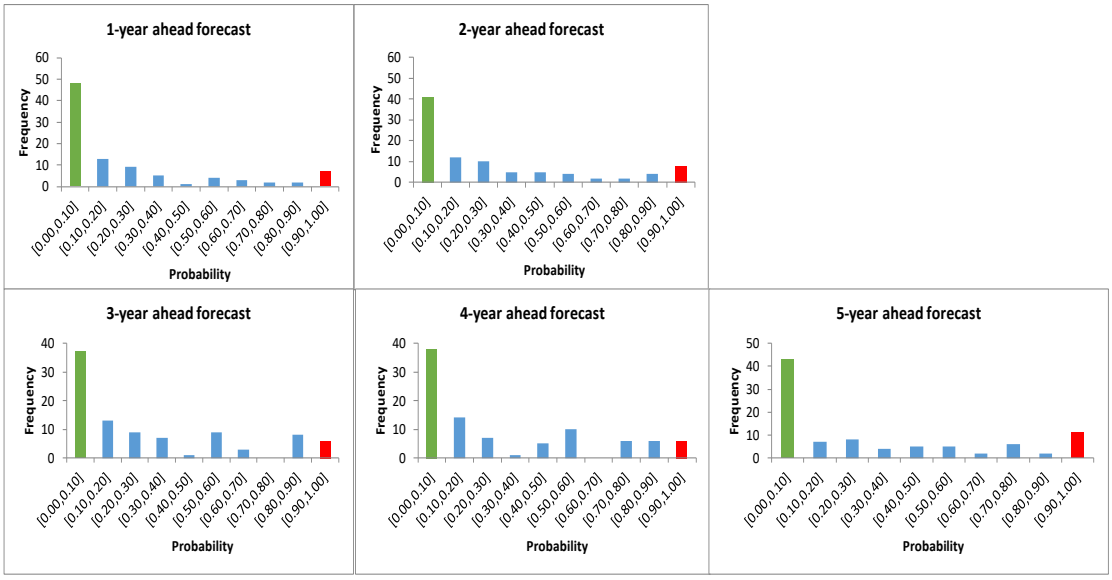
In contrast, countries such as Cambodia, and Romania show high probabilities of unsustainability in the short term, ranging between 60% and 80%, but these probabilities moderate over longer forecast horizons, particularly five years ahead, where they average below 50% (Figure 13). This suggests that these economies may be implementing measures or benefiting from developments that could improve their current account outlook over time. This conclusion is reinforced by the narrowing current account deficits observed in our forecasts.

The latest figures for the current account balance play a crucial role in assessing its future trajectory. Countries with strong surpluses or small deficits tend to have low probabilities of breaching the -8% of GDP threshold. For example, Denmark and Germany recorded

[22] We use the sample income group classifications we constructed in Chapter 3

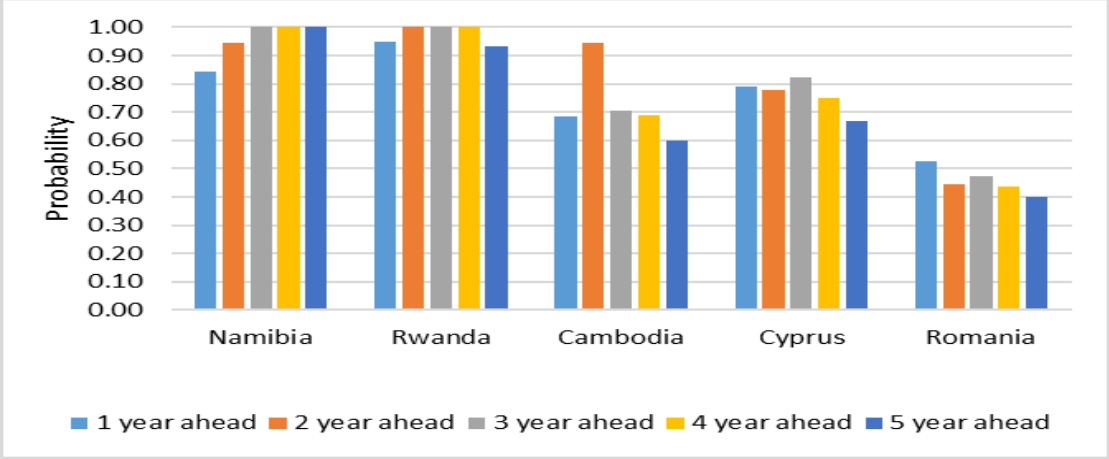
substantial surpluses of 10.9% and 6.8%, respectively, in the latest 2023 data.

Figure 12: Distribution of the probability of a current account deficit exceeding 8% of GDP for 94 countries in 2023



Source: Author's Own Calculations.

Figure 13: The evolution of current account reversal probabilities over the forecast horizon



Source: Author's Own Calculations.

These figures are accompanied by an upward trend in forecasts, with Denmark's surplus expected to reach 14% of GDP by the end of the forecast period, indicating a very low risk of unsustainability. Similarly, Brazil and South Africa posted small deficits of -1.3% and -1.6%, respectively, with stable forecasts averaging around -2% through to the end of the forecast period. In contrast, countries that last recorded large deficits and face persistently elevated forecasts depict a high risk of unsustainability. For instance, Namibia and Senegal had deficits of -10.9% and -15.1%, respectively, and around -7% for Ukraine in 2023.

One might argue that Denmark and Germany, with their large surpluses, are also mature economies that qualify as safe havens, making the low risk of unsustainability expected. However, smaller economies like Azerbaijan and Bahrain, which recorded surpluses of 9.9% and 19%, respectively, in 2023, also show near-zero probabilities of falling below the threshold, particularly in the short term. A similar pattern emerges for deficits: Cyprus, a more developed economy compared to Namibia and Senegal, posted a considerable deficit of -9.3% in 2023, with a probability of over 70% for its current account balance falling below the -8% threshold.

These results suggest that the current account balance may be a more important factor than the size of the economy when evaluating its future trajectory. Large deficits are strongly associated with a high probability of breaching the -8% threshold, indicating unsustainability, while large surpluses are linked to low probabilities, signalling sustainability. Crucially, both patterns appear to hold regardless of the size of the economy.

5.3.1.4 The probability of current account sustainability: government- driven versus private sector-driven deficits

We further consider the sectoral (private versus public) drivers of the current account balance. The primary rationale for this analysis is that government-driven and private sector-driven deficits might adjust differently. Analysing sectoral contributions to the current account deficit would help draw inferences as to whether the current account deficit driven by the government sector is more likely to be sustainable compared to a case where the most significant contributor is the private sector.

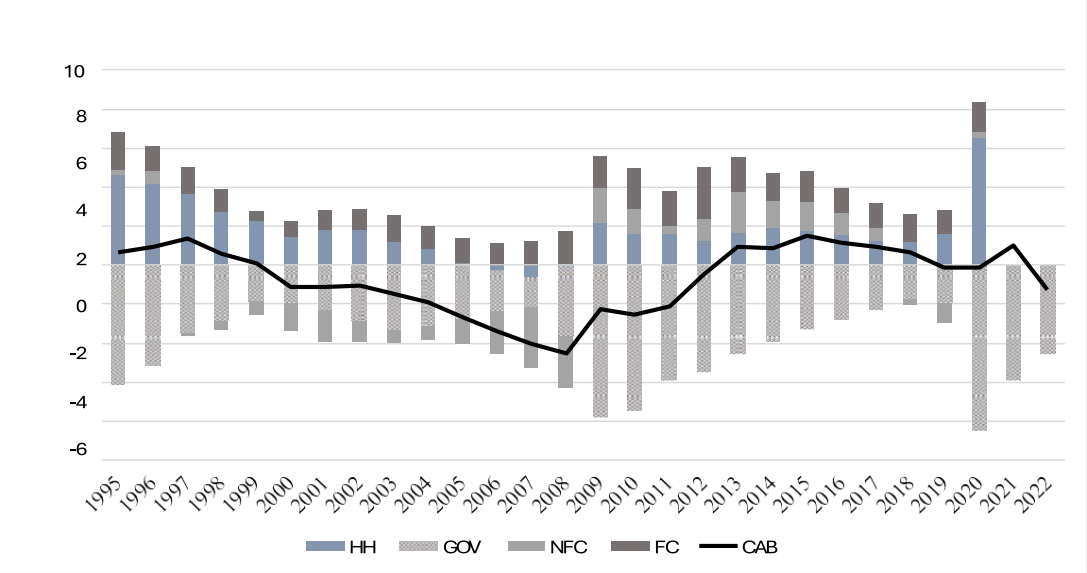
To analyse the impacts of sectoral drivers of current account deficits, we had to use a different set of countries due to data availability at sectoral level. Due to the availability of net financial balance data at the sectoral level, we use the data from ten European Union countries that have had protracted current account deficits in the past. The annual data for these countries is sourced from the Eurostat for the 1980-2022 period[23]. The data shows that the government sector is the largest contributor to the negative balance in the current account, especially during the Covid-19 pandemic (Figure 14).

Traditionally, the current account is decomposed into either the trade balance or the

[23] 2023 excluded due to gaps in the data.

difference between savings and investment (Chinn and Prasad, 2003). However, in recent years, we have seen publication of balance sheet data at sectoral level, especially in the European Union, thereby allowing us to break down the current account balance into the sum of the net financial balances of the households (HHs), the government (GOV), the nonfinancial corporates (NFCs) and the financial corporates sectors (FCs) (for detailed framework, see Allen, 2018)[24]. Changes in each sector has a direct impact on the current account balance.

Figure 14: EU current account deficit countries



Source: Eurostat and own calculations. Notes: Each sector represents the aggregate net financial balances from EU deficit countries. The current account balance is calculated as the sum of these sectoral balances. The selected EU deficit countries: Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Malta, Portugal, Slovenia, Slovakia, Bulgaria, Czech Republic, Croatia, Hungary, Poland and Romania

The net financial position of NFCs has shown considerable volatility (see Figure 14). Prior to the crisis, the NFC sector was a net borrower, contributing an average of 1% to the current account balance. However, following the crisis, the sector transitioned to a net lender position, contributing an average of 0.9%, except in 2018 and 2019, when it temporarily reverted to a net borrowing position.

The household sector, on the other hand, has consistently been a net lender, with an average contribution of 1.7% over the sample period. The only exceptions were in 2006 and 2008,

[24] A negative sign in the net financial balance indicates net borrower and the positive sign indicate net lender.

when households briefly became net borrowers. The sector's net lending position has remained relatively stable, with an average contribution of 1.7% before the crisis, rising slightly to 1.9% post-crisis.

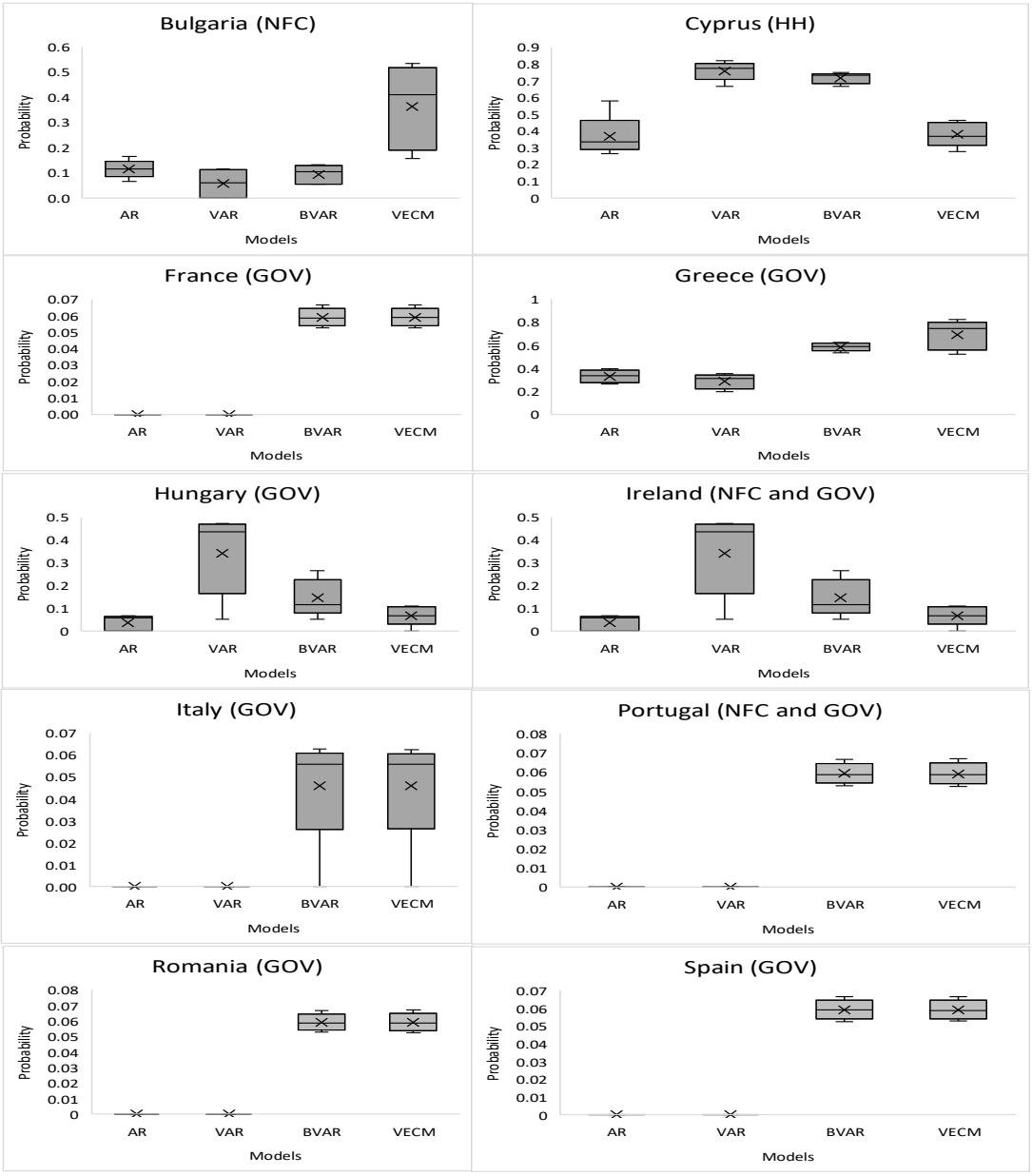
In contrast, the FCs increased their net lending position by 0.5 percentage points, from an average of 1.1% pre-crisis to 1.6% post-crisis. Overall, in the post-crisis period, the corporate sector (combining NFCs and FCs) became a net lender, with an average contribution of 2.4% to the current account, compared to 1.9% from the household sector.

The government sector has consistently been the largest contributor to the current account deficit. Over the sample period, it contributed approximately 3.6% of GDP to the current account deficit. Post-crisis, the government's net borrowing increased significantly, averaging 4.4%, compared to 3% pre-crisis. In 2020, this figure surged to around 8% due to increased public spending in response to the Covid-19 pandemic. Even the rise in net borrowing from the NFC sector in 2019 was overshadowed by the government's dominant role in the current account deficit. However, as Covid-19 pressures have eased and the global environment begins to normalize, the government's borrowing has started to slow.

Figure 15 presents the probabilities of current account (un)sustainability for selected EU deficit countries, derived from various forecasting models using the bootstrap method. The findings show no strong evidence that a government-driven current account balance is sustainable than one driven by the private sector. For countries like France, Italy, and Spain, where government sector dominates, the probability of the current account balance falling below the -8% threshold remains very low, ranging from 0% to 7% across all models and forecast horizons. This indicates a low risk of unsustainability in their current account balances.

In contrast, Bulgaria, and Cyprus, with private sector-driven deficits, exhibit higher probabilities of unsustainability. For Bulgaria, the probabilities range from 11% to 22%,

Figure 15: The probability that the current account balance will be lower than a threshold value – sectoral analysis



Source: Author's calculations. Notes: The boxplot display show the range of probabilities across different forecast horizons from 1-year ahead to 5-year ahead and model for each country. We have excluded some of the EU deficit countries due to data and estimation limitations. The Households (HHs), the government (GOV), the nonfinancial corporates (NFCs), and the financial corporates sectors (FCs). The brackets represent the major contributing sector to each country's current account balance. For each forecast horizon, we calculate the probabilities according to Equation 44.

aligning with its small surplus of 0.29%. Cyprus, however, shows much higher probability values, between 30% and 80%, consistent with its significant current account deficit of -9.29% in 2023.

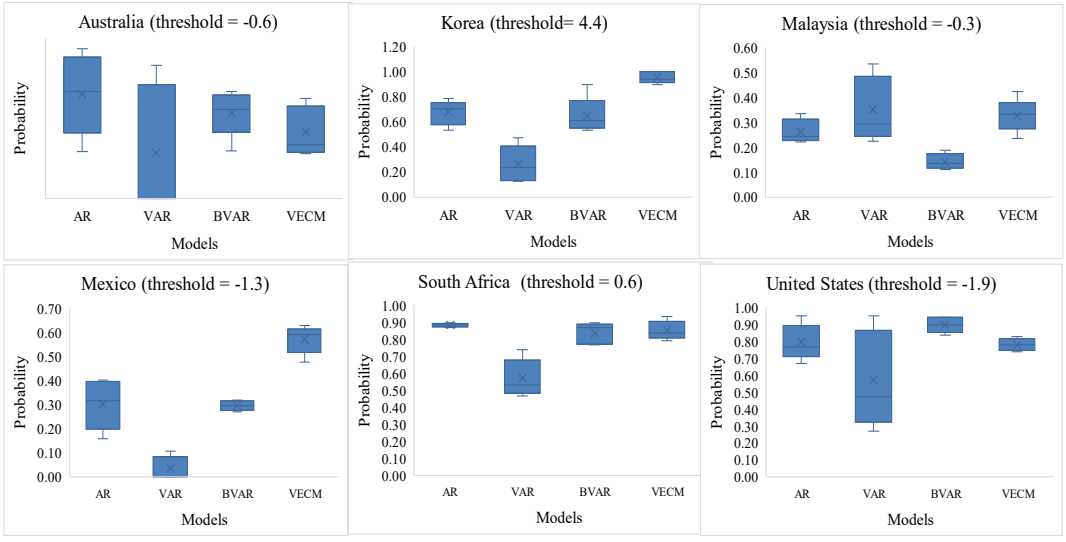
Greece and Romania also have considerable current account deficits, -6.9% and -7.1%, respectively. Both economies have government sector-driven deficits showing different risk profiles. Romania faces a higher risk of unsustainability, while Greece sees moderate risk, with probabilities around 30% in the VAR model.

Ireland's current account balance is driven by non-financial corporates and government sectors. While we see strong evidence of low probability values for Ireland, these values are gradually increasing over time, across the different models, indicating some vulnerability (except in the case of BVAR model).

Overall, despite differences in the driving sectors—private sector for Cyprus, government sector for Greece and Romania—all three countries show considerable risk of their current account balances falling below both the -8% and -5% thresholds. The driving sector—whether private or government—may not be a crucial factor in determining current account sustainability. Instead, it is more likely that external shocks, political and economic conditions, and structural vulnerabilities play a critical role in shaping the risk of current account unsustainability. These factors, combined with the level of the current account deficit itself, may offer a more comprehensive understanding of the risks involved for the different economies.

5.3.1.5 Alternative sustainability thresholds

Figure 16: Country-specific sustainability thresholds: IMF EBA norms – 2023 values



Source: Author's calculations. Notes: The boxplot display show the range of probabilities across different forecast horizons from 1-year ahead to 5-year ahead and model for each country. Bootstrapping approach is applied. For each forecast horizon, we calculate the probabilities according to Equation 44.

When applying country-specific thresholds—derived from the IMF External Balance Assessment (EBA) norms—to estimate the probability of current account (CA) sustainability, our framework yields the following insights (Figure 16):

Across models, the framework consistently predicts sustainable current account balances for Australia, Malaysia, and Mexico. These results align with the 2024 IMF External Sector Report (ESR) assessments for these economies. In contrast, the models indicate a moderate to high risk of unsustainability for Korea, South Africa, and the United States. For Korea, this finding is consistent with the IMF's assessment, which notes that Korea's 2023 CA position was moderately weaker than the level implied by medium-term fundamentals and desirable policies.

However, for South Africa and the United States, our results diverge from the IMF's assessment, which considers their external positions broadly in line with fundamentals. This discrepancy may reflect differences in model sensitivity and threshold calibration. The divergence for South Africa may include model sensitivity to short-term volatility: South Africa's CA may be affected by commodity price swings, capital flow volatility, or cyclical factors. These factors may be captured more strongly by time-series models than by the IMF's medium-term structural approach. Other possible reason is the country-specific threshold (0.6% of GDP) may be too low or not fully reflective of structural buffers (e.g., flexible exchange rate, deep financial markets), which enhance external resilience. Similarly, for the United States as well it might an issue of threshold misalignment. The threshold of -1.9 may be too small and not reflective of the U.S.'s unique external financing capacity, which potentially allows the country to run a larger deficit and therefore a higher threshold.

5.4 Discussion of Results

We have argued that, conceptually, the question of current account sustainability should be viewed as a stochastic process, incorporating economic uncertainty over time. By definition, stochastic processes provide a framework for modelling and analysing systems that evolve in an unpredictable manner over time. Therefore, approaching the current account as a stochastic process entails taking account of economic uncertainty embodied in the time path of the current account balance itself. Since the state of the economy is unknown until each future period, assessing current account sustainability probabilistically is appropriate. Although our proposed approach is heavily empirical, its key advantage is that it avoids

making restrictive assumptions about future behaviour of the economic agents and instead predicts the likelihood of maintaining a sustainable current account balance over various forecast horizons. In this context we asked two research questions: first, conceptually, how to define current account sustainability? Second, how to define current account sustainability in a probabilistic setting?

We define sustainability as having a low probability of the current account deficit exceeding a specified threshold. Conversely, a high or increasing probability indicates unsustainability. We operationalise this probability approach and concept by generating density forecasts up to five years ahead and use the estimated forecast errors to characterise the empirical density function of our forecasts. We then use these forecast distributions to calculate the probability that future current account values will fall below the threshold, capturing uncertainty in our forecasts. In essence, due to inherent economic uncertainty, our empirical framework allows us to consider the potential that current account dynamics can evolve in an unpredictable manner over time.

5.4.1 The proposed probability approach is effective

Our first set of results suggest that our proposed probability framework is effective and valid, highlighting its practical utility. The high probabilities of unsustainability predicted by our probability framework were validated by the actual adjustments observed in current account balances, particularly in cases like Greece and Hungary. Before the global financial crisis, Greece consistently recorded large current account deficits, indicating significant external sector imbalances. The high probabilities generated by our models suggest a strong likelihood of these deficits breaching the sustainability threshold of -8%.

Over the period 2009 to 2012, we observed significant adjustments in the country's current account balance. In 2009 to 2010, the global financial crisis exacerbated Greece's economic woes, leading to heightened scrutiny of its fiscal and current account positions. In 2011, Greece's current account deficit peaked at - 10.1%, reflecting continued severe economic distress and these challenged were amplified by the sovereign debt crisis in 2012. During this period, researchers such as Porzecanski (2012) argued that the country's large current account deficit was one of the key drivers of capital outflows and retrenchment from the Greek economy.

In response to economic pressures and international bailout conditions, the Greek government implemented significant fiscal and structural reforms, including massive wage

bill cuts, tax increases, and efforts to improve tax collection. These measures led to a sharp adjustment in the current account deficit, reducing it to -2.5%. Consequently, during the period 2013-2014, Greece's current account balance stabilized, fluctuating between -2.5% and -3%. The stabilisation was a result of continued economic reforms and austerity measures. Additionally, structural reforms aimed at enhancing productivity and competitiveness contributed to a reduction in the current account deficit. Meanwhile, the financial support from international Organisations such as the International Monetary Fund and the European Union provided the necessary resources for Greece to implement these economic reforms.

Greece's experience highlights the effectiveness of our probability approach in predicting the need for adjustments in current account balances, indicating that the balance was not a sustainable path. The significant reduction in the deficit from -10.1% in 2011 to -2.5% in 2012 underscores the importance of timely and robust economic policies in addressing unsustainable current account positions.

Existing literature on Greece's current account dynamics has yielded similar results using different methodologies. For instance, one of the pioneering studies on current account sustainability, Milesi-Ferretti and Razin (1996) emphasised the importance of incorporating behavioural aspects of the different economic agents, specifically *the willingness to pay and lend*, into the intertemporal solvency framework. They found that countries with persistent and large deficits, like Greece, often faced external crises when these vulnerabilities were not addressed. Similarly, Brissimis *et al.* (2012) examined the macroeconomic, financial, and structural factors shaping Greece's current account from 1960 to 2007. They identified the

vulnerability of Greece's current account balance and highlighted the need for policy measures to restore external sustainability.

Like the case of Greece, Hungary experienced significant current account deficits pre-2007, reflecting external sector imbalances and vulnerabilities. Our probability approach indicated a high likelihood of these deficits breaching sustainability thresholds, signalling the need for adjustments. Between 2007 to 2009 significant adjustments were observed. In 2007, Hungary's current account deficit was -7.4%, indicating substantial economic challenges. During the global financial crisis in 2008 the Hungarian government implemented significant economic reforms and austerity measures. These included fiscal consolidation, structural reforms, and efforts to stabilise the financial sector. Fiscal consolidation included

austerity measures such as reducing public sector wages and pensions and increasing VAT and excise taxes (see Hungary National Report Programme 2023).

On structural reforms, efforts were made to streamline public administration and improve efficiency in public services. Many state-owned businesses were privatised to increase efficiency and attract foreign investment. To boost trade and competitiveness, policies were implemented to boost exports, including improving trade infrastructure and reducing trade barriers. Reforms were made to align with European Union (EU) regulations and standards, facilitating smoother integration into the European market. Importantly, according to the National Reform Programme for 2023, Hungary effectively utilized EU funds for development projects, which helped improve infrastructure and economic growth. These reforms collectively helped Hungary stabilize its economy, reduce current account deficits, and improve overall economic resilience.

As a result of these measures, Hungary's current account deficit sharply reversed to -0.8%, demonstrating a significant adjustment. Over the period 2010 to 2012, Hungary's current account balance continued to improve, reversing from a deficit into a surplus, reflecting the effectiveness of the implemented policies. The surplus was largely due to improved trade balances, alongside continued fiscal discipline and structural reforms. In addition, financial assistance from international organizations provided the necessary support for Hungary to implement these adjustments.

Research on current account sustainability in Central and Eastern Europe, including Hungary, often focused on the speed of mean reversion and the impact of structural reforms. Studies like Cuestas and Monfort (2020) use the Bai and Perron method and identified structural breaks and found that Hungary exhibited a slow speed of mean reversion, indicating that deviations from equilibrium took longer to correct. Kónya (2008) employed the intertemporal approach and found no evidence of cointegration between real exports and imports in Hungary, suggesting unsustainable current account deficits. Both Monfort (2020) and Kónya (2008) identified structural breaks and emphasized the need for continuous monitoring and policy measures to ensure sustainability. Roubini and Wachtel (1998) employed several econometric models to analyse current account deficits in transition economies, highlighting Hungary's reliance on capital inflows and the associated vulnerabilities. Overall, these studies align with our findings, reinforcing the need for comprehensive economic reforms and continuous policy measures to maintain current account sustainability in Hungary.

South Africa's experience underscores the importance of considering economic uncertainty and using probabilistic models to assess current account sustainability. Between 2013 and 2017 the country saw a gradual and modest adjustment in the current account, from -5.3% to -.2.4%. This adjustment was consistent with our model's predictions, which suggested a low probability of significant changes in the current account balance during this period. Similarly, the current account deficit was -2.6% in 2019, and our probability models indicated extremely low probabilities of adjustment, which aligned with the observed stability. In 2020 and 2021, the current account balance unexpectedly turned into a surplus of 1.9% and 3.7%, respectively. This was largely due to lower domestic demand during the COVID-19 pandemic (an unpredictable event), which reduced imports, and a rebound in export volumes as global economic activity recovered.

The country's adjustments reflect a combination of domestic policies, external shocks, and trade dynamics. On domestic policies, efforts to maintain fiscal discipline and manage public debt have influenced the current account balance; and Initiatives to improve competitiveness and economic diversification have also played a role. On external shocks, the COVID-19 pandemic significantly impacted domestic demand and trade balances, leading to an unexpected surplus in 2020-2021. Additionally, global economic conditions in the form of fluctuations in global demand and commodity prices have affected South Africa's export volumes and current account balance. This case study contributes to a deeper understanding of how different economic conditions and policies influence current account sustainability in an emerging-open economy.

Our finding of a low probability for current account unsustainability aligns with existing literature. André *et al.* (2018) used long memory models to show mean-reversion in current account deficits. In contrast, studies using the intertemporal approach often report weak or no evidence of sustainability. Narayan and Srianantha kumar (2020) found intermittent but weak sustainability for South Africa from 1970-2018, highlighting vulnerabilities due to reliance on portfolio flows and the impact of interest payments on the income component of the current account. Freund (2005), Clarida (2006), and Debelle and Galati (2007) raised concerns about South Africa's large external imbalances and potential economic disruptions. Ncanywa (2018) also concluded that South Africa's current account deficit is not sustainable.

The United States (U.S) has experienced persistent current account deficits over the past few decades. These deficits have been influenced by various factors, including domestic economic policies, global economic conditions, and structural characteristics of the U.S economy. In 2008, the U.S. current account deficit was -4.7% of GDP. The global financial crisis significantly impacted the U.S economy, leading to a reduction in the deficit as imports declined due to lower domestic demand. Our probability approach indicated low probabilities of the deficit falling below the -8% threshold in the near term, which aligned with the observed stability. In the post-crisis recovery period, the deficit halved and narrowed to -2.7 in 2012. In the regard, our models suggested that while the deficit was unlikely to breach the -8% threshold in the short term, there were moderate probabilities (60 -70%) of adjustments over longer horizons (4-5 years).

Since 2012, the U.S current account deficit has remained relatively stable, around 2.5% of GDP. This stability reflects the resilience of the U.S. economy and its ability to attract foreign investment. The COVID-19 pandemic had a mixed impact on the current account balance, with fluctuations in trade and capital flows. However, the overall deficit remained within manageable levels. On domestic economic policies, the Federal Reserve's monetary policy, including interest rate adjustments and quantitative easing, has influenced capital flows and the current account balance. Government spending and tax policies have also played a role in shaping the current account deficit. For example, fiscal stimulus measures during economic downturns have impacted trade balances.

The global economic conditions also play a role, as the U.S attracts significant foreign investment, which helps finance the current account deficit. This is partly due to the dollar's status as the world's primary reserve currency, which positions the economy as the safe heaven during tight economic and financial periods. The moderate probabilities of adjustments over longer horizons, as estimated by our framework, highlight the importance of monitoring economic conditions and implementing policies to ensure long-term sustainability. The case of the United States underscores the importance of ongoing vigilance and adaptive policies to address potential vulnerabilities, even for large and open economies.

Our findings of low probability of unsustainability in the short term, but a moderately increasing risk over the long term, are supported by most of the existing literature. Using intertemporal solvency framework, Milesi-Ferretti and Razin (1996) and Husted (1992) both found U.S current account deficits unsustainable in the long run. Obstfeld and Rogoff (2005)

highlighted risks of abrupt adjustments due to large deficits, while Clarida (2007) emphasized the need for adjustments to mitigate significant risks. Dooley *et. al.* (2004) argued that the U.S could sustain large current account deficits due to its unique position in the global economy but warned of potential vulnerabilities. Similarly, Edwards (2005) uses an interesting approach by employing a combination of econometric analysis and historical case studies. The author concluded that the U.S. current account deficit was unsustainable and highlighted the need for policy adjustments to mitigate risks.

5.4.2 Different paths to achieving current account sustainability and the importance of tailored economic policies

We note some similarities and contrasts in how Greece and Hungary corrected their large deficits.

The global financial crisis played a significant role in exacerbating their economic challenges, prompting urgent reforms. In both countries, fiscal consolidation and austerity measures were central to their strategies, involving spending cuts and tax increases. Both countries received international financial support, which was crucial in stabilising their economies.

While both Greece and Hungary experienced large deficits and implemented substantial reforms, the severity of Greece's situation and the nature of its adjustments were more extreme, and the recovery was slower, and worsened by social unrest due to austerity measures. Hungary's broader range of reforms and quicker stabilisation highlight different paths to achieving current account sustainability. These comparisons underscore the importance of tailored economic policies and the effectiveness of our probability framework in predicting necessary adjustments.

On the other hand, Greece and Hungary faced more severe deficits and required more drastic adjustments compared to South Africa and the United States. We also note differences in policy responses, Greece and Hungary implemented stringent austerity and comprehensive reforms, while the South Africa and the United States used a mix of monetary and fiscal policies with more moderate adjustments. All countries were influenced by global economic conditions, but the U.S. and South Africa's adjustments were also significantly impacted by external shocks like the financial crisis and the COVID-19 pandemic. In terms of recovery, the United States has maintained stability, while South Africa has seen modest improvements with occasional surpluses.

Overall, the comparison highlights the diverse approaches and outcomes in managing current account deficits across different countries. While the United States has maintained stable deficits through a combination of domestic economic policies and its global economic position, countries like Greece and Hungary have faced more severe challenges and required more extensive reforms. South Africa's experience underscores the impact of external shocks and the importance of structural reforms in achieving current account sustainability. These comparisons provide valuable insights into the effectiveness of different economic strategies and the role of global conditions in shaping current account dynamics. More importantly, despite the size and openness of the economy, and current account deficit, our probability approach was able to predict the observed adjustments in each of these countries. We have similar observations about our framework in the case of Australia as well. This is a clear indication that adopting probabilistic models to assess current account sustainability is helpful.

5.4.3 Applying the probability approach to the most recent data and forecasting

Now that we are confident that our probability approach would have worked well in the past, we can further test it for the future using the most recent data. Specifically, we answer one of our main research questions: "By examining data from selected countries, what is the probability that future current account deficits would be on a sustainable path?" We noted that the Kernel density estimates suggest a high likelihood of continued deficits for the Greek, Hungarian, Mexican, and United States economies. Following our discussion in the previous sub-sections, this outcome is not surprising, especially for Greece and Hungary, where large deficits tend to exacerbate external sector vulnerabilities, while long-term risks remain pronounced for the U.S. economy despite its unique position in the global economy. Looking at the latest data of 2023, we identified cases of low, medium, and high probabilities of unsustainable current account paths.

5.4.3.1 Sustainable Current Account Balances

Countries such as Australia, Ireland, Korea, Malaysia, South Africa, and United States have current account balances on sustainable paths, as suggested by low probabilities of falling below the threshold of -8%. This outcome is largely due to stable external positions and economic characteristics. For instance, Australia's external debt has been denominated in domestic currency, the Australian dollar, creating a buffer against exchange rate fluctuations and shielding the economy from increases in the domestic currency value of external

liabilities in the event of a currency depreciation. Additionally, foreign direct investment (FDI) has been stronger than portfolio investment (PI) flows in the last two decades. FDI is a more stable source of financing than PI (Darvas et al 2015), thereby making the Australian economy less prone to external risks.

These findings are consistent with previous research such as Milesi-Ferretti and Razin (1996) and Karunaratne (2012). For instance, Milesi-Ferretti and Razin (1996) finds that that Australia's large current account deficits were sustainable due to strong economic fundamentals and a credible policy framework. The willingness of foreign investors to lend and the country's ability to generate future trade surpluses were crucial factors (Milesi-Ferretti and Razin, 1996).

Similarly, several factors could explain Korea's current account sustainability. These include the country's highly export-oriented economy, with significant contributions from industries such as electronics, automobiles, and shipbuilding; diversified export markets, which reduce dependency on any single market and mitigate risks associated with economic downturns in specific regions; continuous investments in technology and innovation, which enhance local productivity and export competitiveness; substantial FDI, which provides a stable source of external financing; fiscal discipline, which has helped maintain relatively low levels of public debt and budget deficits; and a high domestic savings rate, which supports investment and reduces reliance on foreign capital. Milesi-Ferretti and Razin (1996) also found Korea's current account deficit to be sustainable due to high economic growth and effective policy measures. Findings are further supported by Husein, Kara, and Pier (2023). We observe similar characteristics for the Malaysian economy. Moreover, structural features of the United States economy—such as its reserve currency status, economic size, and continued attractiveness to foreign investors are likely to support the sustainability of its current account deficit.

5.4.3.2 High and Increasing Risk of Current Account Unsustainability

Greece depict a high risk of unsustainability, but this risk declines over the longer forecast horizon. The country's experience of large deficits that prompted policy action in the past, could partly explain its potential to avert the risk of unsustainability in the long-term. On the other hand, we note increasing probabilities of unsustainability over the forecast horizon for countries like Chile and Hungary, indicating potential external vulnerabilities in years ahead.

Several economic characteristics could contribute to the potential unsustainability of Chile's current account in the long term. These factors include heavy reliance on commodity exports, mainly copper. Global commodity prices tend to be highly volatile, which can significantly impact export revenues, leading to abrupt adjustments in the current account balance. The Chilean economy is susceptible to external shocks, such as global financial crises or changes in trade policies of major partners. These shocks can disrupt trade flows and investment, negatively affecting the current account.

Chile often runs a deficit in its services balance, including sectors like tourism and logistics. Persistent deficits in these areas can offset surpluses in goods trade, leading to overall current account deficits. Additionally, Chile has accumulated substantial external debt, which requires regular servicing. This can strain the current account, especially if export revenues decline or interest rates rise. Previous research such as Milesi-Ferretti and Razin (1996), Carranza (2002), and OECD (2024) support our findings.

In summary, our analysis highlights that country-specific factors and external sector characteristics play a significant role in current account sustainability. We also reveal the importance of considering both short-term and long-term dynamics in current account sustainability assessments. Key findings are consistent with previous research, reinforcing the validity of our proposed probability approach.

5.4.4 Global current account imbalances are likely to remain relatively stable

Our results from the extended sample revealed that , using the 2023 data, most countries, dominated by high - and middle-income economies like Denmark, Netherlands, Germany, Brazil, and Argentina, are unlikely to experience unsustainable current account balances across all forecast horizons. Only few low income-countries like Namibia, Senegal and Sudan that are at high risk of unsustainable current account deficits. These findings suggest that the global current account imbalances are likely to remain relatively stable, as the majority of high- and middle-income countries are not expected to face unsustainable deficits. This stability is crucial because these economies have considerable influence on global economy, trade and finance. These findings are consistent with the latest report of the IMF, that global current account imbalances are receding (IMF- External Sector Report, 2024). However, the persistence of excess imbalances in some economies highlights the need for continued policy efforts to promote external rebalancing and ensure long-term stability.

5.4.5 Sectoral Differentiation

In terms of sectoral contributions, our data analysis highlighted that the Government Sector (Gov) is the largest contributor to current account deficits, especially during the Covid -19 pandemic. After global financial crisis, government borrowing surged but has since slowed down as global conditions normalize. Non-Financial Corporates (NFCs) has shown volatility, transitioning from being net borrowers pre-crisis to net lenders post-crisis. Likewise, Financial Corporates (FCs) increased net lending position post-crisis. On the other hand, Households are consistently net lenders, with stable contributions.

Our current account sustainability analysis found that there is no compelling evidence that government-driven current account balances are less sustainable than private sector-driven ones. Bulgaria and Cyprus with Private-sector-driven balances show higher probabilities of unsustainability. Meanwhile, France, Italy, and Spain have Government-sector-driven balances and show lower probabilities of unsustainability. We note that the relatively smaller economies like Hungary and Romania, with Government-driven balances face high risks of unsustainability, but risks diminish over time. Portugal is an outlier with mixed sectoral influences, showing a modest surplus and low probability of falling below critical thresholds.

There are three key factors that appear to influence vulnerability for the different sectors across the selected countries. *First, External Shocks* such as external demand shocks, FDI fluctuations, and political/economic uncertainty significantly impact current account sustainability. For Bulgaria, several NFC-related factors including external demand shocks contribute to the country's heightened external sector vulnerability. For instance, Bulgarian NFCs, particularly in sectors like manufacturing, fuels, IT, and agriculture, are highly reliant on exports. Any decline in foreign demand, especially from the European Union, could significantly reduce export revenues, adversely impacting on the current account.

These NFCs rely on FDI inflows or external borrowing to finance their projects. Any decline in FDI or an increase in borrowing costs could restrict their operational capacity, which can lead to increased outflows from the current account. Furthermore, NFCs with high levels of foreign-denominated debt are exposed to exchange rate fluctuations, adding to this vulnerability. These factors could individually or collectively make Bulgaria's current account balance more vulnerable if it remains heavily driven by non-financial corporates.

For Cyprus, the household sector is sensitive to external economic shocks, such as changes in global energy prices or economic downturns in key trading partners. Geopolitical tensions

can affect household confidence and spending, further impacting the current account. For Romania, the need to finance large fiscal and current account deficits can lead to exchange rate volatility, impacting the current account balance.

Second, the Size of the economy, we noted that smaller economies like Hungary and Romania are more susceptible to external shocks compared to larger economies like Italy and France. Smaller economies often rely heavily on a limited number of export markets and products. This makes them more susceptible to global demand fluctuations and trade disruptions. They are more prone to sudden stops or reversals in capital flows, which can lead to macro - financial instability. Additionally, smaller economies may face higher costs for servicing external debt, especially if they have lower credit ratings. The exchange rate risks also tend to be higher which can increase the domestic currency value of external liabilities. In contrast, our broader analysis using a larger sample of countries suggested that large deficits are strongly associated with high probabilities of unsustainability, while large surpluses indicate low probabilities, regardless of the economy's size. This divergence likely indicates that the latter may not hold at sectoral level, implying that despite the size of the current account deficit, smaller economies' sectoral vulnerabilities can lead to different outcomes compared to larger, more diversified economies like Italy and France.

Third, Sector-Specific Risks, we have noted that economic size appears to matter the most for the Non-Financial Corporates (NFCs) sector. NFCs in smaller economies are highly reliant on exports. A decline in foreign demand can severely impact their revenues and the current account balance. Bulgarian NFCs, particularly in manufacturing and agriculture, are vulnerable to fluctuations in Europea Union demand. Hungary's NFCs depend on FDI for growth, making them sensitive to global investment trends. Romanian NFCs face significant risks from currency volatility affecting their foreign-denominated debt.

The household sector in Cyprus presents several risks that contribute to the high likelihood of current account unsustainability. This includes high household debt, low savings rate and dependence on imports. Many households in Cyprus are heavily indebted, which limits their ability to save and increases their vulnerability to economic shocks. This vulnerability is amplified by rising lending rates. Despite economic challenges, household import demand has remained high, particularly oil, further contributing to the current account deficit.

The government sector in Greece and Romania presents several risks that contribute to the high likelihood of current account unsustainability. Romania has experienced large fiscal deficits, which have widened significantly in recent years. The fiscal deficit was over 6% of

GDP in 2023 and is projected to remain high. The pandemic led to increased public spending, further exacerbating the fiscal deficit. Public debt has increased from 35% of GDP in 2019 to 49% in 2023, with projections to exceed 50% in the coming years. Consequently, Higher debt levels increase the burden of debt servicing, which can strain public finances and impact the current account. Inefficiencies in tax collection and administration reduce government revenues, contributing to fiscal imbalances. Additionally, economic growth slowdown can reduce government revenue, meanwhile high inflation and rapid wage growth can undermine external competitiveness, affecting the trade balance and current account. Similar challenges of High Public Debt, Fiscal Deficits, Dependence on External Financing and fragile Economic growth, high inflation and wage pressures are risks posed by the government sector to Greece's current account sustainability.

In contrast, the government sector in France and Italy does not pose significant risks to current account sustainability for several reasons such as strong fiscal framework, effective debt management and economic resilience. Consequently, these factors boost investor confidence. For instance, France has implemented measures to control public spending and improve fiscal discipline, which helps maintain investor confidence. Likewise, following the Eurozone sovereign debt crisis Italy has been implementing structural reforms and fiscal consolidation measures, which help improve fiscal balance. Additionally, for both countries, the access to EU funds has supported growth and fiscal stability and strengthened by the European Union's fiscal rules. More importantly, a substantial portion of Italian debt is held by domestic investors, which reduces exposure to speculative attacks.

The driving sector (private or government) is not the sole determinant of current account sustainability. External shocks, political and economic conditions, economic size, and structural vulnerabilities play a critical role in shaping the risk of current account unsustainability. This analysis highlights the importance of considering not only the sectoral contributions, but broader economic factors in assessing current account sustainability.

4.5.7 Overall comparison of our methodology to the existing literature

So far, our discussion shows that across the countries in our sample, the findings are broadly similar to those from the previous studies. This observation strengthens the significance of our proposed probability approach, as our models are capable of producing reliable results that are consistent with established methodologies. Our probability approach offers enhanced insights by quantifying the uncertainty and calculating the probabilities of different outcomes. This adds a layer of detail and precision that traditional methods may lack, and providing more actionable information for policymakers based on historical episodes.

The flexibility in our approach means that even if the broad conclusions are similar to previous research, the framework can uncover specific risk factors that other methods might miss due to the imposed restrictive assumptions. More importantly, the consistency of results with previous studies serves as empirical validation of our probability framework. It demonstrates that our approach is not only empirically sound but also practically effective in analysing current account sustainability. Quantifying the likelihood of different outcomes, provides a clearer picture of the risks associated with current account deficits.

This helps policymakers understand the probability of current account (un)sustainability under different scenarios. While the previous research may identify risks as well, they often do not quantify the likelihood of different outcomes, which can make it harder to gauge the severity of potential external sector crises.

5.5 Conclusion

This chapter mainly covers our empirical contribution in studying the sustainability of current account balances. Using various forecasting models, we generated five-year forecasts and quantified their uncertainty. Our method successfully identified unsustainable deficits in historical cases and accurately predicted current account adjustments across different countries.

By analysing the sustainability of the 2023 current account balance of selected countries, we identified cases of sustainable current account balance, high-risk of unsustainability and increasing risks over longer horizons. The analysis of these findings suggests that country-specific factors and external sector characteristics significantly influence sustainability. Moreover, the varying degrees of current account sustainability across different countries can be attributed to several factors, including economic structure, policy frameworks and external vulnerabilities. Therefore, it is important that policies are well-tailored and country specific.

We also reveal that while for some countries sustainability is observed in the short-term, there are pockets of long-term vulnerabilities threatening sustainability in longer forecast horizons. This finding underscores the need for continual monitoring and analysis of current account balances to detect unsustainability risks as the economic conditions and policies evolve.

Our results from the extended sample suggest that the global current account balance is likely to remain relatively stable, as the majority of high- and middle-income countries are not expected to face unsustainable deficits. However, the disparities between high- and low-income countries highlight the need for targeted economic policies to support vulnerable economies. This approach can help mitigate risks and promote a more balanced global economic environment.

One of the key findings is that there no strong evidence that a government-driven current account deficit is more or less likely to be sustainable than one driven by the private sector. This outcome implies that while important, we should not over-emphasise the role of the sectoral drivers of the current account balance. Mainly because other such as external shocks, fiscal discipline, economic size, and structural vulnerabilities, play crucial roles.

The findings from the moving window out-of-sample forecast analysis suggest that the 1-year ahead forecast is most effective as a crisis signal, reacting strongly when deficits are large and unsustainable. For low to moderate deficits, longer-term forecasts offer a more reliable lens for assessing sustainability, as they incorporate structural and cyclical dynamics that may not manifest immediately. The model's behaviour in 2022 highlights how country-specific dynamics can override global trends. While most economies faced elevated risks, Ireland and Malaysia demonstrate how structural factors and policy responses can insulate against external shocks. Our methodology has limitations, including reliance on a small sample and linear models. On the sample size, using the latest data we did incorporate more countries to narrow this caveat. The application of our proposed probability approach relies on linear models. However, since our nonlinearity test results are at best mixed, further research could explore nonlinear models to capture any aspects of the data generating process that would be better explained by such a model.

The sustainability threshold may differ across countries. The primary focus of our analysis is on the direction of change in probabilities over different forecast horizons rather than specific threshold values. This focus on evolving probability dynamics allows us to capture trends in the likelihood of current account (un)sustainability across forecast horizons without

needing country-specific thresholds. Although we do not rely on absolute probabilities in this study, it is acknowledged that future work focused on these would indeed benefit from country-specific thresholds.

Despite these limitations, in addition to our historical analysis, the consistency of our results with those of established studies like Husted (1992), Obstfeld and Rogoff (1996) and Edwards (2002) validates the robustness of our methodology. Our proposed approach provides a better understanding of current account sustainability by integrating the role of uncertainty and offering a probabilistic framework that allows us to quantify uncertainty surrounding the future values of the current account and calculating the probabilities of different possible outcomes. The envisaged methodology would be helpful in international institutions like the International Monetary Fund, which is mandated to assess external positions and plays a role in alerting the global community of potential balance-of-payment strains and providing policy advice to reduce such risks.

CHAPTER 6

SUMMARY OF THE THESIS, CONCLUDING REMARKS, POLICY IMPLICATIONS, LIMITATIONS, FUTURE RESEARCH, AND ANSWERS TO RESEARCH QUESTIONS

6.1 Summary of the thesis and concluding remarks

This thesis highlights the risks associated with persistent and excessive current account deficits, which often necessitate severe economic adjustments, as seen in cases like Greece and Chile. Existing literature faces conceptual and modelling limitations in assessing current account sustainability. The primary objective of this thesis is to contribute to the analysis of current account deficit sustainability by attempting to clarify its concept, establish stylised facts about adjustments and reversals, and propose a probabilistic framework – which is heavily empirical to assess sustainability. The analysis draws on data from selected advanced and emerging economies.

6.1.1 Conceptualisation of current account sustainability

Chapter 2 critiques the existing definitions and empirical approaches to current account sustainability. Early intertemporal models viewed large deficits as signals of investment opportunities, but subsequent crises, such as the 1980s debt crisis, exposed their limitations. The intertemporal framework, which defines sustainability as the ability to generate future trade surpluses to meet debt obligations, has been valuable in providing a foundation for understanding current account dynamics. However, it has been criticised for assuming perfect foresight and complete information, thereby treating economic uncertainty as a secondary concern.

Uncertainty is the lack of clarity about the future, affecting economic agents' behaviour. This lack of clarity about the future state of the economy influences government and private borrowing decisions to finance investment and consumption, as well investor decisions to lend. In this context, Chapter 4 discusses the importance of incorporating economic uncertainty into models analysing current account sustainability. We introduce a probabilistic framework based on density forecasts, which characterises the distribution of possible future current account values.

6.1.2 Dynamics of current account adjustments

Chapter 3 examines current account adjustments, focusing on reversals of large deficits. It identifies some theoretical triggers for reversals, including overvalued exchange rates, large deficits, and sudden capital flow stops. A key contribution is refining the definitions of reversal and non-reversal episodes, by avoiding overlaps and excluding extreme deficits to improve accuracy.

The graphical analysis indicates that reversals are common and often occur during domestic imbalances or global economic shocks. While deficits exceeding 8% of GDP significantly increase reversal probabilities, strong macroeconomic indicators can mitigate risks. We demonstrate that the economy tends to overheat before the reversals, a process which is often accompanied by heightened financial vulnerability. Overall, reversal episodes are characterised by significant macroeconomic adjustments, including reductions in investment, increases in savings, and declines in external debt, which eventually lead to improved economic growth. In contrast, non-reversal episodes show more stability but persistent current account deficits.

The empirical evidence confirms that the probability of reversals is predicted to be higher in countries with large current account deficits. Our findings further indicate that global economic and financial conditions—particularly world growth and U.S. real interest rates—play a more impactful role. Similar to conclusions by Debelle and Guy (2005), it appears that these global developments often precipitate current account adjustments, likely by triggering the unwinding of underlying domestic macroeconomic imbalances. Moreover, the growth effects associated with current account reversals underscore the influential role of global demand. At the same time, preceding domestic conditions—particularly pre-reversal economic growth and the real effective exchange rate—also significantly shape the trajectory and intensity of these effects. This dual influence highlights the importance of considering both external and internal factors when assessing the macroeconomic consequences of current account adjustments.

6.1.3 Applying a probabilistic framework for sustainability

Chapter 5 tests the proposed probabilistic approach using data from selected advanced and emerging economies. Our method successfully identifies historical cases of unsustainable deficits and predicts adjustments across countries. Moreover, it captures varying degrees of unsustainability, likely reflecting country-differences in economic structures, policy frameworks, and external vulnerabilities.

Contrary to conventional view, we did not find significant differences between the sustainability of deficits driven by government versus private sectors. This underscores the importance of considering a broad set of factors, beyond sectoral differences.

More importantly, the findings from the moving window out-of-sample forecast analysis demonstrate the usefulness of our proposed framework by showing its responsiveness to both crisis conditions (like Covid19 period) and gradual shifts makes it a valuable tool for policymakers, analysts, and researchers. By integrating forecast horizon sensitivity, it supports nuanced and timely decision-making in the face of evolving global economic challenges.

Using country-specific thresholds derived from the IMF External Balance Assessment (EBA) norms, our probability framework effectively identifies sustainable current account balances for Australia, Malaysia, and Mexico, in line with the IMF's 2024 External Sector Report. However, we also identified some divergences between our model's predictions and the IMF's external balance assessments. Our framework may be more sensitive to short-term volatility and cyclical factors, which are often underweighted in the IMF's medium-term structural assessments. This suggests that our model could be more responsive in capturing near-term

risks, especially in economies exposed to commodity price fluctuations or capital flow volatility like South Africa. Our model provides a probabilistic, data-driven lens that can flag potential risks earlier than structural assessments might. However, this also signals that to enhance practical applicability of the model continuously refining the sustainability thresholds could improve its predictive accuracy. This is a scope for future research.

6.2 Policy implications

Chapter 3 of our thesis reveals that global economic and financial conditions—particularly world growth and U.S. real interest rates—are significant predictors of current account adjustments for both developing and developed economies. In examining the growth effects of current account reversals, our findings show that domestic economic conditions—alongside global developments—play a critical role. These insights carry important policy implications, particularly for countries that are vulnerable to external shocks and face persistent current account imbalances. Recognising the interplay between global and domestic factors is essential for designing effective and context-sensitive adjustment strategies.

Since global developments often precipitate current account adjustments, likely by triggering the unwinding of underlying domestic macroeconomic imbalances, domestic policymakers should avoid complacency regarding sizeable current account deficits, even if these have persisted for years. Instead, they should prioritise strengthening of macroeconomic resilience. This requires implementing counter-cyclical fiscal and monetary policies, alongside structural reforms to mitigate the impacts of global downturns and tightening financial conditions. Close monitoring of global financial developments remains essential. Countries should also invest in early warning systems and scenario-based stress testing frameworks that incorporate global indicators to better anticipate potential reversals.

Furthermore, promoting trade diversification and regional integration is essential to reduce vulnerability to fluctuations in global demand. While global factors lie beyond the control of individual economies, coordinated policy responses can mitigate cross-border spillovers. In this context, active participation in international forums—such as the Group of Twenty (G20)—is crucial for advocating stable global financial conditions and inclusive growth.

Since domestic economic conditions—particularly pre-reversal GDP growth— also play a critical role in shaping the growth effects of current account reversals, it is essential for

countries to invest in institutional capacity. Strengthening areas such as fiscal management, financial regulation, and social safety nets can help ensure smoother adjustment processes and mitigate the adverse growth impacts associated with reversals.

In Chapter 5, our study identifies three country profiles: sustainable current account balances (e.g., United States and South Africa), high-risk unsustainability (e.g., Chile and Greece), and increasing risks over longer horizons (e.g., Hungary).

Countries with sustainable current accounts can maintain their existing policies, as these reflect underlying policy stability. Furthermore, such countries may have scope to further liberalise trade without risking external imbalances. This could enhance their attractiveness to foreign investors and support efforts to diversify exports.

However, the recent trade war and tariff hikes of the new United States (U.S.) administration present an interesting case for the United States' trade policy. We find a sustainable current account deficit for the U.S., which implies no need for aggressive trade restrictions aimed at reducing the goods trade deficit. Moreover, the United States trade deficit may not reflect unfair trade practices, as the U.S government claims but rather structural economic characteristics and preferences.

According to the New Trade Theory of Krugman (1979), trade patterns can emerge from economies of scale and consumer preferences. The U.S. likely imports more goods due to strong consumer demand, its deep integration into global supply chains, and its comparative advantage in services and capital-intensive industries—while importing labour-intensive and consumer goods. Addressing the trade deficit through tariffs risks misdiagnosing these structural drivers and could harm sectors reliant on imported production inputs. On the other hand, Gourinchas et al. (2024) argue that in the post-pandemic period, the U.S. trade balance has been primarily driven by domestic macroeconomic factors—notably persistent dissaving and a widening fiscal deficit—which have exacerbated the current account deficit. Accordingly, the appropriate policy remedies should focus on addressing these domestic imbalances, particularly through fiscal consolidation and the reinforcement of sound macroeconomic policy frameworks. Complementing this view, the 2025 IMF External Sector Report finds that higher tariff barriers in deficit countries like the U.S. have only a marginal impact on global imbalances. This is largely because tariffs function as a negative supply shock within the tariff-imposing country, rather than correcting underlying demand-side imbalances.

For countries facing high-risk unsustainability, targeted measures to reduce trade deficits should be considered. These may include strategies such as import substitution and export promotion. Tariff reforms—such as temporary tariffs or quotas—could be implemented to curb excessive imports, provided they comply with World Trade Organization (WTO) rules. Structural reforms, particularly in areas like labour productivity and infrastructure, may be necessary to address any underlying competitiveness challenges. Additionally, maintaining flexible exchange rate regimes may help correct imbalances. Most importantly, strengthening macroeconomic fundamentals is essential to reduce vulnerability to external shocks such as sudden reversals in capital flows.

Countries experiencing increasing risks over longer forecast horizons may require the prevention of domestic macroeconomic imbalances and focused adjustments to trade policy to ensure a forward-looking framework that anticipates potential imbalances. Promoting export competitiveness may be crucial for maintaining a stable current account balance. Moreover, strengthening trade ties within regional blocs can enhance economic resilience. It is also important to maintain cautious flexibility in trade policy to respond effectively as risks materialise.

Overall, all countries should consistently monitor current account trends and adjust trade policies in a fair manner, that complies with WTO rules. To advance further, policymakers may start integrating sustainability indicators into trade policy frameworks to ensure long-term external stability.

Beyond the trade policy implications, the variation in current account sustainability across countries is not a surprise, as this likely reflects the influence of country-specific factors and external sector characteristics on sustainability– although these factors are not explicitly explored in this study. Countries with sustainable current accounts may focus on maintaining prudent fiscal policies, enhancing export competitiveness, and diversifying their economies. These measures could help sustain their current account balances and mitigate potential risks. Our analysis has shown that for countries with high-risk current accounts, it is crucial to improve external sector resilience and manage debt levels effectively. Structural reforms aimed at boosting productivity and competitiveness may also play a vital role in mitigating risks. More importantly, these measures could encourage both long-term investments and portfolio flows that would provide the necessary financial resources.

For countries with increasing risks over longer horizons, the key policy implication is the need

for long-term strategic planning, continuous monitoring, and periodic reassessment of current account balances. Establishing early warning systems can help detect emerging risks and enable timely policy adjustments. The specific policy actions could include strengthening economic resilience by diversifying the economy, ensuring fiscal discipline, and building robust financial systems. Developing adaptive policy frameworks that can be adjusted as new data and trends emerge ensures that policies remain effective over time.

Our research further indicates that both government and private sector-driven deficits require attention. The analysis of these results suggests that in addition to the driving sector of the deficit, it is important to consider external shocks, fiscal discipline, economic size, and structural vulnerabilities to capture the vulnerability of current account imbalances.

In summary, across all country profiles, integrating sustainability indicators, maintaining macroeconomic stability, and enhancing competitiveness may be crucial to ensuring long-term external balance and attracting stable capital flows.

6.3 Limitations of the research and further research

A limitation of the implementation of our proposed probability approach is the use of linear models. We have argued that large current account deficits can be unsustainable under certain circumstances and can adjust abruptly, suggesting that the dynamics of the current account can be nonlinear. However, our nonlinearity test results are at best mixed. Therefore, it would be important to extend the research to include nonlinear models to uncover other aspects of the data generating process. For example, future research could estimate a smooth transition VAR, in which both states (normal times versus capital flow reversals) could be modelled directly.

A further limitation is the use of a uniform threshold of -8% of GDP for the current account across all countries in our baseline specification. However, the sustainability threshold may differ across countries, influenced by country-specific factors, such as reserve currency status, which could justify a higher sustainable deficit for the United States. While we emphasise the time profile of the estimated probability of falling below the threshold over a one- to five-year ahead horizon—an indicator that is independent of the threshold's level— future work could focus on deriving country-specific thresholds. The importance of this limitation is underscored by some discrepancies we identified in subsection 5.3.1.6. Although we conducted a

complementary exercise using the IMF's country-specific current account norms as thresholds, these norms represent equilibrium values, whereas countries may sustain larger deficits for prolonged periods.

We selected ten countries that have historically experienced persistent current account deficits, with some undergoing adjustment and others not. Extending this research to a broader sample could help identify additional country-specific factors influencing current account dynamics and the associated risks to sustainability. Nonetheless, the selected economies offer a diverse set of cases for examining the sustainability of current account balances.

Data accessibility constraints—specifically, the availability of net financial balance data at the sectoral level—limited our sectoral analysis to European Union countries. Within this group, we focused on those with a history of prolonged current account deficits. Ideally, broader regional representation would enhance the generalisability of the results.

Finally, the database was limited in terms of the number of variables included. Expanding future research to incorporate additional explanatory variables would be valuable. However, this limitation does not undermine the relevance of the variables used, as they maintain a strong theoretical and empirical link to current account dynamics.

6.4 Answering the research questions

6.4.1 What are the strengths and weaknesses of conceptual definitions and empirical methods used in the literature to assess the current account's sustainability?

Key strengths of the intertemporal solvency models include strong economic theoretical foundations, which provide a clear and structured approach for assessing current account sustainability. These models take a long-term perspective by emphasising a country's ability to meet its external obligations over time, accounting for future trade surpluses and deficits. Additionally, the models assume that economic agents have rational expectations, which can lead to more accurate predictions of future economic behaviour. Moreover, intertemporal models incorporate expectations of future net cash flows, making them a forward-looking approach that offers insights into future sustainability based on current and expected economic conditions. Another important advantage is their ability to directly link the current account balance to changes in the debt-to-GDP ratio, highlighting the importance of maintaining a

sustainable level of foreign indebtedness.

On key weaknesses, the intertemporal solvency framework assumes that individuals have perfect foresight and complete information, which is often unrealistic in practice. Furthermore, the model's simplistic assumptions about the behaviour of economic agents and the structure of the economy may oversimplify complex real-world interactions, and the basic model does not account for government actions or liquidity constraints, which can significantly impact a country's ability to meet its obligations. Moreover, the intertemporal models' reliance on expectations of future net cash flows means that it can be highly sensitive to changes in these expectations, which can be influenced by unpredictable factors such as political events or global economic shocks. Thus, considering economic uncertainty is vital.

Empirical applications are another key drawback, because the intertemporal models oversimplify complex economic interactions and may not capture the comprehensive picture of a country's external sustainability. Overall, while the intertemporal solvency framework provides valuable insights into current account dynamics, it is important to consider its limitations and complement it with other approaches and empirical analyses.

6.4.2 What are the main stylised facts about historical episodes of current account deficit reversals? What factors contribute to a current account deficit reversal?

We answer these questions in three ways:

***First*,** we find that reversals are not rare, but there was no significant increase over the years.

***Second*,** we find macroeconomic conditions around reversal and non-reversal episodes are characterised by:

- *Pre-reversal episodes:* Macroeconomic fundamentals are dwindling, potentially necessitating the correction in the CA deficit.
- *Post- reversal episodes:* the economy undergoes significant adjustment, and it takes about a year for the economy to rebound, with increasing growth and FDI inflows and falling external debt.
- *Non-reversal episodes* are characterised by a lower current account deficit (5%); a growing economy and low fiscal deficit. They are also characterised by generally stronger

macroeconomic fundamentals compared to the aftermath of reversal episodes.

***Third*, by using a multivariate probit model:**

- We find that global factors, such as world growth, play significant roles.
- The predictability of reversals remains consistent pre- and post-global financial crisis. For instance, countries with a high current account balance are less likely to experience reversals. The world growth and U.S real interest remains significant predictors of reversals, particularly for low- and middle-income countries.
- Our finding of broadly unchanged predictability of reversals across time implies that external vulnerabilities are not necessarily cyclical, but rather tied to deeper macroeconomic and global linkages i.e more structural.
- The impact of current account reversals on growth largely depends on prior domestic and global growth conditions, on whether the real effective exchange rate was overvalued prior to the reversal, and on fiscal discipline pre-reversal.
- The growth effects of reversals reflect structural shifts in the global economy and the rising influence of global conditions on domestic growth. In this context, domestic policies and fundamentals may have become much less influential in a more interconnected and volatile global environment. For instance, while pre-reversal domestic GDP growth remains significant determinant of reversals post-GFC, the effect is less pronounced compared to pre-GFC era.
- Reversals that coincide with crisis periods tend to amplify negative effects, and frequent reversals are particularly harmful to growth.

6.4.3 Conceptually, how to define current account sustainability?

Our thesis highlights that the question of current account sustainability does not have a simple yes or no answer. Instead, it should be viewed as a probabilistic concept that reflets economic uncertainty, providing a more nuanced and realistic approach to the understanding and assessment of sustainability. We propose a probabilistic framework using density forecasts, which estimate the distribution of the future current account balance.

6.4.4 How to define current account sustainability in a probabilistic setting?

We introduce a novel probability approach to examine the sustainability of the current account balance by generating density forecasts and calculating the probability that the current account balance will be lower than a specified threshold. When this probability is low, the current account deficit is unlikely to spiral out of control, indicating sustainability. Conversely, a high probability throughout the forecast horizons, or a considerably increasing probability as the forecast horizon increases, indicates unsustainability. Moreover, the estimated evolution of this probability is crucial: an initially low, but rising probability with the forecast horizon suggests that the current account might become unsustainable in the absence of policy intervention.

6.4.5 By examining data from selected countries, what is the probability that future current account deficits will be on a sustainable path?

By examining data from selected countries, we identified cases of sustainable current account balances, high-risk unsustainability, and increasing risks over longer horizons. The varying degrees of current account sustainability across different countries can be attributed to several factors, including economic structure, policy frameworks, and external vulnerabilities. Therefore, it is important that policies are well-tailored and country specific.

6.4.6 By examining data from selected countries, what is the likelihood that a current account deficit driven by the government sector is less sustainable than when the private sector drives the deficit?

We find no evidence that government-driven deficits are less sustainable than private sector-driven deficits.

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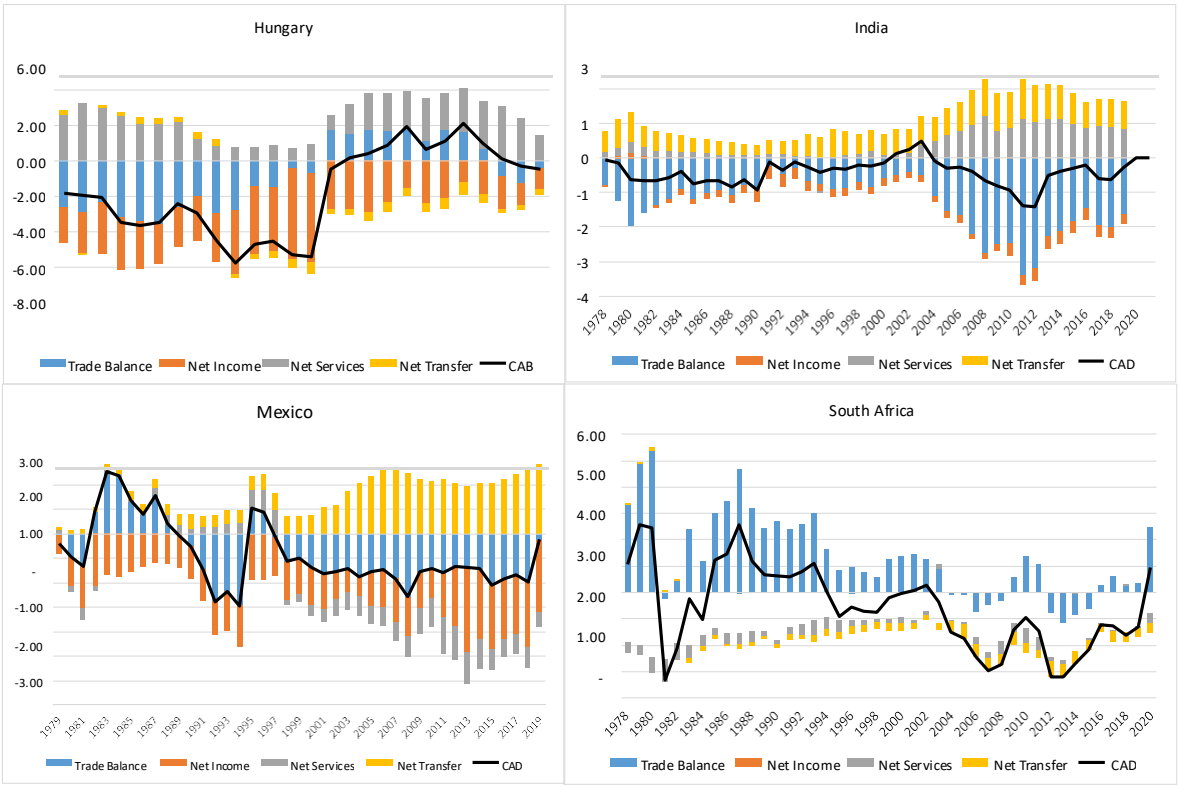
APPENDICES

A. The current account balance and its composition in selected countries



Source: International Monetary Fund-International Financial Statistics and Institute of International Finance.

Note: All data is presented as a percent of GDP.

B. Data definitions and sources

Variable	Definition	Source
CA	Current account balance (% of GDP)	IMF-WEO
GDP GROWTH	Gross Domestic Product growth (%)	IMF-WEO
INVESTMENT	Gross Capital Formation (% of GDP)	IMF-WEO
SAVINGS	Savings (% of GDP)	IMF-WEO
PUBLIC DEBT	General government gross debt (% of GDP)	IMF-WEO
BUDGET BALANCE	General Government Net lending (+) / net borrowing (-) (% of GDP)	IMF-WEO
FOREIGN RESERVES/IMPORT	Total reserves/months of imports	WB
EXTERNAL DEBT	External debt stocks (% of GNI)	WB
FDI NET INFLOWS	Foreign direct investment, net (% of GDP)	WB
TRADE OPENNESS	Trade Openness (% of GDP)	WB
TOTAL DEBT SERVICE	Total debt service (% of GNI)	WB
WORLD GROWTH	GDP growth (annual %).	WB
US REAL INTEREST RATE	Real interest rate (%). The Real Interest Rate are calculated as ((1+i)/(1+π^e)-1)*100, where i= Federal Funds Effective Rate; π^e = Inflation expectations.	WB
REAL EFFECTIVE EXCHANGE RATE	CPI-based Real effective exchange rate index (reversal year= 100)	Bruegel Institute
INFLATION RATE	Inflation, average consumer prices	WB
INTEREST PAYMENT/GOVERNMENT REVENUE	Interest payments (% of revenue)	WB
SHORT-TERM_EXTERNAL DEBT	Short-term debt (% of total external debt)	WB

Notes: IMF-WEO=International Monetary Fund-World Economic Outlook 2022;
WB=World bank Database. Real Interest Rate: Federal Funds Effective Rate, Percent, monthly, Not Seasonally Adjusted and sourced from Federal Reserve Bank of St. Louis >>Federal Reserve Economic Data. We convert the data to annual averages. We use the Fall WEO historical forecasts for the inflation expectations. Since inflation expectations are only available from 1990, we used backward-looking inflation data from IMF-WEO April 2023 for the period 1980-1989.

C. Testing the link between time period and reversals and non-reversals

Reversals	Pearson $\chi 2$ (1) = 2	Decision
3%	Pr= 0.157	We fail to reject H0
5%	Pr= 0.157	We fail to reject H1
Non-Reversals		
1.5%	Pr= 0.157	We fail to reject H0
2.5%	Pr= 0.157	We fail to reject H1

Source: Author's calculations. Notes: ***Null Hypothesis (H0)***: There is no association between the time period and the occurrence of current account reversals and non-reversals. *The frequency of reversals and non-reversals is the same across different periods.* ***Alternative Hypothesis (HA):*** There is an association between the period and the occurrence of current account reversals and non-reversals. *The frequency of reversals and non-reversals varies across different periods*.

D. Incidents of reversals (200)

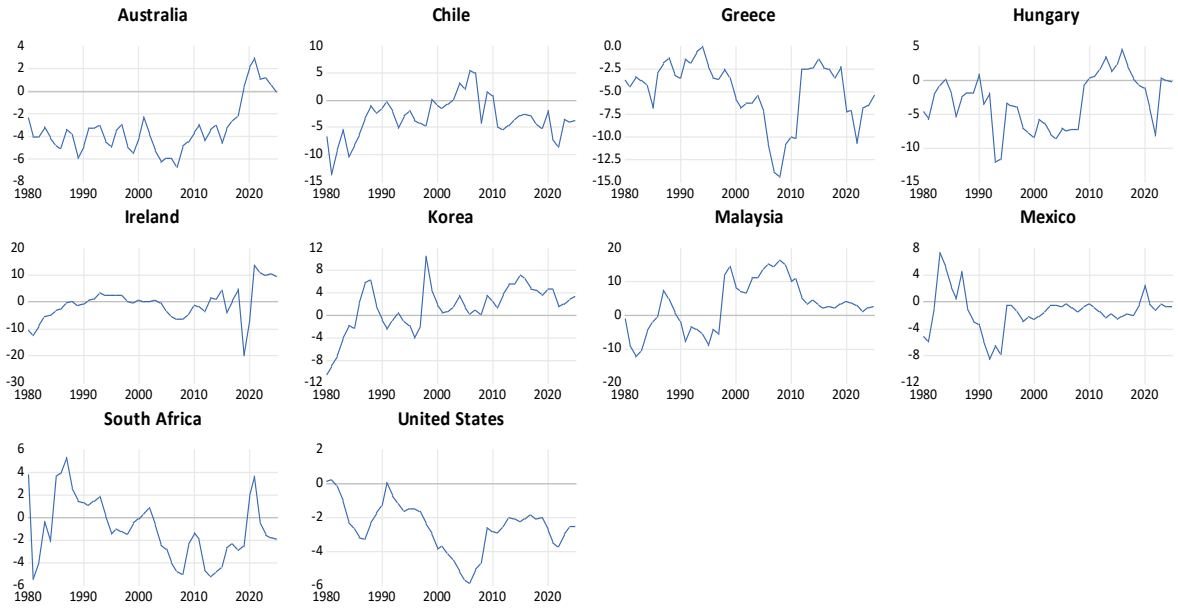
Incidents of Reversals (200)		
Country	**Year**	**Income group**
Algeria	1980	Middle-income
Algeria	1990	Middle-income
Algeria	2018	Middle-income
Algeria	2021	Middle-income
Angola	2004	Middle-income
Angola	2017	Middle-income
Argentina	2000	Middle-income
Argentina	2019	Middle-income
Armenia	1999	Middle-income
Armenia	2002	Middle-income
Armenia	2011	Middle-income
Armenia	2015	Middle-income
Armenia	2021	Middle-income
Australia	2017	High-income
Australia	2020	High-income
Austria	2002	High-income
Bahrain	2000	High-income
Bahrain	2003	High-income
Bahrain	2018	High-income
Belarus	1992	Middle-income
Belarus	2007	Middle-income
Belarus	2015	Middle-income
Belgium	2017	High-income
Belgium	2021	High-income
Benin	1984	Low-income
Benin	2004	Low-income
Botswana	2006	Middle-income
Brazil	1985	Middle-income
Brazil	2013	Middle-income
Brazil	2022	Middle-income
Bulgaria	1994	Middle-income
Bulgaria	2021	Middle-income
Burkina Faso	1994	Low-income
Burkina Faso	2009	Low-income
Burundi	2009	Low-income
Burundi	2016	Low-income
Chile	1980	Middle-income
Chile	2017	Middle-income
China	1987	Middle-income
China	1999	Middle-income
China	2003	Middle-income
Costa Rica	1988	Low-income
Costa Rica	1999	Low-income
Côte d'Ivoire	2000	Middle-income
Croatia	2000	High-income
Democratic Republic of the	2009	Low-income
Democratic Republic of the	2013	Low-income
Denmark	1980	High-income
Denmark	1985	High-income

Denmark	2011	High-income
Egypt	2013	Middle-income
Eritrea	2015	Low-income
Estonia	2020	High-income
Eswatini	2011	Middle-income
Ethiopia	2008	Low-income
Finland	2018	High-income
France	1984	High-income
France	2009	High-income
Gabon	1993	Middle-income
Germany	1994	High-income
Germany	2021	High-income
Ghana	2019	Middle-income
Greece	1999	High-income
Greece	2009	High-income
Guatemala	2015	Middle-income
Guinea	2010	Low-income
Guinea-Bissau	1997	Low-income
Guinea-Bissau	2014	Low-income
Haiti	2000	Low-income
Haiti	2021	Low-income
Honduras	1995	Middle-income
Honduras	1998	Middle-income
Honduras	2014	Middle-income
Hong Kong SAR	1992	High-income
Hong Kong SAR	2014	High-income
Hungary	1994	High-income
Hungary	2009	High-income
India	1983	Middle-income
India	1998	Middle-income
Indonesia	2009	Middle-income
Iran	1998	Middle-income
Iraq	2009	Middle-income
Iraq	2012	Middle-income
Israel	1994	Middle-income
Jamaica	1986	Middle-income
Jamaica	2009	Middle-income
Jamaica	2021	Middle-income
Japan	1985	High-income
Japan	2003	High-income
Jordan	1993	Middle-income
Jordan	2012	Middle-income
Kazakhstan	1992	Middle-income
Kazakhstan	2014	Middle-income
Korea	2010	Middle-income
Kuwait	2014	Middle-income
Kyrgyz Republic	1998	Middle-income
Lao P.D.R.	2014	Low-income
Lebanon	2000	Low-income
Lebanon	2001	Low-income
Lesotho	1990	Low-income
Lesotho	2019	Low-income
Liberia	2009	Low-income
Liberia	2014	Low-income
Lithuania	2013	Middle-income
Lithuania	2017	Middle-income
Madagascar	2000	Low-income
Madagascar	2009	Low-income
Mali	2022	Low-income
Mangolia	1995	Middle-income
Mauritania	2011	Middle-income
Mexico	2001	Middle-income
Moldova	2012	Middle-income
Morocco	1999	Middle-income
Morocco	2009	Middle-income
Mozambique	2004	Middle-income
MUS	2011	Middle-income
Namibia	2001	Middle-income
Namibia	2004	Middle-income
Nepal	2001	Low-income
Nepal	2004	Low-income
Netherlands	2017	High-income
Nicaragua	1995	Middle-income
Nicaragua	1999	Middle-income
Niger	1981	Low-income
Nigeria	2009	Low-income
North Macedonia	2009	Middle-income
North Macedonia	2017	Middle-income
Norway	1983	High-income
Oman	2000	High-income
Pakistan	2010	Middle-income
Panama	2000	Middle-income
Panama	2022	Middle-income
Papua New Guinea	2000	Low-income
Papua New Guinea	2010	Low-income
Peru	1982	Middle-income
Peru	1987	Middle-income
Peru	2019	Middle-income
Philippines	1985	Middle-income
Philippines	1990	Middle-income
Philippines	1993	Middle-income
Philippines	2000	Middle-income
Philippines	2014	Middle-income
Poland	1988	High-income
Portugal	1984	High-income
Portugal	1999	High-income
Portugal	2003	High-income
Portugal	2016	High-income
Puerto Rico	1984	Middle-income
Puerto Rico	2002	Middle-income
Republic of Congo	1984	Low-income
Republic of Congo	2011	Low-income
Rwanda	1999	Low-income
Rwanda	2009	Low-income
Rwanda	2013	Low-income
Saudi Arabia	2020	High-income
Senegal	2015	Low-income
Serbia	2000	Middle-income
Sierra Leone	2013	Low-income
Singapore	1990	High-income
Singapore	2018	High-income
Slovak Republic	2002	Middle-income
Slovak Republic	2020	Middle-income

Slovenia	1990	High-income
Slovenia	2005	High-income
Somalia	2012	Low-income
Spain	1985	High-income
Sri Lanka	2015	Middle-income
Sweden	1999	High-income
Sweden	2021	High-income
Switzerland	1985	High-income
Switzerland	2006	High-income
Thailand	1997	Middle-income
Thailand	2014	Middle-income
Togo	2017	Low-income
Trinidad and Tobago	1989	Middle-income
Trinidad and Tobago	2000	Middle-income
Tunisia	1985	Middle-income
Turkmenistan	2000	Middle-income
Turkmenistan	2018	Middle-income
Uganda	2002	Low-income
Ukraine	1999	Middle-income
Ukraine	2014	Middle-income
Uruguay	2015	Middle-income
Uzbekistan	2000	Low-income
Vietnam	1996	Middle-income
Vietnam	1999	Middle-income
Vietnam	2010	Middle-income
Yemen	1994	Middle-income
Yemen	1999	Middle-income
Yemen	2010	Middle-income
Zambia	1987	Middle-income
Zambia	2003	Middle-income
Zambia	2018	Middle-income
Zimbabwe	1998	Low-income
Zimbabwe	2014	Low-income
Zimbabwe	2019	Low-income

Notes: This is a list of reversal episodes at 3 percent threshold, excluding *extreme* current account deficits.

E. Current account balance (% of GDP) – actual data plots



Source: IMF- World Economic Outlook, 2025

F. Probit analysis: pre- and post-GFC

	Sample period: 1980-2007			Sample period: 2008-2022		
	Full Sample	**Low & Middle Income countries**	**High Income countries**	**Full Sample**	**Low & Middle Income countries**	**High Income countries**
CURRENT ACCOUNT_LAG	-0.1094***	-0.1091***	-0.1154	-0.1010***	-0.1211***	-0.1087***
	(0.023)	(0.028)	(0.075)	(0.017)	(0.021)	(0.039)
WORLD GROWTH_LAG	-0.4743***	-0.5842***	-0.6661*	-0.0700	0.0611	-0.5568**
	(0.153)	(0.201)	(0.403)	(0.094)	(0.115)	(0.266)
REAL INTEREST RATE USA_LAG	0.0760	0.1539**	0.0763	-0.0235	-0.0960	0.2182
	(0.054)	(0.075)	(0.145)	(0.071)	(0.087)	(0.150)
FDI NET INFLOWS_LAG	-0.0129	0.0103	-0.0562	-0.0056	0.0030	-0.0158
	(0.029)	(0.036)	(0.177)	(0.018)	(0.032)	(0.027)
REAL EFFECTIVE EXCHANGE RATE_LAG	0.0029	0.0022	-0.0220	0.0071	0.0099	0.0015
	(0.004)	(0.005)	(0.062)	(0.009)	(0.010)	(0.034)
GDP GROWTH_LAG	0.0057	0.0089	-0.0985	0.0068	-0.0062	0.1441
	(0.031)	(0.035)	(0.222)	(0.031)	(0.037)	(0.118)
BUDGET BALANCE_LAG	-0.0108	-0.0022	-0.1927*	0.0149	-0.0062	-0.1151*
	(0.019)	(0.027)	(0.102)	(0.020)	(0.028)	(0.068)
INVESTMENTS_LAG	0.0290	0.0127	-0.0212	0.0072	0.0075	-0.0511
	(0.018)	(0.022)	(0.119)	(0.015)	(0.022)	(0.062)
TRADE OPENNESS_LAG	-0.0028	0.0011	-0.0085	-0.0001	0.0010	-0.0036
	(0.003)	(0.004)	(0.010)	(0.002)	(0.004)	(0.004)
SAVINGS_LAG	0.0064	0.0146	0.1539**	-0.0131	-0.0124	0.0361
	(0.014)	(0.018)	(0.076)	(0.013)	(0.019)	(0.048)
*INTEREST PAYMENT_LAG			-0.0537			0.8218
			(0.077)			(3.592)
C	-0.8460	-0.4914	0.2945	-1.8461*	-2.9274**	-0.0340
	(0.806)	(0.897)	(7.313)	(1.045)	(1.168)	(0.052)
R^2	0.16	0.15	0.36	0.11	0.15	0.21
N	306	205	74	390	272	97

Source: Author's work.

Notes: 'Reversal' is a dependent variable that takes the value 1 for reversal episodes and 0 for non-reversal episodes. Standard errors in parentheses; $^{***}p<0.001$, $^{**}p<0.05$, $^{*}p<0.01$. The (-)/(+) sign indicates (decrease)/(increase) in the probability of reversal. The *INTEREST PAYMENT variable (on external debt) is excluded from the full and, low- and middle-income country samples because including them—especially when adding country dummies—triggers an error due to large data gaps in that variable. However, this issue does not arise in the high-income sample because the data for interest payments is more complete there.

G. Reversal and non-reversal episodes: pre-GFC (1980-2007) and post-GFC (2008-2022)

Source: Authors' calculations. Full Sample.

H. Reversals, non-reversals, and the IMF current account norms

Reversal episodes	Reversal year value (*CA_t*)	*CA_t+1*	*CA_t+2*	*CA_t+3*	IMF Current Account Norm*
Argentina (2019)	-0.78	0.80	1.38	-0.32	-1.20
Australia (2017)	-2.57	-2.21	0.44	2.39	-0.60
Australia (2020)	2.39	3.15	2.12	0.75	-0.90
Indonesia (2020)	-0.42	0.29	2.18	1.11	-0.80
Italy (2012)	-0.23	1.11	1.90	1.44	1.00
Poland (2013)	-1.82	-2.62	-0.91	-0.79	-1.00
South Africa (2020)	1.97	3.68	1.20	-1.01	2.60
Spain (2012)	0.09	2.04	1.70	2.03	1.80
Thailand (2014)	2.86	6.92	10.51	9.63	3.00
Non-Reversal episodes	**Non-Reversal year value *(CA_t)***	***CA_t+1***	***CA_t+2***	***CA_t+3***	**IMF Current Account Norm***
Brazil (2012)	-3.43	-3.24	-4.14	-3.04	-1.00
Brazil (2016)	-1.36	-1.07	-2.68	-3.47	-2.60
Brazil (2019)	-3.47	-1.69	-1.74	-1.45	-2.50
Canada (2013)	-3.14	-2.32	-3.50	-3.09	2.00
Canada (2016)	-3.09	-2.80	-2.38	-2.04	0.60
France (2012)	-0.97	-0.51	-0.96	-0.37	3.00
France (2015)	-0.37	-0.49	-0.77	-0.83	2.50
France (2018)	-0.83	0.51	-1.80	0.36	0.50
France (2021)	0.36	-1.26	-1.51	-1.17	0.30
United States (2017)	-1.85	-2.14	-2.09	-2.97	-0.70
United States (2020)	-2.97	-3.68	-3.94	-3.14	-0.50

Source: Author's work. Note: The years in brackets indicate a reversal or non-reversal year.

* Indicates the corresponding IMF Current Account Norm for each year of reversal or non-reversal.

I. Model specifications

I1. AR Model

$$CA_t = \alpha + \beta CA_{t-1} + e_t$$

I2. VAR Model

$$CA_t = \alpha + \beta_{11} CA_{t-1} + \beta_{12} GDP_{growth_{t-1}} + \beta_{13} REER_{t-1} + \beta_{14} TO_{t-1} + \beta_{15} OAD_{t-1} + \beta_{12} BB_{t-1} + e_t$$

I3. VECM Model

$$\Delta CA_t = \xi_1 \Delta CA_{t-1} + \xi_2 \Delta GDP_{growth_{t-1}} + \xi_3 \Delta REER_{t-1} + \xi_3 \Delta OAD_{t-1} + \alpha ECT_{t-1} + \varepsilon_t$$

Cointegrating Equation:

$$ECT_{t-1} = \xi_1 \Delta CA_{t-1} - \xi_2 \Delta GDP_{growth_{t-1}} - \xi_3 \Delta REER_{t-1} - \xi_3 \Delta OAD_{t-1} - \alpha ECT_{t-1} - c_t$$

Summary Table of Cointegration Test Results

Country	Number of Cointegrating Equations at 0.05 level	Trace Statistic	0.05 Critical Value	p-value
Australia	2	12.8423	15.4947	0.1207
Chile	3	1.5784	3.8415	0.2090
Greece	2	8.8397	15.4947	0.3804
Hungary	2	12.7039	15.4947	0.1261
Ireland	4	19.7644	21.1316	0.0768
Korea	1	20.7869	29.7971	0.3711
Mexico	1	21.1775	29.7971	0.3467
South Africa	2	9.5063	15.4947	0.3206
United States	1	29.7242	29.7971	0.0510

Source: Author's calculations. Notes: Johansen cointegration test results for each country

I4. BVAR Model

$$CA_{t+h}^{h} = c + B_1 CA_{t-1} + B_2 GDP_{growth}{}_{t-1} + B_3 REER_{t-1} + B_4 OAD_{t-1} + B_5 TO_{t-1} + u_{CA,t+h}$$

I5. BTVC-VAR Model

$$CA_t = c_t + \beta_{1,t} CA_{t-1} + \beta_{2,t} GDP_{growth}{}_{t-1} + \beta_{3,t} REER_{t-1} + \beta_{4,t} OAD_{t-1} + \beta_{12} BB_{t-1} + e_t$$

Where,

$\varepsilon_t \sim N(0,\ \Sigma_t)$: time-varying error variance.

$c_t = c_{t-1} + \varepsilon_t, \varepsilon_t \sim N(0, U_{t\hat{}c})$: time-varying intercept

$\beta_{i,t} = \beta_{i,t-1} + \vartheta_t,\ \vartheta_t \sim N(0, U_{t\hat{}B})$: time-varying coefficients

I6. Optimal lag-length

For all model specifications the optimal lag length is 1.

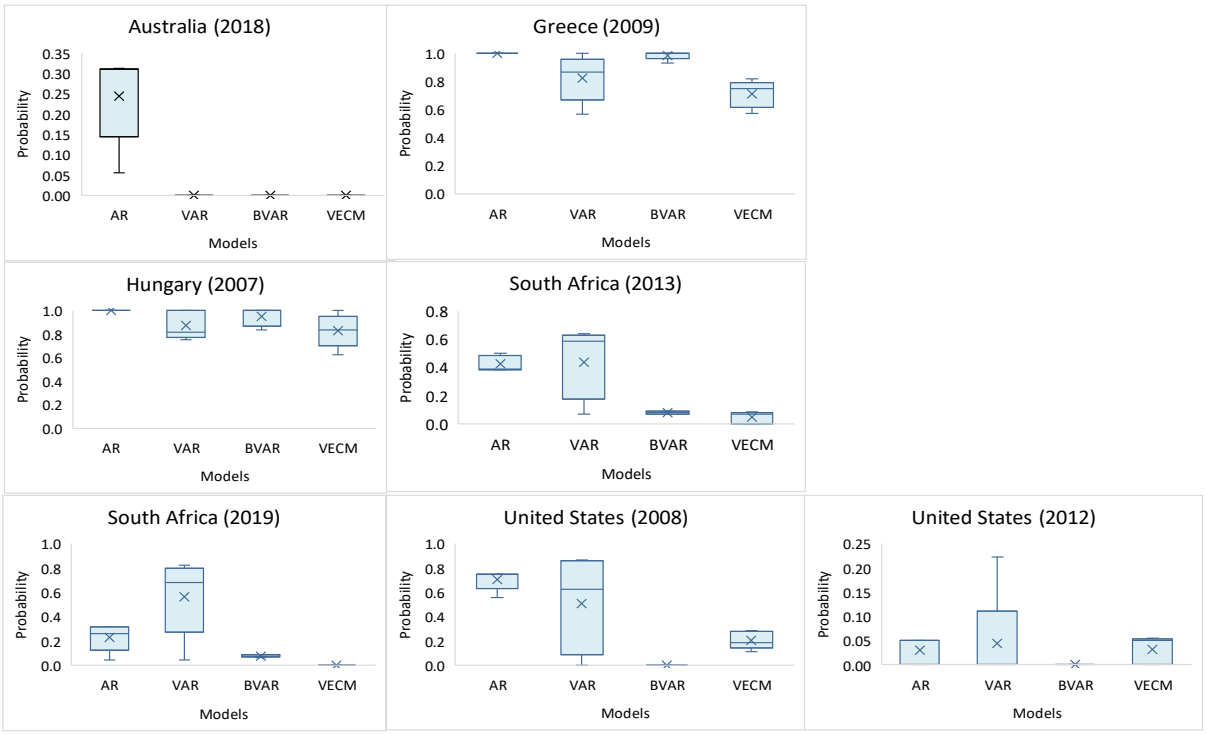
I7. Serial autocorrelation test (ACF test)

Country	Lag	p-value
Australia	2	0.7923
Chile	1	0.11736
Greece	2	0.47341
Korea	2	0.43393
Mexico	2	0.92429
Malaysia	2	0.96705
South Africa	2	0.18481
United States	2	0.62289

Source: Author's work. Notes: H0: No serial autocorrelation;
H1: Serial autocorrelation. Estimated Model: VECM ; *We*

present the ACF results from the VECM model due to the consistency of outcomes across countries included in the analysis.

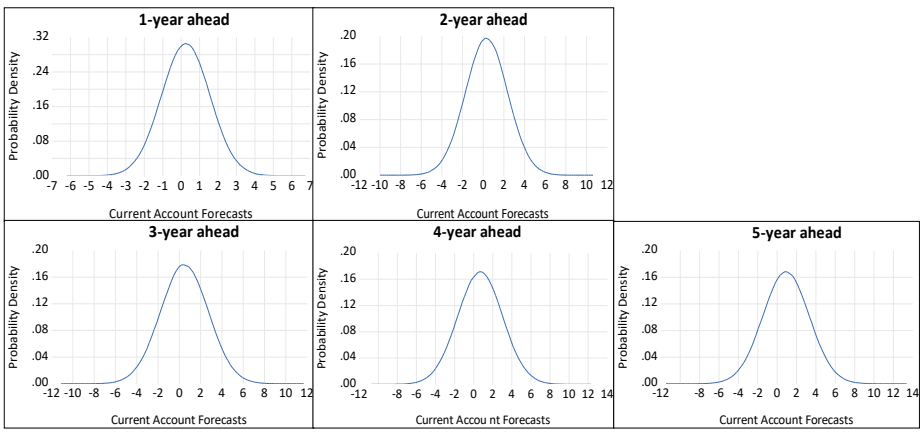
J. Historical analysis: The validation of our probability approach method based on historical current account episodes



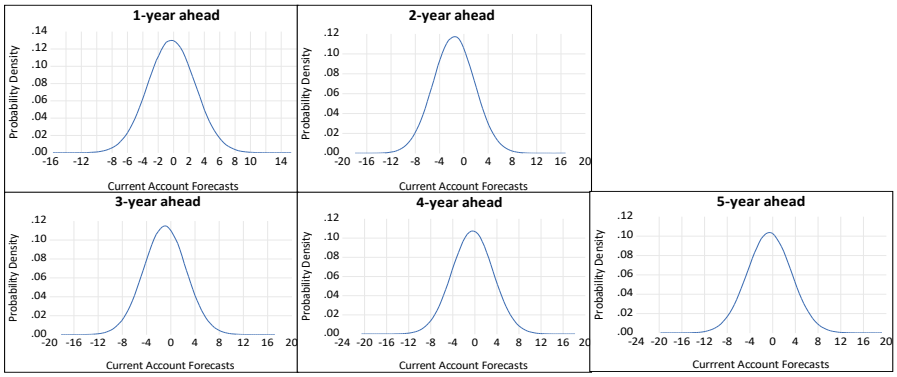
Source: Author's calculations. Notes: For each forecast horizon, we calculate the probabilities according to Equation 44***44***. The figures in the parenthesis represent the year for which we calculate the probability of the current account balance falling below the threshold of -8% in the subsequent years. The models assume normal distribution is forecast errors, and AR* applies bootstrapping. For Hungary, the VAR model excludes trade openness and Budget Balance due to data limitations. Likewise, Chile, Ireland, Korea, Malaysia, and Mexico were excluded due to a lack of data availability pre-1980.

K. The probability distribution of current account forecasts

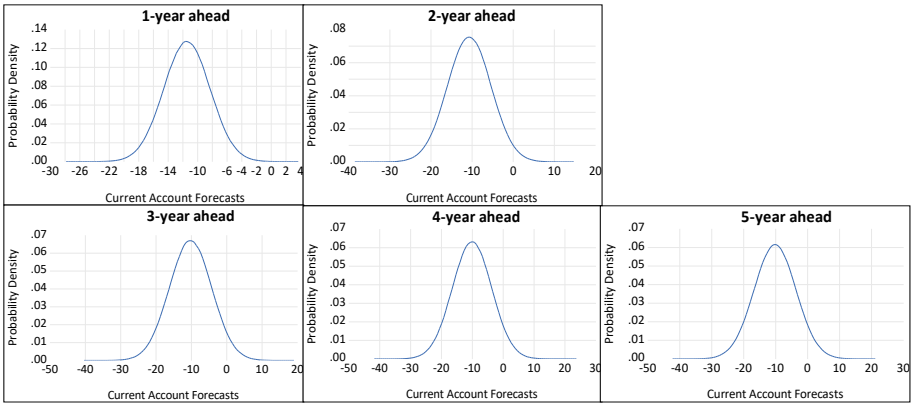
1. Australia



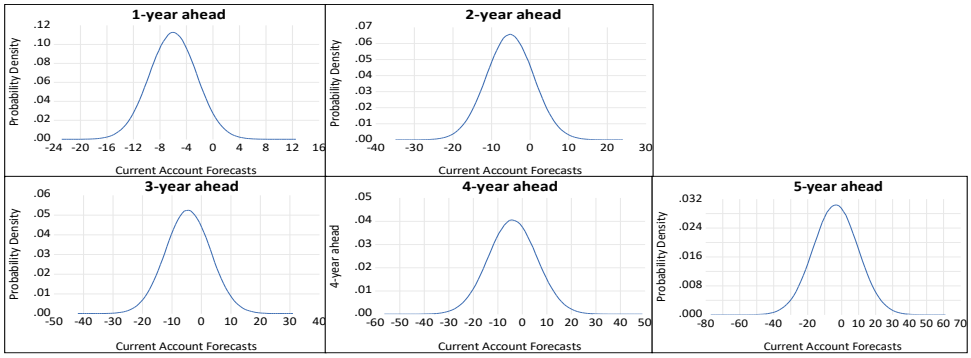
2. Chile



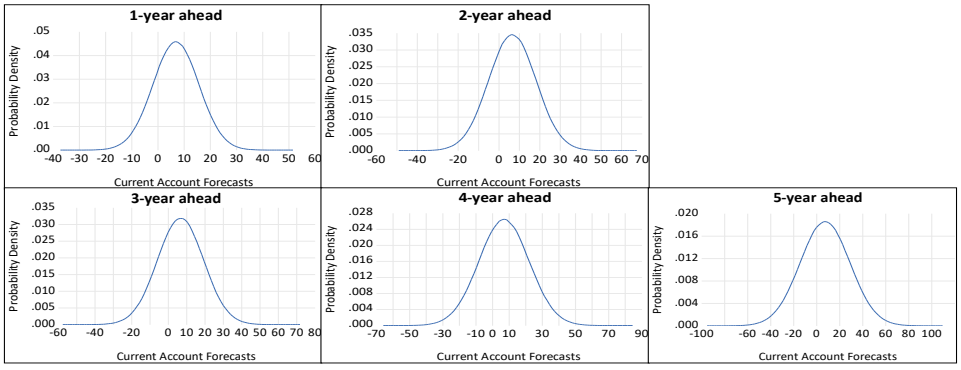
3. Greece



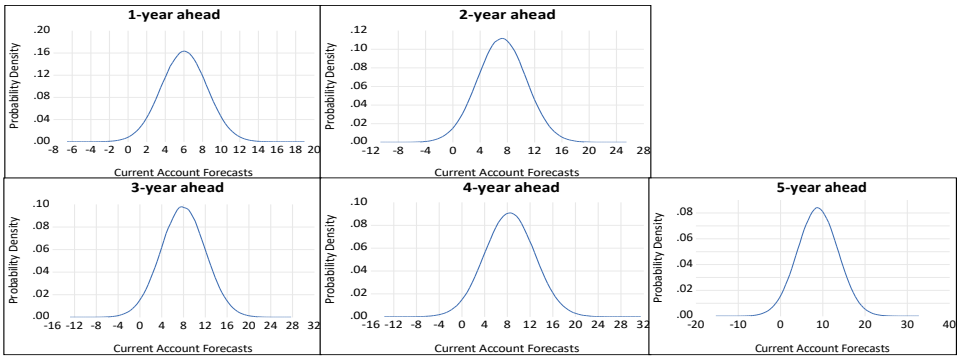
4. Hungary



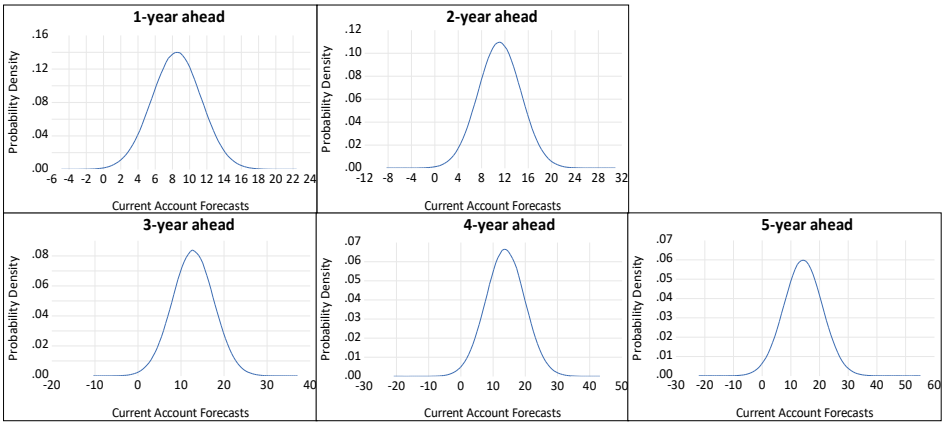
5. Ireland



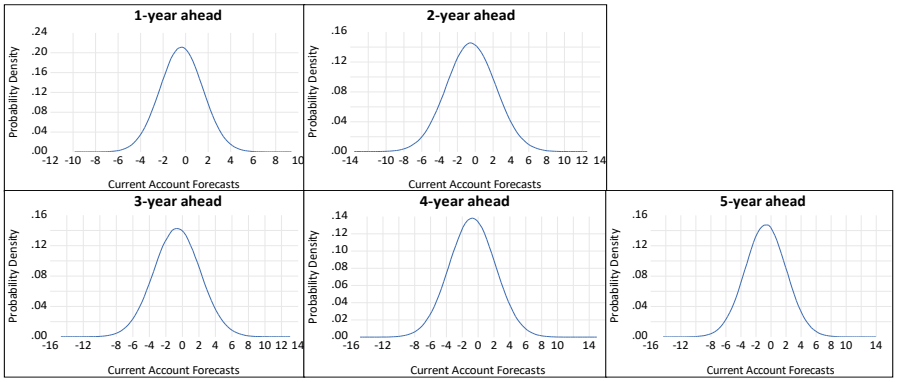
6. Korea



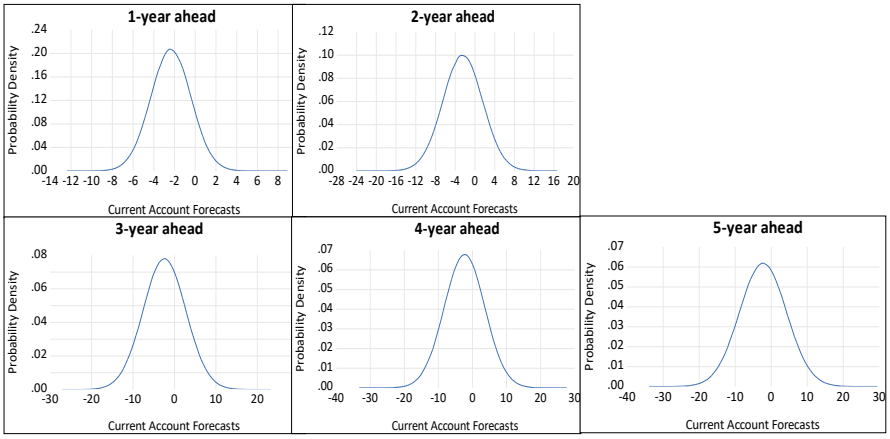
7. Malaysia



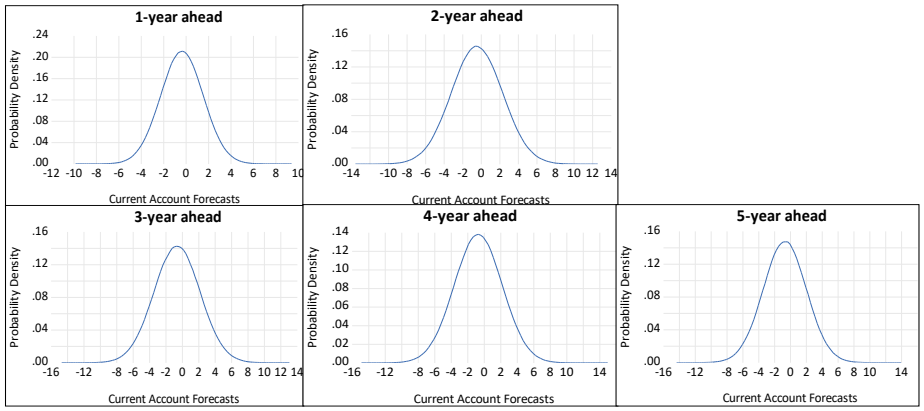
8. Mexico



9. South Africa

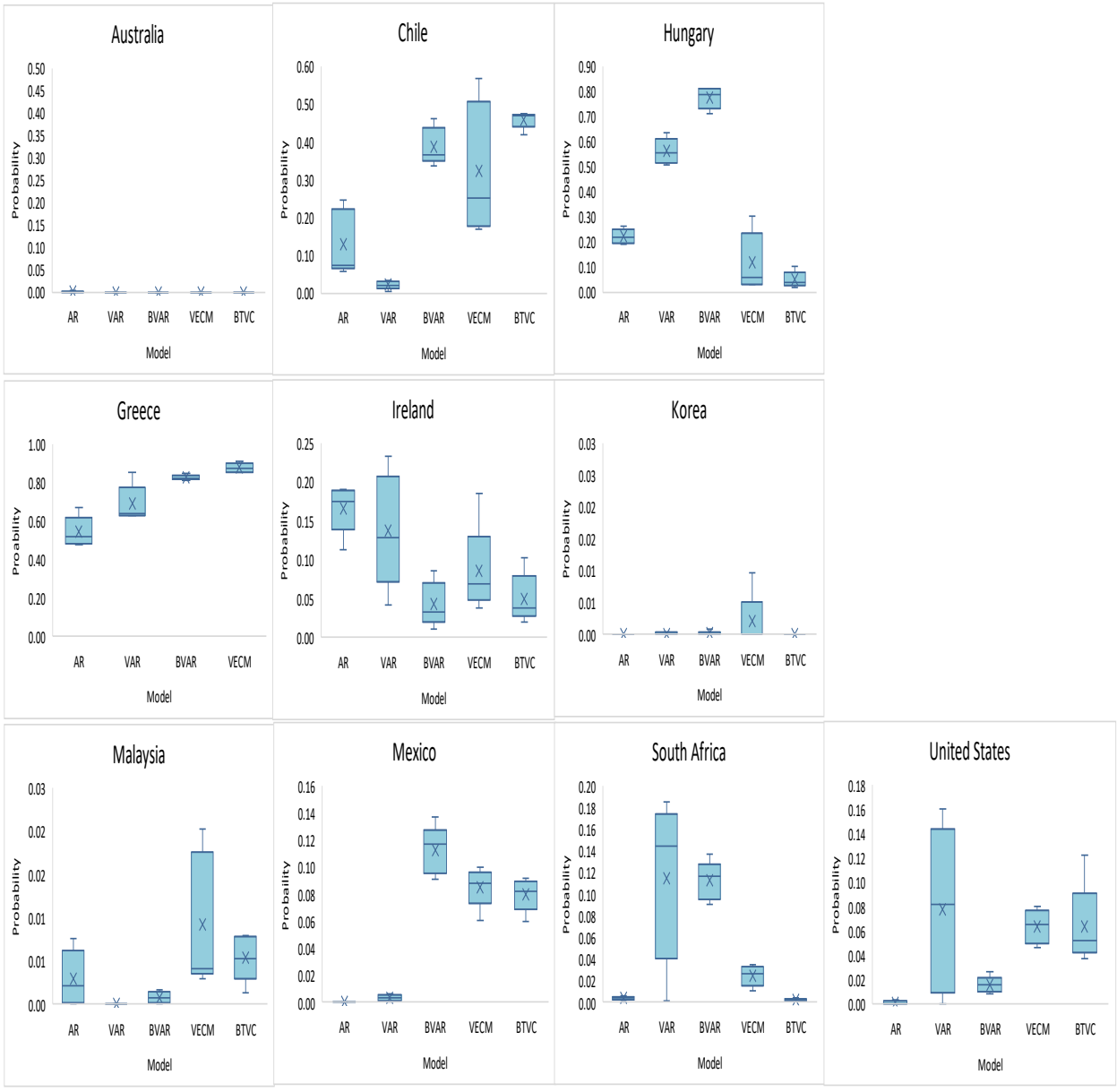


10. United States



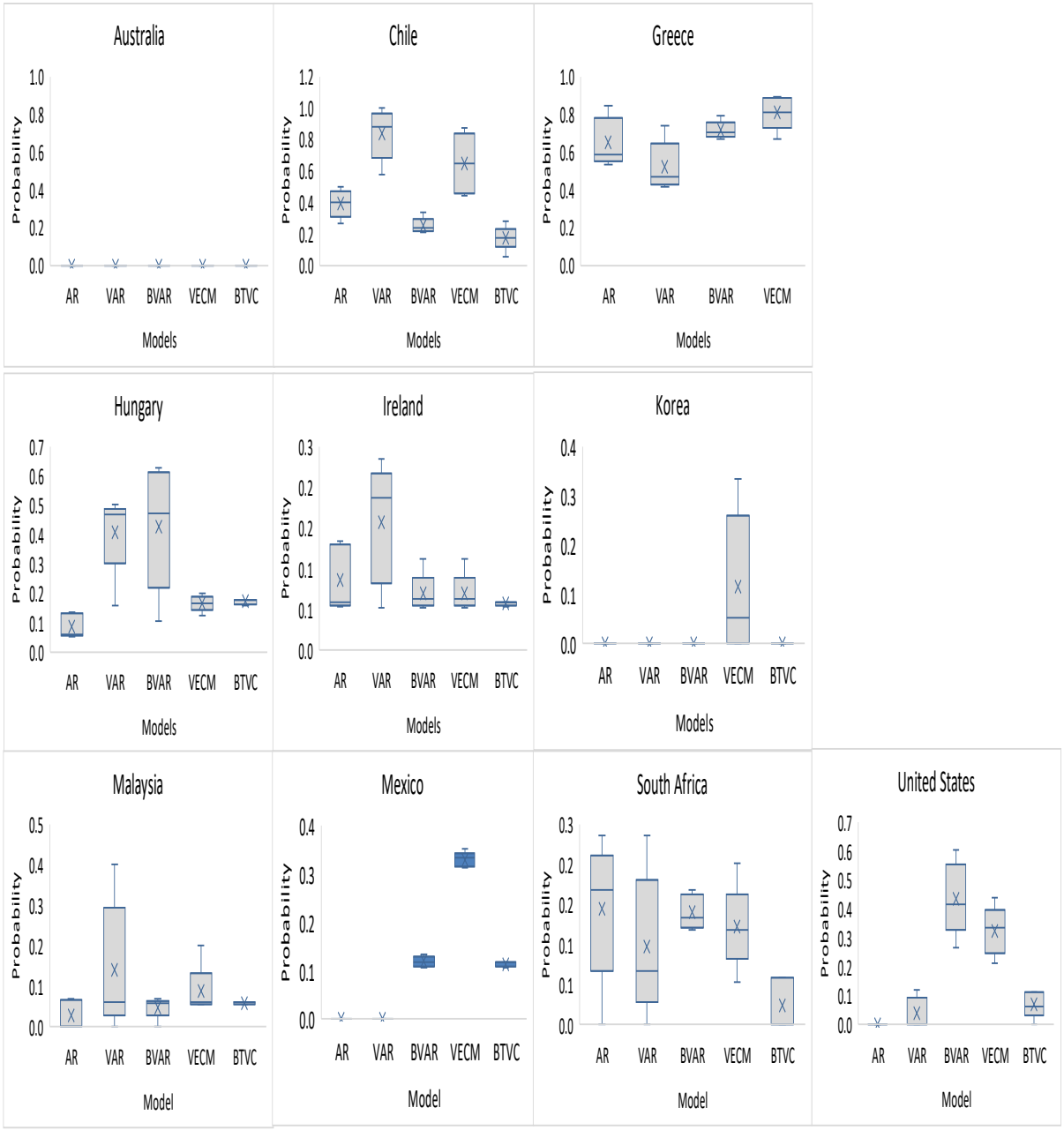
Source: Author's work

L. The probability that the current account balance will be lower than a threshold value: 2023 current account balances – normal distribution in errors; -8% threshold



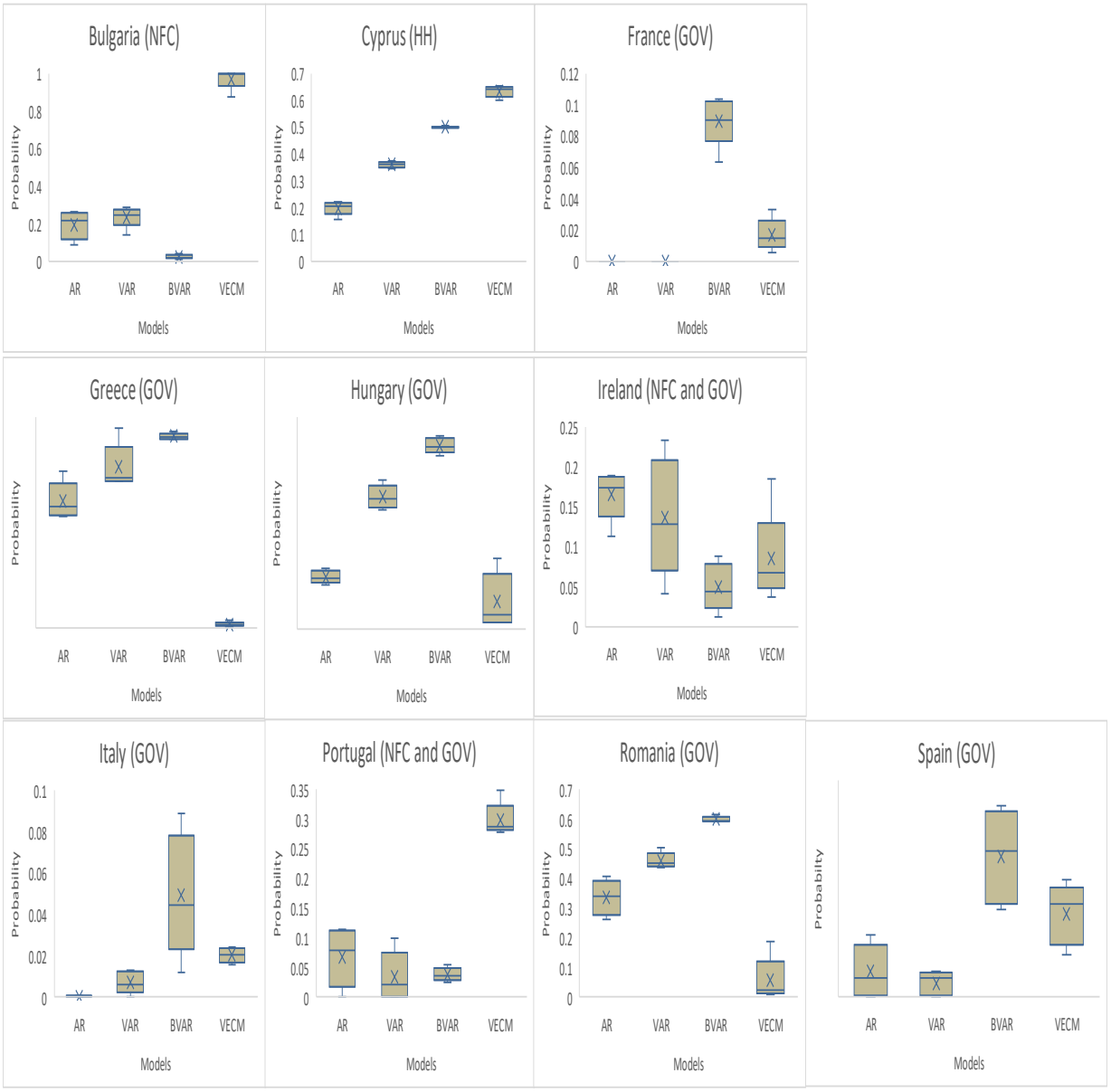
Source: Author's calculations. Notes: The boxplot display show the range of probabilities across different forecast horizons from 1-year ahead to 5-year ahead and model for each country. For each forecast horizon, we calculate the probabilities according to Equation 44.

M. The assessment of 2023 current account balances: -5% threshold; bootstrapping method



Source: Author's calculations. Notes: The boxplot display show the range of probabilities across different forecast horizons from 1-year ahead to 5-year ahead and model for each country. This appendix corresponds to the analysis under the normal distribution assumption. For each forecast horizon, we calculate the probabilities according to Equation 44.

N. The probability that the current account balance will be lower than a threshold value: sectoral analysis, normal distribution in errors; -8% threshold



Source: Author's calculations. Notes: The boxplot display show the range of probabilities across different forecast horizons from 1-year ahead to 5-year ahead and model for each country. We have excluded some of the EU deficit countries due to data and estimation limitations. The Households (HHs), the government (GOV), the nonfinancial corporates (NFCs), and the financial corporates sectors (FCs). The brackets represent the major contributing sector to each country's current account balance. For each forecast horizon, we calculate the probabilities according to Equation 44.