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Vulnerability to Crisis, Fiscal Consolidation and Banking Sector Stability: Evidence from Selected Economies.

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Vulnerability to Crisis, Fiscal Consolidation and Banking Sector Stability: Evidence from Selected Economies

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Abstract

This thesis examines the effects of fiscal consolidation on banking sector stability for 53 randomly selected developing and developed countries for the period 1960 to 2017. This thesis includes two parts. The first part investigates a causal link between public debt and primary surplus to estimate the vulnerability of a country to fiscal crisis. We estimate vulnerability through three debt methods: Bohn's approach, a screening process and a threshold regression. The threshold model estimates a unique level of debt to gross domestic product (GDP) for every country, beyond which the economy may slip into fiscal crisis—called a vulnerable economy. Further, we offer a reconciliation of a debt approach with investment approach, analysed through financial net worth, to distinguish vulnerable from non-vulnerable economies. Using these debt and investment approaches, we propose a fiscal vulnerability selection procedure (Figure 5.2, Chapter 5). Applying this procedure, we find 26 economies vulnerable to fiscal crisis, with threshold ranges from a minimum of 21.16 per cent to a maximum of 84.06 per cent of public debt to GDP, respectively, for France and Belgium. These results are in contrast to the findings of Reinhart and Rogoff (2010), which considered 90 per cent of debt to GDP a criterion of vulnerability to fiscal crisis. Further, we observe some economies where the debt approach suggests those economies to be vulnerable, in contrast with the investment approach. The first part provides the basis (by distinguishing countries into vulnerable and non-vulnerable to fiscal crisis) for the second part of thesis, which investigates the effects of fiscal consolidation on financial sector stability.

In the second part, we analyse the effects of fiscal consolidation on the financial sector stability for all countries and also for the subsamples of vulnerable and non-vulnerable economies. We use the conservative definition of fiscal consolidation (Ardagna, 2009) and carefully identify consolidation episodes for each country. In our panel analysis, we use bank-level capital adequacy ratios (Tier-1 and Tier-2) for each country by employing Bankscope data for the period from 1960 to 2017. We estimate both fixed-effects panel data models and the generalised method of moments proposed by Arellano and Bond (1991) through Roodman (2009) collapse to analyse the role of fiscal consolidation in banking sector stability. This enables two-dimensional analyses covering both the panel settings, where the number of countries and banks may affect estimations. We find that financial stability (Tier-1 ratio) improves by 0.36 percentage points as a result of one episode of fiscal consolidation across all countries included in the sample. The results follow by improvement of 0.58 percentage points

in the subsample of vulnerable economies; however, non-vulnerable economies appear neutral in response to fiscal consolidation. Further, we conduct a country-wise empirical analysis to observe whether the country-specific settings may add some additional value to the panel analysis. For this purpose, we conduct aggregated and disaggregated analysis using data from 1960 to 2017. For aggregate analysis, we use risk-weighted regulatory capital, Z-scores and stock market capitalisation. The results of aggregated analysis reveal that standard capital adequacy ratios improve significantly in the vulnerable economies, compared with the non-vulnerable economies. For disaggregated analysis, we use the bank-wise Bankscope data on different banking variables. The results reveal that Indonesia, South Korea, New Zealand and Germany—as non-vulnerable economies—have also responded to fiscal consolidation. More interestingly, we find that strict fiscal consolidation may allow banks to compromise with their capital adequacy ratio; however, this seems true only for New Zealand and Germany. Therefore, we may infer that fiscal consolidation helps generate financial stability, particularly in economies vulnerable to fiscal crisis.

Key words: Fiscal vulnerability, Banking sector stability, Fiscal consolidation, and Threshold models.

Declaration by author

This thesis is submitted to Bond University in fulfilment of the requirements of the degree of Doctor of Philosophy.

This thesis represents my own original work towards this research degree and contains no material that has previously been submitted for a degree or diploma at this University or any other institution, except where due acknowledgement is made.

HABIB-UR-RAHMAN

Signature

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List of Abbreviations

Augmented Dickey–Fuller	ADF
Australian Prudential Regulation Authority	APRA
Australian System of National Accounts	ASNA
Australian Securities Exchange	ASX
Cyclically Adjusted Primary Balance	CAPB
Capital Adequacy Ratio	CAR
Conditional Value at Risk	CVaR
Fiscal Consolidation	FC
Gross Domestic Product	GDP
Global Financial Crisis	GFC
Government Finance Statistics	GFS
Generalised Method of Moments	GMM
Hodrick–Prescott	HP
International Monetary Fund	IMF
Kwiatkowski–Phillips–Schmidt–Shin	KPSS
Non-performing Loan	NPL
Organisation for Economic Co-operation and Development	OECD
Otoritas Jasa Keuangan	OJK
Ordinary Least Squares	OLS
Primary Balance	PB
Phillips–Perron	PP
Return on Assets	ROA
Standard & Poor's Financial Services	S&P
System of National Accounts	SNA
Structural Vector Auto-regression	SVAR
The Global Economy	TGE
United Kingdom	UK
United States	US
Value at Risk	VaR
Vector Auto-regression	VAR
Vector Error Correction Model	VECM

CHAPTER 1. Introduction

1.1 Motivation

A decade after the global financial crisis (GFC), policy makers, analysts and academicians are still struggling to unfold the fiscal–financial conundrum.[1] The current debate on the issue of sovereign defaults[2] and banking crisis offers two distinguishing viewpoints: (i) financial turmoil leads to sovereign defaults and (ii) sovereign defaults trigger banking crises. Recently, Broner, Erce, Martin, and Ventura (2014), among others,[3] have found that financial turmoil leads to sovereign defaults through fiscal costs, including bailout money, the materialisation of contingent liabilities and government deposits. However, Acharya, Drechsler, and Schnabl (2014) and Gennaioli, Martin, and Rossi (2014), among many others,[4] believe that sovereign defaults may cause banking sector crises through various means. Predominantly, they include the channels of sovereign downgrades, stress between the public and financial sector, borrowing costs, direct balance sheet effect and asset channels. Consistent with the latter, Panizza and Borensztein (2008) observed that the conditional probability of banking crises is much higher than the unconditional probability of banking.[5] They further stated that the conditional probability of sovereign defaults is not higher than the unconditional probability of

[1] The fiscal–financial conundrum implies interdependence of the fiscal (sovereign risk/sovereign defaults) and financial sector (banking sector stability).
[2] Standard & Poor's define sovereign defaults as the failure of a government to meet a principal and interest payment on the due date (or within a specified grace period) contained in the original terms of the debt issue (Gennaioli et al., 2014, p. 841). For further details on the definition of sovereign defaults, see Manasse, Roubini, and Schimmelpfennig (2003).
[3] For example, Reinhart and Rogoff (2011), Haldane and Alessandri (2009), Rixtel and Gasperini (2013) and Broner et al. (2014).
[4] See Noyer (2010); De Paoli, Hoggarth, and Saporta (2009); Acharya et al. (2014); Gennaioli et al. (2014); Hemming, Schimmelpfenning, and Kell (2003) and International Monetary Fund (IMF) (2002).
[5] The conditional probability of banking crisis is defined as the probability of a banking crisis conditional on sovereign defaults.

sovereign defaults.[6] Gennaioli et al. (2014) documented a long history of defaults and crisis episodes, indicating that sovereign defaults led banking crises in almost 60 per cent of a total 110 crisis episodes from 1980 to 2005 in 81 economies. This thesis draws motivation from the above competing views regarding the direction of causality between sovereign defaults and banking sector crisis.

Contemporary debates[7] on twin crises[8] have emphasised that sovereign defaults prompt financial crises in the banking sector. Therefore, sovereign risk appears to be a focal point in the debate on fiscal–financial interactions. For example, Akitoby and Stratmann (2008) found a strong connection between sovereign risks and banking crisis—a weak fiscal position that spills over into the bank's balance sheet mainly because of the bank holdings of a defaulted government. Similarly, Agnello, Castro, Jalles, and Sousa (2015b) indicated that sovereign risks may further deteriorate the financial position of banks, thereby shaking investors' confidence in the economy. Consequently, higher sovereign risk requires banks to make changes in the composition of their portfolios, mainly between investments in private and government securities. The banks' portfolio rebalancing[9] directly translates into the composition of risk-weighted assets—a phenomenon of financial sector stability (banking sector stability[10]). Therefore, relevant to the importance of the composition of risk-weighted assets, the Basel Accords and other prudential standards have allocated less risk weight to government securities.

In light of the above discussion, we argue that the policy option of *fiscal consolidation* helps improve fiscal health (commonly known as fiscal vulnerability to crisis), which eventually determines the financial stability of a country. Further, we identify the appropriate channels through which banks make adjustments to their portfolios in response to the policy stance of fiscal consolidation. Hence, a higher capital adequacy ensures the stability of the banking sector.

[6] The conditional probability of sovereign defaults is defined as the probability of sovereign defaults conditional on a banking crisis.
[7] For further discussion on transmission channels, see Noyer (2010), De Paoli et al. (2009), Acharya et al. (2014), Gennaioli et al. (2014), Hemming et al. (2003) and IMF (2002).
[8] Balteanu, Erce, and Fernandez (2013) defined twin crises as sovereign defaults that result in financial/banking crises, or vice-versa. See Table A1 (Appendix A) for further details on these crises. A review of 110 crisis episodes from 1980 to 2005 in 81 economies indicated that sovereign defaults led to banking crises in almost 60 per cent of these cases (Gennaioli et al., 2014).
[9] This portfolio rebalancing is a trade-off between risk and return (Demirguc-Kunt & Huizinga, 2010). This concept is further explained in various ways by different researchers. For example, rebalancing is expected to increase shareholders' wealth (Cybo-Ottone & Murgia, 2000).
[10] The Basel Accords allocate higher weights to private securities; thus, risk-weighted assets will be higher. Risk-weighted assets are used as denominators in measuring banking stability through capital adequacy ratios (Bank for International Settlement, 2017). Therefore, lower capital adequacy ratios cause banking instability.

This thesis explores the above linkages and investigates them empirically, which has been largely ignored in the available literature on the issue of sovereign defaults and banking crisis.[11]

This thesis has two main parts. Each part contributes in several ways to the literature on the role of fiscal stance in the financial stability of a country. The first part identifies economies with vulnerability to fiscal crises, from a large sample of countries. This is achieved through using a multi-approach (static to dynamic analysis) method to correctly identify whether each country is vulnerable to fiscal crisis. Further, we extend our analysis from the conventional debt approach to the investment approach, and select countries commonly identified by both approaches as vulnerable to fiscal crisis. This procedure offers a rigorous analysis and may be considered superior to the existing procedures, which are subject to heavy criticism involving methodological issues or suggesting a single cut-off of public debt to gross domestic product (GDP) as a criterion for vulnerability to fiscal crisis. We largely use the debt approach led by the threshold regression model, which estimates the optimal level of public debt to GDP, beyond which an economy is identified as vulnerable to fiscal crisis. Further, we use the investment approach, which calculates the financial net worth of all sample countries to determine their fiscal vulnerability. We finally match the results of both the above approaches to determine the fiscal health (vulnerability to fiscal crisis) of an economy. We find 26 countries commonly identified by the debt and financial net worth approaches as vulnerable to fiscal crisis, from 1960 to 2017. Interestingly, some economies appear to be vulnerable to fiscal crisis according to the debt approach, yet non-vulnerable according to the net worth approach. We successfully classify the entire sample of countries (53) into economies that are vulnerable (26) and non-vulnerable (27) to fiscal crisis, based on the above fiscal vulnerability selection procedure of debt and investment analysis.

The second part contributes to the literature through analysing the role of fiscal consolidation (a policy option) in financial sector stability. In this part, we maintain that the fiscal health (vulnerability to fiscal crisis) of a country largely depends on the pace of fiscal consolidation, which eventually determines the financial stability (banking sector stability) of the country. In general, fiscal consolidation refers to a tight policy stance—a deliberate attempt to reduce the budget deficit. In this study, we use the fiscal consolidation concept described in Ardagna (2009), and define fiscal consolidation episode as a period where the cyclically adjusted primary balance (CAPB) improves by at least 1.5 per cent of GDP in a year, or improves by at

[11] This is according to the best information of the authors.

least one per cent of GDP per year for a period of two consecutive years. We finally estimate the effects of fiscal consolidation on financial sector stability for the panel of all sample countries and subsamples of vulnerable and non-vulnerable economies for the period 1990 to 2017.[12] We further replicate estimations for each country by considering bank-wise panels. The above scheme of estimations may help us confirm the results if the coefficient of fiscal consolidation in association with financial stability remains relevant and may vary (in terms of magnitude) depending on the fiscal health of a country. The above scheme of analysis was motivated by propositions suggested in Ardagna (2009) that fiscal consolidation may result in a greater effect on financial sector stability in economies that are vulnerable to fiscal crisis. We estimate both fixed-effects panel data models and the generalised method of moments proposed by Arellano and Bond (1991) through Roodman (2009) collapse to analyse the role of fiscal consolidation and banking sector stability. This allows two-dimensional analyses covering both the panel settings, where the number of countries and banks may influence the estimations.

We find overwhelming evidence that fiscal consolidation (policy stance) improves financial stability (capital adequacy ratio—Tier-1) by 0.36 percentage points across the full sample of selected countries (vulnerable and non-vulnerable economies). These findings are followed by a 0.58 percentage point improvement in financial stability (Tier-1) in the subsample of economies vulnerable to fiscal crisis. In the overall panel of non-vulnerable economies, the results of fiscal consolidation are not significant (statistically). However, two countries (individual country analysis) from the group of non-vulnerable economies indicate 1.27 (Indonesia) and 0.13 (South Korea) percentage point improvement in financial stability (Tier-1). In contrast, New Zealand and Germany indicate a 1.32 and 0.28 percentage point decline, respectively, in their capital adequacy ratio (Tier-1) because of their stance on fiscal consolidation. This is interesting to note because, in New Zealand and Germany, excessive fiscal consolidation might be occurring, which may further force the financial sector to opt for more risky assets in their portfolio of investment. In other words, this finding implies that fiscal surplus may not warrant financial stability.[13] Therefore, we can extract from the above results that fiscal consolidation helps generate financial stability, particularly in economies vulnerable to fiscal crisis.

[12] The Bankscope database maintains individual bank balance sheet data from 1990 onwards. Therefore, we could not maintain the time period considered in the fiscal health analysis. We used banking and financial data from 1990 to 2016 for the financial sector stability analysis.

[13] See the discussion on the demand and supply effect of direct channel at the end of Section 3.3, Chapter 3.

The remainder of this chapter is organised as follows. Section 1.2 discusses the concept and issues involved in measuring fiscal vulnerability. Section 1.3 presents the concept of fiscal consolidation, along with its measurement issues. Section 1.4 discusses financial stability and its alternative measures, while Section 1.5 presents an overview of the linkages between fiscal consolidation and financial sector stability. Section 1.6 discusses the thesis research question, objectives and potential contributions. Finally, Section 1.7 explains the organisation of the thesis.

1.2 Concept of Fiscal Vulnerability and Measurement Issues

In general, fiscal vulnerability refers to a situation in which the increasing level of public debt may deplete the primary surplus of a country. More generally, fiscal vulnerability is related to vulnerability to crises. The typical dictionary definition of vulnerability is being open to attack or damage. In this sense, an increase in vulnerability indicates an increase in probability that the shock will be translated into crisis, rather than being absorbed by the economy (Furman, Stiglitz, Bosworth, & Radelet, 1998). Vulnerability is also defined as the risk that solvency and liquidity conditions are violated.[14] Following these definitions, fiscal vulnerability is a component of overall vulnerability. Hemming and Petrie (2002, p. 161) defined fiscal vulnerability as a situation in which the government is exposed to the possibility of failing to achieve the aggregate objectives of the fiscal policy.[15]

The literature has identified many inevitable reasons for increasing the public debt of a country. For example, Reinhart, Reinhart, and Rogoff (2012) considered decreasing economic growth as a reason for accumulating debt stocks.[16] Similarly, Ghosh, Kim, Mendoza, Ostry, and Qureshi (2013); Ciarlone and Trebeschi (2005); and Tinker (2002) considered social spending, solvency risk exposure and an ageing population, respectively, to be relevant sources of

[14] See Allen, Setser, Keller, and Roubini (2002) for further detail.
[15] See Section II background of Hemming et al. (2003) for further detail on fiscal vulnerability.
[16] The GFC from 2007 to 2009 has left a legacy of a historically high and surging level of public debt in developed economies (Lane, 2012; Reinhart et al., 2012). However, there is inconsistency with the argument of growing public debt after the GFC in developed economies. For example, some of the Organisation for Economic Co-operation and Development (OECD) economies, including Switzerland and Norway, managed to reduce their public debt, while Sweden and Germany managed to maintain their level of debt. In contrast, the public debt of Australia increased by 280.47 per cent—from 9.68 per cent of GDP in 2007 to 36.83 per cent of GDP in 2015 (see Figure A1, Appendix A). The Australian general government public debt was at a historic low (9.68 per cent of GDP) in 2007, and surged to 36.83 per cent of GDP in 2015 because of a series of spending-driven budget deficits. Meanwhile, private credit in Australia is also at its highest level of 137.60 per cent of GDP. This situation requires empirical investigation because debt is a double-edged sword—a moderate level helps improve welfare, while excess levels result in financial disaster (Cecchetti, Mohanty, & Zampolli, 2011; Reinhart & Rogoff, 2010).

increasing public debt, which may further cause fiscal vulnerability to crisis. Consequently, fiscally vulnerable economies may face difficulties in absorbing exogenous (averse) shocks, and, in some cases, countries may declare their sovereign defaults. Sovereign defaults through sovereign downgrades, stress between the public and financial sector through borrowing costs, direct balance sheet effect and assets channels may further transmit into banking sector crises.[17]

Most of the empirical literature follows Bohn (1998) and Reinhart and Rogoff (2010) to quantify fiscal vulnerability. However, both approaches are different in terms of vulnerability assessment. Moreover, they hold apparent methodological issues. Bohn's (1998) approach measures vulnerability through calculating the coefficient (negative) of debt to GDP in relation to primary surplus. Bohn's model is simple, yet allows many caveats, including overestimating the debt coefficient—with misleading results. Reinhart and Rogoff (2010) calculated a unique (single) cut-off of 90 per cent public debt to GDP, beyond which debt crisis is triggered. This approach remained prevalent until Herndon, Ash, and Pollin (2014) and Egert (2015) reproduced different results by using the same dataset as Reinhart and Rogoff (2010). They discovered that a single cut-off is a biased and misleading explanation of fiscal vulnerability. We overcome the above methodological issues by estimating vulnerability through a rigorous procedure and conducting sensitivity analyses. We calculate the data using more rigorous methods that suggest an appropriate level of country-specific public debt, beyond which fiscal vulnerability to crisis may arise. As part of this procedure, we attempt to reconcile the results of debt analysis with investment analysis—calculated through a net financial approach. In this framework, we propose a fiscal vulnerability selection procedure (Figure 5.2, Chapter 5), which helps us classify economies into vulnerable and non-vulnerable.

We begin with Bohn's (1998) model, which identifies 30 economies as vulnerable to fiscal crisis. However, it is expected that this model may produce biased results because of overlapping periods of vulnerability and non-vulnerability in some of the economies.[18] We attempt to overcome this issue through estimating forward, backward and moving screening processes. Interestingly, we identify nine additional economies vulnerable to fiscal crisis at some time during the given period of analysis. Nevertheless, this process may not completely

[17] These channels are discussed in Acharya et al. (2014), De Paoli et al. (2009), Gennaioli et al. (2014), Noyer (2010), Panetta et al. (2011) and IMF (2002).

[18] During the sample period, the vulnerability of an economy may vary because of changes in fiscal policy stance. Therefore, pooling a vulnerable period with non-vulnerable period is expected to provide misleading results. For more information on this topic, see the stability analysis (forward, backward and moving screening) provided in Chapter 5, Section 5.3.

avoid identification (vulnerable versus non-vulnerable) problems because some of the vulnerable periods can be nullified by non-vulnerable periods within the sample.[19]

We argue that backward and forward screening process may provide several episodes of vulnerability, yet do not indicate the optimal level of debt to GDP necessary to determine the vulnerability of a country. Therefore, we finally use a threshold regression model to calculate the optimal level of debt to GDP that may cause a fiscal crisis in each country. We conduct threshold regression analysis for every country to calculate the country-specific threshold level of debt to GDP.[20] The threshold model supposes that an economic time series can be modelled as belonging to a number of distinct regimes, where the regimes are characterised by different conditional distribution of the process. The threshold model identifies one more economy as vulnerable, in addition to the 39 economies specified through Bohn's (1998) approach and the screening approach. Ultimately, we identify 40 economies as vulnerable to fiscal crisis out of a total sample of 53 economies.

Finally, we employ the investment approach to reconcile the vulnerable economies identified through the debt approach. We use financial net worth in a value-at-risk and conditional value-at-risk framework to identify the economies vulnerable to fiscal crises. This last step of the fiscal vulnerability selection procedure leaves us with 26 economies vulnerable to debt crisis. At the end, we apply alternative techniques available in the literature and compare these results with our main approach, as well as with the sovereign credit rating of different rating agencies. Our results are consistent with the credit rating agencies. The next section discusses the nexus of fiscal consolidation and banking stability.

1.3 Concept of Fiscal Consolidation and Measurement Issues

Fiscal consolidation is a policy stance or commitment to reduce budget deficit gradually. In particular, fiscal consolidation is defined as a deliberate attempt to reduce government budget deficit (Cimadomo et al., 2014). The literature has suggested different approaches that have been used to gauge fiscal consolidation. These methods are commonly known as narrative techniques (Devries et al., 2011) and CAPB processes (Alesina & Ardagna, 2010; Alesina & Perotti, 1995; Ardagna, 2009). Narrative techniques use historical records of governments' intentions to reduce excessive public spending. Historical records can be observed from the

[19] Section 5.2 (Chapter 5) provides complete details on the forward, backward and moving screening processes.
[20] Section 5.3 (Chapter 5) presents the empirical strategy of the threshold regression, while Section 6.1 (Chapter 6) presents its results.

stability and convergence programs submitted by the authorities to the European Commission, from OECD and IMF reports, budget speeches and respective central bank reports. However, it is tedious to collect and process all information from the above sources to quantify the fiscal consolidation for an economy.[21] Therefore, we mostly rely on CAPB to calculate the fiscal consolidation episodes for all 53 economies included in the sample.[22] It may be relevant to note that CAPB is derived by computing the cyclical components of the primary balance by employing the Hodrick and Prescott (Hodrick & Prescott, 1997) filter and/or econometric techniques. In this thesis, we use the Hodrick and Prescott method to extract the cyclical component for all countries, except the Australian economy, for which we also use econometric techniques. In general, the fiscal consolidation is viewed with positive changes (improvements) in CAPB; however, the amount of changes remains largely unclear in the literature.

Mirdala (2013) stated that fiscal consolidation (episode) occurs if the CAPB of a country improves by at least 1.5 per cent of GDP in one year ('cold shower') or does not drop by more than 0.5 per cent of GDP over a period of three years (referred to as gradual consolidation). Alternatively, Stephanie, Mike, Eckhard, and Christophe (2007) define fiscal consolidation (episode) as an improvement in CAPB by at least one per cent of potential GDP in one year or two consecutive years, with 0.5 per cent for two years at the beginning of the period. Ardagna (2009) defined fiscal consolidation (episode) as CAPB improving by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year. In the rest of our financial stability analysis, we apply fiscal consolidation as defined by Ardagna (2009) because of its relatively longer duration. Ardagna's definition of fiscal consolidation may reflect the serious efforts of fiscal authorities to reduce primary deficit. This is also because the financial sector may achieve confidence as a result of constant improvement in fiscal position, as also observed in Agnello et al. (2015a).

1.4 Concept and Measures of Financial Stability

The term 'financial stability' was initially used by the Bank of England in 1994. The Bank of England used this term to denote its objectives that were not related to the efficient functioning of the financial system and price stability (Allen & Wood, 2006). As stated by the Governor of Sveriges Riksbank, stability is a vague concept that is difficult to define (see Heikensten, 2004).

[21] We collect these historical records only for the case of Australia and compare our fiscal consolidation episodes measured using CAPB. For further details on this comparison, see Section 6.3 (Chapter 6).
[22] See Table E3 (Appendix E) for the fiscal consolidation episodes of all economies.

There is still no widely accepted definition of financial stability. However, Allen and Wood (2006) and Schinasi (2004) proposed definitions of financial stability that have some operational and practical relevance. According to Allen and Wood (2006), the best approach is to first define the features of the episode of financial instability. One can then define financial stability as a state of affairs in which the episodes of financial instability are unlikely to occur. Schinasi (2004) defined financial stability in terms of its ability to facilitate the economic processes, absorb shocks and manage risks.

The financial sector has many dimensions and subsequently can be evaluated with various measures of assessment. For example, Beck, Hesse, Kick, and von Westernhagen (2009) used the Z-score, non-performing loan (NPL) score and probability of default (PD) score to assess the financial stability of the banking sector in Germany. The Z-score measures the distance from insolvency, the NPL score measures the lending risk, and the PD score measures the actual insolvency risk. These approaches focus on the performance aspect of the banking sector. The IMF (2006) recommended a comprehensive measure with 12 core indicators categorised as asset-based, capital-based, and income- and expense-based financial stability indicators for the deposit takers of the financial sector.[23] The Bank for International Settlement (2017) provided a much broader measure of banking stability (commonly known as capital adequacy ratios) by incorporating credit risk, market risk and operational risk. The capital adequacy ratios are also known as risk-weighted capital ratios, which are termed 'Tier-1' and 'Tier-2' capital ratios, depending on the nature and composition of the assets of the banks.

Tier-1 includes common equity Tier-1 and additional Tier-1. Common equity Tier-1 includes common shares, retained earnings and other reserves. Additional Tier-1 includes capital instruments with no fixed maturity. Tier-2 includes subordinated debt and general loan-loss reserves. Banks with more regulatory capital are better able to fund lending growth. Conversely, banks with a greater amount of risk-weighted assets require more capital to absorb any shocks. Along these lines, the Bank for International Settlement (2017) defined capital adequacy ratios as the amount of regulatory capital divided by the amount of risk-weighted assets. Relatively recently, Cimadomo et al. (2014), among others, used the above capital adequacy ratios (Tier-1 and Tier-2) to assess the financial stability of the banking sector. We also apply the Tier-1

[23] Swamy (2014) used a panel vector autoregressive (PVAR) model on bank-specific variables to investigate financial stability through banking sector performance.

and Tier-2 measures of capital adequacy ratios because of their close association with the fiscal sector to investigate the role of fiscal consolidation in financial sector stability.

1.5 Linkages between Fiscal Consolidation and Financial Stability

The interdependence between the public (in terms of primary balance) and bank balance sheet reflects important economic and financial implications. Therefore, frequent and persistent economic and financial crises may ultimately convert into a sovereign crisis. Correspondingly, abrupt changes in market perceptions of sovereign risk weaken the bank balance sheet, which creates an adverse feedback loop between sovereign and banking risk (Cimadomo et al., 2014; Panetta et al., 2011). More directly, sovereign risk that is closely related to the weak fiscal position of the economy transmits into the banking sector mainly because of the bank holdings of government securities.[24] Similarly, Agnello et al. (2015b) observed that government defaults destroy the bank balance sheet, which further increases investors' concerns. Therefore, it is widely understood that sustainable and sizable fiscal adjustments are required to restore sound fiscal positions and ease financial market pressure.

The above discussion motivated this thesis to further investigate the role of fiscal consolidation subject to fiscal vulnerability in financial sector stability. Agnello et al. (2015a, 2015b) observed that debt crisis and consequent fiscal consolidation invite financial reforms, based on the experience of developing and developed countries. Cimadomo et al. (2014) sought to explore the connections between fiscal consolidation and financial sector stability through direct and indirect channels for 17 OECD countries. The direct channel operates through the demand and supply of government securities, while the indirect channel operates through the macroeconomic effects of fiscal consolidation. According to Cimadomo et al. (2014), if fiscal adjustments in the form of consolidation lead to an economic downturn, it is expected that NPLs and write-offs will increase. Further, if the effects are intense, investors will prefer to invest in government securities, particularly in periods of fiscal consolidations. Finally, Cimadomo et al. (2014) found that fiscal consolidation improved financial stability through improving capital adequacy (Tier-1) in a selected sample of OECD countries.

However, the available studies—especially Cimadomo et al. (2014) and Agnello et al. (2015, 2015a)—did not make any prior distinctions between vulnerable and non-vulnerable

[24] This was observed in 25 countries by Akitoby and Stratmann (2008). Further, the above study reported that debt-financed spending results in higher sovereign risk, while tax-financed spending lowers the risk. Further, the above study observed that the reaction of financial markets to fiscal policy depends on political institutions.

economies in their sample of selected countries. This distinction is necessary to investigate the effective role of fiscal consolidation. A country can be identified as non-vulnerable to fiscal crisis because of prior fiscal consolidation. Conversely, a country can be identified as vulnerable because of insufficient or no fiscal consolidation. We attempt to address this issue and investigate the role of fiscal consolidation for a larger sample of selected countries.

This thesis empirically investigates the effects of fiscal consolidation on the financial stability of the banking sector for the selected 53 countries, classified as vulnerable and non-vulnerable to fiscal crisis. We use a direct channel, which relates to the supply and demand effects on government bond markets, where the risk weights of securities play an important role in the empirical investigation. The Basel Accords allot zero per cent risk weight to government securities, and 20 to 100 per cent for other types of private securities (Bank for International Settlements, 2015). Therefore, the total risk-weighted assets change when banks shift their portfolio from one type of securities to other securities. Therefore, it is plausible to consider that banks will conduct their portfolio rebalancing as a result of fiscal consolidation, which will reduce risk-weighted assets because of lower risk weights allocated to public securities. Consequently, the increased capital adequacy ratio will warrant banking stability.[25]

1.6 Research Questions, Objectives and Potential Contribution

This thesis seeks to answer two main questions: (i) Does public debt reduce primary surplus? (ii) What is the effect of fiscal consolidation on financial sector stability? We set several objectives to investigate these questions empirically. These objectives are as follows:

1. We estimate the vulnerability of fiscal crisis for a large sample of 53 developing and developed economies. We use a state-of-the-art methodology to calculate fiscal vulnerability, and then classify countries into vulnerable and non-vulnerable economies.
2. As part of the fiscal vulnerability analysis, we aim to calculate the appropriate level of public debt to GDP for each country, which may be the tipping level to cause vulnerability to fiscal crisis. In this manner, we may determine whether public debt reduces the primary surplus in countries during periods of fiscal crises.
3. We compute and identify episodes of fiscal consolidation for each economy based on the methods suggested in Ardagna (2009).

[25] See Chapter 3, Section 3.2.1, for a detailed discussion on the construction and calculations of capital adequacy ratios. Further, see Section 3.3 for a discussion on direct channels, which affect the demand and supply of government bonds.

4. We incorporate all banks (subject to data availability) with their financial stability indicators (Tier-1 and Tier-2) from every country included in the sample.
5. Finally, we estimate the effect of fiscal consolidation on the financial sector (Tier-1 and Tier-2) separately for the group of vulnerable and non-vulnerable economies.

This thesis contributes to the literature in the following ways:

- For a very large sample of countries, it calculates the threshold level of debt as a proportion of GDP, beyond which a country may fall into fiscal crisis.
- It calculates the threshold level based on a special case of the regime switching model, which is used for the first time in the literature on this topic.
- It reconciles the results of the debt approach with the investment approach to confirm the results of the debt approach to estimate vulnerability to fiscal crisis.
- It successfully estimates and finds that fiscal consolidation performs an important role in banking sector stability, particularly during fiscal crises.

1.7 Organisation of Thesis

This thesis is organised into two parts with seven chapters. Chapter 2 presents detailed literature on fiscal vulnerability and linkages between fiscal consolidation and banking sector stability. Chapter 3 illustrates the framework of analysis by presenting details of debt and primary surplus, and the interdependence of fiscal consolidation and banking sector stability. Chapter 4 elaborates the data sources, along with important definitions and construction of the variables used in empirical analysis. Chapter 5 explains some weaknesses of the various methods previously used in such analyses. As part of this chapter, we present and discuss the advantages of the threshold model used to estimate the fiscal vulnerability of a country. Further, this chapter presents some methodological notes on computing fiscal consolidation episodes. Chapter 6 presents the fiscal vulnerability analysis and compares our results with the available country rating conducted by different rating agencies. Chapter 7 first presents the analysis of fiscal consolidation and then discusses the role of fiscal consolidation in the financial stability of vulnerable and non-vulnerable economies. Chapter 8 extends the role of fiscal consolidation in the financial sector stability by conducting aggregated and disaggregated analysis, while the final Chapter 9 offers concluding remarks, the study contributions and the policy implications. Finally, this chapter discusses the limitations of this study, alongside scope for future research.

CHAPTER 2. Literature Review

2.1 Introduction

This chapter presents detailed literature on fiscal vulnerability and the transmission channels through which sovereign defaults are transmitted into the banking sector. Further, this chapter presents the literature on the linkage between fiscal consolidation and the financial stability of the banking sector. This chapter is broadly organised into two parts: (i) fiscal vulnerability and (ii) fiscal consolidation and banking stability. We classify the fiscal vulnerability literature based on available techniques to classify an economy as vulnerable. We then classify the relevant literature on the linkage between fiscal consolidation and banking stability based on the costs associated with government defaults. These defaults are costly because they destroy the balance sheet of domestic banks. To discuss all of these aspects, the remainder of the chapter is organised as follows. Section 2.2 discusses the relevant literature on fiscal vulnerability. Section 2.3 presents the relevant literature on the linkages between fiscal consolidation and banking stability. Section 2.4 presents the literature gaps and remedies. Section 2.5 concludes the literature review on this topic.

2.2 Fiscal Vulnerability

The issue of fiscal vulnerability can be better understood in comparison with the approaches available in the literature. Table 2.1 presents a summary of these approaches, and broadly attempts to identify fiscal vulnerability in the relevant economies.[26] Interestingly, most of the approaches suggest a single threshold level of public debt to GDP that applies to all countries included in the sample.

[26] We did not include the early 1980s literature in this classification; however, its synthesised discussion is presented in this section.

Table 2.1: Literature Based on Quantitative Approaches

Study	Country/countries	Timeframe	Conclusion and comments
		Bohn's (1998) model	
Bohn (1998)	United States (US)	1916 to 1995	The study reported the US economy as non-vulnerable.
Valderrama (2005)	Korea and Thailand	1975 to 2003	The study reported only Thailand as a vulnerable economy, especially for 1990 to 2003 (the second period in the subsample analysis).
Mauro, Romeu, Binder, and Zaman (2015)	55 developed and emerging economies	1800 to 2011	The study reported a significantly weaker policy response (increase in primary balance in response to debt) when inflation is high, sovereign borrowing cost is low, and potential economic growth deteriorates suddenly. Our concern with these types of studies is that vulnerability varies within the sample period, yet the debt coefficient provides a single estimate over the sample period.
		Single threshold	
Reinhart and Rogoff (2010)	44 developed and emerging economies	200 years	By defining a single threshold of 90 per cent (public debt to GDP), this study reported a decrease of one per cent in the median growth rate of an economy when public debt increased to 90 per cent of GDP.
		Public debt overhang	
Cecchetti, Mohanty, and Zampolli (2011)	A panel of 18 OECD economies	1980 to 2010	The study reported a threshold of 86 per cent (public debt to GDP). Based on this finding, they suggested that countries with a higher level of debt must act quickly and decisively to address their fiscal issues.
Reinhart, Reinhart, and Rogoff (2012)	Advanced economies	1860 to 2011	The study identified 26 public debt overhang episodes since early 1800, where the public debt exceeded 90 per cent of GDP. They further reported that 10 out of 20 episodes lasted for more than 10 years.

continued…

Table 2.1 (…continued): Literature Based on Quantitative Approaches

Study	Country/countries	Timeframe	Conclusion and comments
		Replicating single threshold	
Herndon, Ash, and Pollin (2014)	44 developed and emerging economies	200 years	Replicating Reinhart and Rogoff (2010), this study indicated serious concerns, including: (i) coding errors, (ii) exclusion of available data in selective cases and (iii) inappropriate weighting.
Égert (2015)	44 developed and emerging economies	200 years	This study validated the criticism that 90 per cent is not an appropriate threshold. The results suggested that a negative association between central government debt and growth may appear at a debt level as low as 20 per cent (central government debt to GDP). **Comment:** In a single-threshold framework, the main criticism is the assumption of debt–growth association across countries.
		Alternative approaches	
		Financial net worth/balance sheet approach	
Barnhill Jr and Kopits (2004)	Ecuador	1995 to 2002	This study examined the significant risk of government financial failure stemming from the volatility of the exchange rate, interest rates, oil prices and output. **Comments:** Empirical investigation issues: (i) increasing negative value, since the average value of financial net worth in OECD economies is recorded as -65 per cent of GDP in 2013, compared with the pre-crisis value of -38.1 per cent (OECD, 2015, p. 60); and (ii) the data availability on financial assets and liabilities.
Mellor (1996)	Balance sheet measures of Australia	When the Australian government changed its accounting base of fiscal policy measures—1996	This study stated that the Australian government's new proposed reporting (accrual reporting) should be complemented with an accrual planning and budgeting regime, which would ensure that financial performance is planned and assessed on similar bases. This study proposed using change in net worth to assess the fiscal policy of the Australian government.

continued…

Table 2.1 (…continued): Literature Based on Quantitative Approaches

Study	Country/countries	Timeframe	Conclusion and comments
Makin and Pearce (2016)	Descriptive analysis (of balance sheet items), along with providing stabilising federal government debt and required fiscal consolidation for the case of Australia	Different time period used, ranging from 1971 to 2020 (projected)	This study proposed three possibilities as medium-term budgetary policies: (i) moving from negative net public worth to zero to restore the fiscal solvency, (ii) mitigating the level of foreign debt to zero and (iii) decreasing the level of net public debt to zero.
		Fiscal vulnerability index	
Baldacci, McHugh, and Petrova (2011)	Selected advanced and emerging economies	Spring and autumn of 2010	This study found that the index is high for advanced economies; however, solvency risk is lower in emerging economies. **Comments:** Estimation issues—the z-score was constructed from the sample mean of public debt to GDP (across the country), while the behaviour of these fiscal variables was country specific.
		Classification and regression tree, and descriptive analysis	
Manasse and Roubini (2009)	Emerging economies	1970 to 2002	The study reported the following rules of thumb: (i) total external debt above 49.7 per cent of GDP, (ii) short-term debt above 130 per cent of reserves and (iii) public external debt above 214 per cent of fiscal revenues. Further, they stated some thresholds for some risk factors.
Robinson (2002)	Discussion using a reconciliation of Australian general government operating balance, fiscal balance and cash balance measures	Used the 2001 to 2002 Australian general government operating statement and balance sheet	This study explained and evaluated the new fiscal measure (fiscal balance) introduced under accrual accounting in the late 1990s. This study concluded that net financial liability is a more meaningful fiscal measure than fiscal balance, even though the new measure (fiscal balance) is superior to the cash budget balance measure.

continued…

Table 2.1 (…continued): Literature Based on Quantitative Approaches

Study	Country/countries	Timeframe	Conclusion and comments
Gruen and Sayegh (2005)	Descriptive analysis of Australia	1980 to 2005	A sustained fiscal consolidation shifted the budget deficit of 3.50 per cent of GDP (1983 to 1984) into a budget surplus of 1.75 per cent of GDP within five years. However, severe recession in the early 1990s interrupted this process and the budget returned again to deficit. During this period, peak deficits were recorded in 1992 to 1993 at 4.75 per cent of GDP. The second half of the 1990s repeated the same experience, and the budget returned to surplus in 1997 to 1998. Further, this paper indicated two key motivating factors behind extended fiscal consolidation: (i) current account deficit and associated foreign build-up of net foreign liabilities, and (ii) the ageing of the population and the projected rising public cost of health services.

A single threshold does not appear to be a realistic policy option or explanation of fiscal vulnerability.[27] There are many possible reasons for the presence of as many cut-off points of debt to GDP as there are countries under analysis. We categorised the existing literature on fiscal vulnerability into three main classes: (i) Bohn-type models, (ii) single-threshold approaches and (iii) alternative approaches.[28] In the early 1980s, the literature on fiscal sustainability was based on the present value budget constraint (solvency criteria), where fiscal sustainability required that today's government debt should be equal to the excess of future primary surplus over primary deficits in present value terms (Hamilton & Flavin, 1986; McCallum, 1984). Along these lines, Hamilton and Flavin (1986) used historical data to test the present value borrowing constraint. They empirically tested two different views of the limitations of government borrowing. One view was that the government can run a permanent budget deficit if it pays its interest when it is due. The alternate view was that creditors will be reluctant to purchase government securities unless the government has made a commitment to balance its budget in present value terms. Hamilton and Flavin (1986) empirically tested these views of fiscal sustainability, and concluded that the post-war US deficits were consistent with the second alternate that the present value budget constraint must hold. Further, they suggested that the present value budget constraint holds if primary balance and debt are stationary. Nonetheless, this is a sufficient yet unnecessary condition for sustainability. In other words, the fiscal policy can be sustainable even if the public debt is nonstationary (also see Chalk & Hemming, 2000).[29]

Trehan and Walsh (1988) suggested that the stationarity of net-of-interest deficit is neither a necessary nor sufficient condition for intertemporal budget balance. Moreover, Trehan and Walsh (1991) tested intertemporal budget constraints[30] to the US federal budget and current account deficits. Through examining the federal budget, they extended the previous work of Trehan and Walsh (1988) by indicating that the existence of a stationary linear combination of government debt and net-of-interest deficit is a necessary and sufficient condition for the

[27] The specific issues in this unique level of public debt to GDP are elaborated in a later part of this section.
[28] The studies using alternative approaches were further divided into three sub-classes: fiscal vulnerability index, financial net worth/balance sheet approach, and classification and regression tree.
[29] Trehan and Walsh (1988) tested the hypothesis that the present value budget constraint is shown to be equivalent to the condition that government debt and primary balances are cointegrated. Using US data from 1890 to 1986, this study reported results consistent with the intertemporal budget constraint where the government debt was sustainable.
[30] The government's intertemporal budget constraints at each date require that the present value of net tax payments of current and future generations should be sufficient to cover the present value of future government consumptions, as well as pay off the initial net indebtedness of the government. Failure to satisfy this constraint indicates that the government will default on its liabilities (Auerback, Gokhale, & Kolikoff, 1944).

intertemporal budget balance if: (i) expected real rates are constant and (ii) the quasi-difference of the net-of-interest deficit is stationary. Trehan and Walsh (1991) further reported that the deficit process is consistent with fiscal sustainability for post-war US data. Another strand of the literature used similar techniques and reported different results. For instance, Hakkio and Rush (1991) tested US fiscal policy using data from 1980, and could not find any cointegration between government spending (including interest payments) and revenue. Based on these results, they suggested that the then-recent taxation policies of the government violated the intertemporal budget constraint.

Conversely, Tanner and Liu (1994) reinvestigated the long-term solvency of the US government and reported sustainability. They incorporated a break term for 1981 to capture the shift in the fiscal process during the first Ronald Reagan administration. The results with a significant break revealed that expenditure and debt were cointegrated. Consequently, the long-term intertemporal budget constraint held. Similarly, Wilcox (1989) found mixed evidence on stationarity by indicating that the period of 1960 to 1984 could not be treated as a single sample because of a shift in the structure of fiscal policy. This study reported that the US fiscal policy at the time was unsustainable. Kremers (1989) further extended the constraint that the fiscal surplus cannot be larger than the output, and, in this case, the stationarity of government debt is both a necessary and sufficient condition for the present value budget constraint, as mentioned in Chalk and Hemming (2000).

Bohn (1991) and Bohn (1995) raised an important point that sustainability in the above literature was examined in an environment with certainty. Sustainable policies will no longer be sustainable in an uncertain environment, and the present value budget constraints must be expressed in expected value terms.[31] This distinction in two different versions of present value budget constraints is important because, with uncertainty, the discount factor is determined by the marginal rate of technical substitution between two different periods. In contrast, the discounting rate is the risk-free rate of return in a certain world. However, the marginal rate of technical substation between two periods (t and $t + 1$) differs considerably from the interest rate on government bonds. Therefore, the growth rate of debt above the risk-free rate of return does not necessarily imply uncertain behaviour. Based on these grounds, Bohn (1998) argued that some of the cointegration tests in the earlier literature (Hakkio & Rush, 1991; Trehan &

[31] See the section on sustainability and uncertainty in Chalk and Hemming (2000) regarding the modification of present value budget constraints during uncertainty.

Walsh, 1988, 1991) were expected to give misleading results. Bohn (1998) further argued that, if the primary surplus responds positively to the increasing amount of government debt, the fiscal policy reaction function can be considered sustainable. Bohn (1998) estimated the fiscal sustainability of the US by employing data from 1916 to 1995, and reported the US to be a non-vulnerable economy. The main concern with this approach is that it provides a debt coefficient over the sample period to determine fiscal sustainability. The common criticism of Bohn's approach is that it requires sufficiently large time series information to determine fiscal sustainability and provide a constant parameter of sustainability for that entire period. Moreover, the above model may be unable to determine vulnerability for a specific year. However, this model is frequently used in the empirical literature on this subject.

Considering the second strand of literature, the single-threshold and public-debt-overhang approaches are mainly criticised because of the assumed homogenous association between debt and growth across countries.[32] Among these, Reinhart and Rogoff (2010) calculated the cut off of public debt to GDP to be 90 per cent, beyond which public debt may lead towards vulnerability to crisis. They used historical data information from 44 countries for 1800 to 2009, and assumed homogeneous debt–growth associations across countries. More precisely, based on descriptive evidence, they observed that the median GDP growth rate was 4.5 per cent when the public debt to GDP was below 90 per cent. However, the median growth fell markedly to 2.9 per cent when public debt to GDP was above 90 per cent. However, there has been intense critique of the above study regarding the unique benchmark of debt to GDP, which diminished the growth rate in the selected economies. For example, Herndon et al. (2014) criticised the above findings by reproducing the results from the same dataset. Herndon et al. noted some serious concerns, including some coding errors in the data. Further, they noted that some data for the selected case were excluded from the analysis, which eventually led to misleading results because the threshold changed substantially by including these data. They further noted that Reinhart and Rogoff (2010) used inappropriate weights for their analysis. Therefore, the results of Reinhart and Rogoff could be biased and misleading. Similarly, Egert (2015) reinvestigated the above issue of unique threshold by using the same dataset that was employed in the above two studies. Egert validated this criticism by confirming the weighting and data

[32] The studies using the public-debt-overhang approach (Cecchetti et al., 2011; Reinhart et al., 2012) were also categorised under single-threshold approaches because they provided a single threshold of 86 per cent and 90 per cent, respectively. Further, this criticism was also indicated in Égert (2015).

exclusion issues. On this specific topic, we extend the literature by providing a fiscal vulnerability selection approach with an appropriate level of public debt as the threshold.

Another strand of the literature (Barnhill Jr & Kopits, 2004; Makin & Pearce, 2016; Mellor, 1996) uses the public sector balance sheet for fiscal vulnerability analysis.[33] In this field, Eisner and Pieper (1984) stated that gross public debt ignores the accumulation effect of financial and real assets, which contribute to the growing net worth of a government.[34] Consequently, revenue and capital expenditures are not distinguished properly in the existing literature (Cecchetti et al., 2011; Mauro et al., 2015; Valderrama, 2005), which widely deviates from the prevailing accounting theory. In this setting, applying conventional fiscal vulnerability tools to the private sector classifies most non-vulnerable firms as vulnerable firms (Eisner & Pieper, 1984). Therefore, these conventional fiscal vulnerability tools are biased towards vulnerability (Gruber, 2016), and this is consistent with the recent studies on the Australian context (Makin & Pearce, 2016; Mellor, 1996). Makin and Pearce (2016) recently evaluated the balance sheet implications of the growing level of Australian public debt, and suggested significant fiscal consolidations to mitigate future fiscal risks. Similarly, Abelson (2012) pointed out that public debt should not be analysed separately from net public worth and net financial liabilities.

Net public worth and net financial liabilities incorporate capital investment aspects of the government balance sheet. Therefore, public debt and net worth analysis present a complete picture of government finances. For further details, see Chapter 24—'Government Borrowing and Debt'— of Abelson (2012) on pages 427 and 428. Similarly, different measures of government financial position have been used in the existing literature. For instance, one strand of literature emphasises the net public worth of the government (Bohn, 1992; Buiter, 1985; Mellor, 1996). The Australian Government Treasury (1999) defines net worth as the residual interest in the assets of a reporting entity after the deduction of its liabilities. Mellor (1996) suggested using change in net worth to assess the fiscal policy of a government, while Di Marco et al. (2009) focused on incorporating offsetting accounts in the gross public debt to assess the fiscal sustainability of Australia. In particular, they reported the net public debt of the Australian general government as an accurate measure to assess its fiscal sustainability. Recently, Makin and Pearce (2016) examined the net worth and financial net worth of the

[33] The public sector balance sheet measures the fiscal performance of a country since it revealed the aggregated effects of imbalance in historical budgets. Considering the growing importance of the public sector balance sheet, the IMF has created a special task force, which is working to harmonise public sector accounting. See Yescombe (2011), Chapter 5: 'The Public-Sector Investment Decision'.

[34] For further details, see Eisner and Pieper (1984), Section 1, on actual budget deficits and debts.

government to assess the growing level of public debt in Australia. Further, Robinson (2002) and Abelson (2012) included net financial liability in the list of key measures for the government's financial position. Despite all these suggestions from the Australian fiscal literature, to the best of our knowledge, there is no empirical evidence assessing the fiscal sustainability of Australia using balance sheet data. Thus, this study provides this empirical evidence, along with the threshold level at which government policy becomes unsustainable.

Consistent with the existing literature, the Australian general government balance sheet reveals that its key measures are financial assets, non-financial assets and liabilities. During the past two decades, researchers have started to consider these measures in the evaluation of government budgets, including implicit measures of government budgets (Gruber, 2016). For instance, Gokhale and Smetters (2003) applied intertemporal budget constraint by calculating the present discounted value of fiscal imbalances. They reported a long-term fiscal imbalance of US$44.2 trillion for the US federal government as of the end of fiscal year 2002. Based on their recommendations, the social security trustee adopted these measures for future programs (Gokhale & Smetters, 2003, 2006). A wide range of literature (Bohn, 1992; Funnell, Cooper, & Lee, 2012; Robinson, 2002) has recommended that these new measures are more meaningful in fiscal sustainability testing when fiscal balances are measured using accrual accounting (Australian Bureau of Statistics, 2002), compared with the traditional cash accounting system.

Buiter (1985) provided the public sector's intertemporal budget identity by using the expected rates of return on all assets of the public sector. Here, the present value of the exhaustive current spending programme provides complete detail of the net worth of the public sector. This includes public sector assets, the present value of taxes, the present value of seigniorage and the present value of public sector capital formation. However, two components should be excluded to determine the intertemporal budget identity. These two components are public sector debt and the present value of terminal net liabilities. This intertemporal budget identity of the public sector indicates that the growing public debt has two implications for the public sector balance sheet. These implications are channelled through changes in the public worth of the country. The public debt to finance budget deficits deteriorates the balance sheet of the country. Conversely, the public debt improves the balance sheet if it is used for public investment purposes. In the latter case, the government can repay the debt along with debt services through means other than taxation. This association between growing public debt and the government balance sheet needs to be incorporated in fiscal sustainability analysis (Abelson, 2012; Mellor, 1996).

Similarly, Hemming and Partie (2002) stated that the structure of debt is important in assessing the fiscal sustainability of the government. They further emphasised that, if a government has some sizable financial assets, then net financial assets are more relevant than gross public debt.[35] For these reasons, the public sector balance sheet—a much-neglected macro-fiscal measure (Makin & Pearce, 2016, p. 2)—should not be ignored in this analysis. We incorporated this aspect in the fourth step of our fiscal vulnerability selection procedure.[36] The approach of financial net worth has two main issues.[37] First, it is observed that the negative value of financial net worth is increasing substantially in developed economies, especially after the recent GFC. For example, the average value of financial net worth in OECD economies had increased to -65 per cent of GDP in 2013, compared with the pre-crisis value of -38.1 per cent. Second, most developing and emerging economies do not have relevant available data. In particular, data on non-financial assets and liabilities are not available for most developing and emerging economies.[38]

Considering these issues, one possibility to incorporate non-financial assets in fiscal vulnerability analysis is to use the worst-case value of financial net worth (Barnhill Jr & Kopits, 2004), since data on non-financial assets for most emerging and developing economies are unavailable. We could not find any study on this topic, except Barnhill Jr and Kopits (2004).[39] However, the recent data on financial net worth indicate that this technique cannot be applied as a standalone approach to identify public finance vulnerability. Among many concerns, one of the key issues is that the exact proportion of financial and non-financial assets cannot be

[35] Hemming and Partie (2002) further stated that contingent liabilities should be included in fiscal vulnerability analysis. Contingent liabilities can be categorised into explicit and implicit. Explicit contingent liabilities include indemnities, guarantees and warranties of a government. Implicit contingent liabilities include any potential obligation of a government to bail out any insolvent units, including lower-level governments, financial institutions and public enterprises.

[36] See Figure 5.2 in Chapter 5.

[37] The financial net worth approach is also discussed as an alternative approach. We applied financial net worth in our fiscal vulnerability selection procedure to incorporate the investment aspect in debt analysis, which aligns with Abelson (2012) and Gruber (2016). As an alternative approach, financial net worth is used as a standalone technique. However, we used financial net worth (value at risk and conditional value at risk) in both cases.

[38] For further details on this aspect, see OECD (2015).

[39] Mellor (1996) and Makin and Pearce (2016) are two relevant studies. These studies used the balance sheet measures of the public sector. However, these studies did not discuss the use of value at risk or conditional value at risk in the public sector balance sheet. Mellor (1996) suggested that the Australian government new proposed reporting (accrual reporting) should be complemented with an accrual planning and budgeting regime, which would ensure that financial performance is planned and assessed on similar bases. This study proposed using change in net worth to assess the fiscal policy of the Australian government. Makin and Pearce (2016) evaluated the balance sheet implication of the growing level of Australian public debt and suggested significant fiscal consolidations to mitigate future fiscal risks. Theoretically, the public sector balance sheet measures the fiscal performance of a country over the time, since it reveals the aggregated effects of imbalance in historical budgets.

identified (Backus, Brainard, Smith, & Tobin, 1980). This proportion varies from country to country, and governments can use the income from non-financial assets—including land, public trading enterprises or other property—to pay their debt obligations (Abelson, 2012, p. 427). Among the alternative approaches, the fiscal vulnerability index approach—as noted in Baldacci et al. (2011)—is also based on the homogeneous assumption, since the z-score is constructed from the sample mean of public debt to GDP across the country. Conversely, the behaviour of the fiscal variable of individual countries in the sample is country specific. Therefore, this approach provides inconsistent results in different samples. Classification and regression-tree approaches attempt to define a rule of thumb for each of the fiscal variables to assess fiscal vulnerability. However, the main problem with the above approaches is linked with general and single-value estimates for a group of emerging economies.

In the current study, we initially used a Bohn-type model, assuming an uncertain environment in all 53 economies. However, previous studies exclusively relying on this approach were unable to correctly identify some vulnerable economies. For instance, Khan and Saqib (2007) reported that the fiscal balances of Pakistan had remained sustainable in the long term and in the recent past. Our results based on this approach were consistent with these findings. Nevertheless, this model presumes that economic time series can be modelled as belonging to a number of distinct regimes, where the regimes are characterised by different conditional distributions of the process. Hence, our proposed measure allowed for flexibility in model parameters through regime-switching behaviour, where the model assumed that the behaviour of the parameter of public debt changes once its series enters a different regime. Consequently, our proposed techniques identified the Pakistan economy as vulnerable to debt crisis at a critical level of 73.29 per cent of public debt to GDP. Applying a single threshold of 90 per cent of public debt to GDP, as proposed in Reinhart and Rogoff (2010), is also misleading because the public debt of Pakistan has never moved beyond 90 per cent over the last three decades. Thus, the results of the first approach, as given in Khan and Saqib (2007), can be misleading when the sample for the period of vulnerability is pooled with non-vulnerability. We addressed these issues in our proposed fiscal vulnerability approaches. The next section discusses the literature on the linkage between fiscal consolidation and banking stability.

2.3 Fiscal Consolidation and Banking Stability

This subsection presents the literature on the linkages between fiscal consolidation and banking stability. The effect of fiscal policy shocks on macroeconomic variables is well documented, especially for developed countries.[40] For instance, Giuliodori and Beetsma (2004) used vector auto-regression (VAR) methodology to analyse the spillover effects of fiscal policy shocks in European countries using data from 1970 to 1998. They reported that fiscal expansion in some of these countries—such as France, Italy and Germany—led to a significant increase in imports from a number of other European countries. Perotti (2005) applied a structural VAR (SVAR) approach to analyse the effect of fiscal shocks on prices, interest rates and GDP in five OECD countries, using quarterly data from 1960 to 2003. This study reported the small effect of fiscal policy on these variables. Laxton, Mursula, Clinton, and Kumhof (2010) presented a view of short-term pain and long-term gain. This study evaluated the costs and benefits of fiscal consolidation using a simulation based on the Global Integrated Monetary and Fiscal Model (GIMF—the IMF global dynamic stochastic general equilibrium model). This study suggested that a well-targeted permanent reduction in budget deficits leads to a considerable increase in both the level of output and growth rate. Likewise, the nexus between monetary policy and bank balance sheets is also well documented (Hosono & Miyakawa, 2014; Kashyap & Stein, 2000). For instance, Kashyap and Stein (2000) analysed the effect of monetary policy on banks' lending. They used quarterly data of US commercial banks from 1976 to 1993 and reported that the effect of monetary policy on banks' lending was much stronger for the banks with less liquid balance sheets.

However, the previous literature lacks an exploration of the channels through which fiscal consolidation affects banking stability. Angeloni, Faia, and Winkler (2011) analysed the influence of three alternative public debt consolidation policies on the stability of the banking sector. Their approach was based on debt consolidation policies, and the focus of the paper was on the composition and consequences of fiscal adjustment for banking stability. However, this paper did not propose any empirical test to determine the linkage between fiscal consolidation and banking stability.

[40] See Blanchard and Perotti (2002); Mountford and Uhlig (2009); and Aghion, Hemous, and Kharroubi (2014).

Recently, Cimadomo et al. (2014) analysed the effect of fiscal consolidation on banking stability for 17 developed economies.[41] Their analysis was limited to only those economies for which the newly compiled database on fiscal consolidation proposed by Devries et al. (2011) was available. Cimadomo et al. (2014) reported that Tier-1 capital ratio increased by 1.5 per cent as a result of one per cent of GDP fiscal consolidation in two years.[42] Further, they reported that this improvement was due to portfolio rebalancing. In short, specific empirical evidence on the influence of fiscal consolidation on banking sector stability is only available in Cimadomo et al. (2014). Therefore, we located the relevant literature on the linkage between fiscal consolidation and banking stability, and classified this literature in three groups. This classification linked different parts of the literature, including higher banking cost through persistent fiscal vulnerability as a result of higher sovereign risks.

Several studies have been conducted on the responses of GDP growth, private investment and private consumption to substantial changes in fiscal stance.[43] However, the linkage between fiscal consolidation and financial markets has been overlooked in the existing fiscal literature, although a few studies have covered some of the related aspects. For instance, Adrangi and Allender (1998) empirically investigated the effect of high budget deficits on stock prices in the vector autoregressive framework. This study was conducted in some industrialised economies using monthly data from 1974 to 1995.[44] A Granger causality test and impulse response functions reported inverse relations between budget deficit and stock return, especially in the US. Agca and Igan (2013) analysed the transmission of default risk premium in the corporate bond and stock market.[45]

Ardagna (2009) studied the behaviour of financial markets against fiscal consolidation. This study used a panel of OECD countries from 1960 to 2002, and reported two key aspects: (i) a decline in stock market prices in the period of loose fiscal policy and (ii) a rise in stock market prices during the period of substantial fiscal tightening. This study further reported that these results depend on the initial fiscal position of each country, as well as the type of fiscal

[41] Australia, Austria, Belgium, Canada, Germany, Denmark, Spain, Finland, France, Ireland, Italy, Japan, the Netherlands, Portugal, Sweden, the UK and the US.
[42] Tier-1 capital ratio is a widely used measure of banking stability.
[43] For example, Giavazzi and Pagano (1990); McDermott and Wescott (1996); Alesina and Perotti (1997); Alesina and Ardagna (1998); Giavazzi, Jappelli, and Pagano (2000); and Ardagna (2004).
[44] The US, France, Germany and Japan.
[45] They reported that, as a result of fiscal consolidation, the default risk premium arising from sovereign debt will be reduced. Consequently, the market will expect improved economic performance. This improvement in the lower cost of credit is transmitted to the corporate debt market and stock market.

consolidation.[46] For instance, if fiscal consolidation occurs in a period of high public debt and causes a substantial and permanent decrease in debt level, then stock prices will rise because of the lower perceived risk premium. Ardagna (2009) provided the only study that documents the reaction of financial markets to fiscal consolidation. In this context, we attempted to classify the existing literature in a way that indicates the association between the different components of fiscal and financial sectors. This led us to the gaps in this literature. The existing literature can be classified into three distinct groups: (i) fiscal vulnerability, sovereign risks and bank costs; (ii) sovereign defaults and bank balance sheets; and (iii) fiscal consolidation and banking stability. Table 2.2 summarises the classified literature in these three distinct groups.

Summarising Table 2.2, sovereign defaults are transmitted into the banking sector because of the bank holdings of the defaulted government. Further, this transmission mechanism operates through sovereign downgrades, stress between the public and financial sector, borrowing costs, the direct balance sheet effect, and asset channels. The existing literature describes capital adequacy ratios (Tier-1 capital ratio and total capital ratio) as the most suitable approach to measure banking stability (Bank for International Settlements, 2017).

[46] Hemming and Petrie (2002) indicated the weak initial fiscal position as a key indicator of fiscal vulnerability. They further reported a set of fiscal position indicators of fiscal vulnerability. This set included insufficient balance sheet information, poor accounting and control, significant quasi-fiscal activities, and sizable uncovered contingent liabilities. Also see Hemming and Petrie (2000).

Table 2.2: Literature on Fiscal Consolidation and Banking Stability

Study	Technique	Country/countries	Context	Conclusion/findings
		Fiscal vulnerability, sovereign risks and bank costs		
Akitoby and Stratmann (2008)	Panel regression analysis using fixed effects and instrumental variables (Anderson-Hsiao).	A panel of 25 emerging market economies, including Argentina (10), Brazil (10), Bulgaria (10), Chile (5), Colombia (7), Croatia (5), Ecuador (9), Egypt (3), El Salvador (2), Malaysia (8), Mexico (10), Morocco (6), Pakistan (1), Panama (8), Peru (7), the Philippines (6), Russia (6), South Africa (9), Thailand (7), Tunisia (2), Turkey (8), Ukraine (4), Uruguay (3) and Venezuela (10).	The objectives of this study were to: (i) examine the effect of fiscal policy on the sovereign risk spread and (ii) investigate the effect of the interaction of fiscal variables with political institutions on financial markets.	The study indicated that *debt-financed spending results in higher sovereign risk*, while tax-financed spending results in lower risk, indicating that international investors prefer tax-financed spending. Further, this study provided evidence that the reaction of financial markets to fiscal policy depends on the political institutions.
Panetta et al. (2011)	Using regression analysis, this study evaluated the effect of sovereign risk on the cost of bank funding.	A sample of 534 unsecured fixed-rate senior bonds from a total 116 banks from advanced economies.	Sovereign debt has lost its risk-free status in some economies. In this context, this report evaluates the effect of sovereign risk concerns on the cost and availability of bank funding conditions through describing its channels.	*Investors' concerns about sovereign risk have increased, especially in the Eurozone, and bank funding costs have subsequently risen sharply.* Sovereign risk affects the cost and availability of bank funding through four key channels: (i) asset channel holding of sovereign debt and its derivative positions have direct effects on bank balance sheets and profitability, (ii) reduction in the value of collateral, (iii) sovereign downgrades tend to lower the rating of domestic banks and (iv) reduced benefits from explicit and implicit government guarantees.

continued….

Table 2.2 (…continued): Literature on Fiscal Consolidation and Banking Stability

Study	Technique	Country/countries	Context	Conclusion/findings
Ağca and Celasun (2012)	Panel regression analysis with fixed effects used to empirically investigate this phenomenon.	Fifteen emerging economies.	This study analysed the behaviour of the corporate borrowing costs of emerging markets against sovereign debt.	This study reported that the yield spread increased by nine per cent as a result of one standard deviation increase in the public external debt. Sovereign defaults increased corporate borrowing costs; however, this cost was seven times higher in countries that had already experienced sovereign defaults in the past, compared with those that had not.
Sovereign defaults and bank balance sheets				
IMF (2002)	Descriptive using 1/*T* = 1999 as the event for the case of Ecuador and Pakistan, and *I*/T = 1998 for the case of Russia and Ukraine.	(i) Russia and Ecuador: the governments decided to default on all or part of their debts. (ii) Pakistan and Ukraine: the governments restructured terms with creditors under the shadow of default.	This study provided evidence on the effect of sovereign debt restructuring on the domestic economy using four specific cases.	Sovereign defaults first transmit into bank balance sheets and then spill over into corporations and households through: (i) general economic distress, (ii) reducing the net present value of the restructured debt and (iii) exchange rates. In this context, this study indicated the key role of the banking system in propagating these crises throughout the economy. The key concluding remark was that the ripple effect of sovereign debt crisis is higher if a significant portion of restructured debt is held with residents, particularly with banks. This study proposed an alternative to deal with sovereign default using swift recapitalisation to strengthen the bank's balance sheet. This could prevent the defaults from propagating into other sectors of the economy.

continued…

Table 2.2 (…continued): Literature on Fiscal Consolidation and Banking Stability

Study	Technique	Country/countries	Context	Conclusion/findings
Gennaioli, Martin, and Rossi (2014)	Through empirical analysis, this study used a fixed-effects model.	A panel of 20 emerging and developed economies.	*Government defaults are costly because they destroy the balance sheets of domestic banks.* During these conditions, banks increase their leverage, which makes them more vulnerable to sovereign defaults. This is most likely to be in economies where financial institutions are more developed and banks hold more government securities.	Recent historical facts reveal a close linkage between sovereign defaults and private financial markets.
Brutti (2011)	Panel regression analysis used for the empirical investigation.	Twenty-eight manufacturing sectors in a cross-section of 59 developing economies.	This study reported a direct linkage between sovereign debt crises and (i) liquidity crises and (ii) financial turmoil.	In emerging markets, sovereign debt crises are usually associated with liquidity and banking crises. Along these lines, this study emphasised the direct linkage between sovereign defaults and liquidity crises based on *two key assumptions*: (i) government securities are the key source of liquidation for the domestic private sector and (ii) the government is unable to discriminate between domestic and foreign creditors in case of default.
Arteta and Hale (2008)	Panel regression analysis with fixed effects used to empirically investigate this phenomenon.	Thirty emerging economies.	This paper analysed the access of emerging markets' private credit to international debt markets during sovereign debt crises.	This study reported that sovereign defaults result in a statistically significant decline in foreign credit to the private sector: (i) during sovereign defaults and (ii) for over two years after restructuring the agreements. This study further reported that this effect is concentrated in the non-financial sector of

continued…

Table 2.2 (…continued): Literature on Fiscal Consolidation and Banking Stability

Study	Technique	Country/countries	Context	Conclusion/findings
				emerging economies, where exporting and non-exporting sectors behave differently. Further, the magnitude of this effect depends on the restructuring agreements.
Correa, Lee, Sapriza, and Suarez (2014)	Traditional event study techniques.	Thirty-seven economies.	This study aimed to explore the joint effect of expected government support to banks and sovereign credit rating changes on bank stock returns.	This study indicated that sovereign credit rating downgrades have a negative (large) effect on the stock returns of those banks that receive stronger support from their respective governments. In this context, the effect is stronger in advanced economies, since governments are in a better position to provide support. Further, this study suggested that stock market investors perceive a connection between domestic banks and sovereigns.
Linkage between fiscal consolidation and banking stability				
Cimadomo et al. (2014)	Arellano–Bond dynamic panel data estimation.	Bank-wise consolidated data of 17 selected economies for which the IMF fiscal consolidation database constructed in Devries et al. (2011) was available.	To empirically investigate the effect of fiscal consolidation on banking sector stability.	This study indicated that fiscal consolidation is associated with improved banking sector stability, mainly driven by commercial banks. More directly, a fiscal consolidation of one percentage point results in an increase in Tier-1 capital ratio of 1.5 percentage points for median banks in the selected 17 economies. The results further suggested that improvement in the capital adequacy ratio is due to portfolio rebalancing from private securities to government securities. Specifically, the findings of this study suggest that fiscal consolidation of one per cent reduces the ratio of private to total securities by about five percentage points.
Agnello, Castro, Jalles, and Sousa (2015b)	A rare events logistic regression model, as well as the traditional probit and logit	A panel of 17 economies.	This paper aimed to investigate the effect of fiscal consolidation on the likelihood of financial reforms.	This study reported that large austerity plans (mainly implemented through cuts on spending, rather than tax hikes) are associated with promoting financial reforms. Specifically, banking sector reforms are mainly promoted during tax-driven

continued…

Table 2.2 (…continued): Literature on Fiscal Consolidation and Banking Stability

Study	Technique	Country/countries	Context	Conclusion/findings
	models.			fiscal consolidation, while domestic finance reforms are promoted during spending cuts–driven consolidation. Further, this study reported that a lower degree of trade openness, higher inflation, deterioration of financial conditions and fall in degree of competitiveness enhance the probability of financial reforms.
Agnello, Castro, Jalles, and Sousa (2015a)	Probit model and annual data for a panel of economies.	A panel of OECD and non-OECD economies.	This paper investigated the 'crisis-induced reform' hypothesis.	This study indicated that debt crises trigger financial reforms where: (i) sovereign debt restructuring and IMF stabilisation programs favour the implementation of financial reforms, (ii) financial reforms are more likely to occur when general economic conditions deteriorate and (iii) financial reforms are positively associated with the quality of economic conditions.
Arezki, Candelon, and Sy (2011)	This study used VAR methodology.	European financial markets.	This study aimed to analyse the spillover effects of sovereign rating news on the financial markets of Europe.	The results of this study indicated that sovereign rating downgrades have significant (statistically and economically) spillover effects across financial markets, as well as economies. The sign and magnitude of the spillover effect depend on: (i) the type of announcement and (ii) the rating agency. Further, they observed that the downgrades near speculative grade rating have systematic spillover effects across the Eurozone economies.

Following our classification in Table 2.2, the synthesised discussion on the relationship between fiscal consolidation and banking stability was classified into three distinct subsections: (i) fiscal vulnerability, sovereign risks and banks cost; (ii) sovereign defaults and balance sheets; and (iii) the linkage between fiscal consolidation and banking stability.

2.3.1 Fiscal Vulnerability, Sovereign Risks and Cost to the Banking Sector

Investors' concerns about sovereign risk have increased, especially in the Eurozone, and bank funding costs have subsequently risen sharply (see Panetta et al., 2011). On this topic, Akitoby and Stratmann (2008) evaluated that debt-financed spending is closely associated with sovereign risk, as compared with tax-financed spending. More specifically, this study examined the effect of fiscal policy on the sovereign risk spread through investigating the interaction of fiscal variables with political institutions on financial markets. However, this study only used a sample of emerging economies, which are expected to behave differently to developed economies. Moreover, in this classification, the initial fiscal position and type of fiscal consolidation is expected to be significant, as indicated in Ardagna (2009). There is a substantial lack of empirical literature on this topic, where specific study has been undertaken on classified economies based on fiscal vulnerability analysis. Ardagna (2009) is the only study with a specific focus on long-term interest rates and stock prices using a panel of OECD economies.[47] The key findings in this study related to long-term interest rates, which are also used in the theoretical framework of our study.

Ardagna (2009) stated that the long-term interest rates on public securities decrease if the fiscal position of a country improves. In particular, this effect is obvious if the economy was vulnerable before. Theoretically, the interest rates on government securities are expected to have a significant effect on the interest rates charges of other private securities (see Barr & Campbell, 1997). Ardagna (2009) estimated the expected future real interest rates and the inflation rates from the observed prices of government bonds in the United Kingdom (UK). Investigating this same topic, Barr and Campbell (1997) used index-linked bonds, and accounted for the imperfections in the indexation of UK index-linked bonds. They reported that the expected long-term returns on all types of bonds were almost equal, and the expected real interest rates and inflation were linked with the bond prices. This study provided sufficient evidence that interest rates on private securities are linked with government securities.

[47] This panel included Australia, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Spain, Sweden, the UK and the US.

However, these rates of returns on private and government securities are different where the return on private securities is more than for government securities because of the difference in return (Brealey, Myers, Allen, & Mohanty, 2012).[48] On this topic, Akitoby and Stratmann (2008) evaluated whether vulnerability increases sovereign risk, which is the key reason for increasing long-term interest rates through a higher sovereign risk premium. This linkage has empirical evidence from Agca and Igan (2013). Specifically, Agca and Igan (2013) analysed the mediatory role of default risk premium as a result of fiscal consolidation episodes, which is closely related to the empirical investigation of our study (Chapter 6, Section 6.4). Further, Agca and Igan (2013) reported that the default risk premium arising from sovereign debt reduces as a result of fiscal consolidation. Consequently, the market will expect improved economic performance. This improvement of a lower cost of credit is transmitted to the corporate debt market and stock market.

This general concern of investors focused on the banking sector particularly after the recent debt crises.[49] Over the last couple of years, the major debt crises in European economies have increased investors' concerns about sovereign risk, which has been transmitted into bank funding costs. Along these lines, we found the three most relevant studies on the transmission mechanism between sovereign risks and banking costs (Ağca & Celasun, 2012; Borensztein & Panizza, 2009; Panetta et al., 2011). Among these studies, Borensztein and Panizza (2009) applied regression analysis to evaluate the economic costs through financial systems associated with sovereign defaults. For this purpose, the study focused on banking costs using data from 149 selected economies. Specifically, Borensztein and Panizza (2009) empirically evaluated the four key costs associated with sovereign defaults: (i) reputational costs, (ii) political costs, (iii) international trade exclusion costs and (iv) economic costs through the financial system. This regression analysis reported that the sovereign defaults increased the probability of a banking crisis by approximately 11 percentage points. Similarly, this study analysed indirect costs of sovereign defaults on other sectors of the economy.[50] Similarly, credit rating and borrowing costs were affected in two distinct ways: (i) credit rating had a negative effect of about one notch in the three years after the default and (ii) borrowing costs increased by 250 to 400 basis points in the two years after the default.

[48] See the chapters on risk and return of Brealey, Myers, Allen, and Mohanty (2012) for more discussion on the topic.
[49] See Lane (2012) for more discussion on the European sovereign debt crisis and banking costs.
[50] For example, there was also a negative effect of sovereign defaults on GDP growth, ranging from 0.6 to 2.5 percentage points. However, its effect disappeared in the next year of sovereign default.

Panetta et al. (2011) analysed a sample of 534 unsecured fixed-rate senior bonds from 116 banks from advanced economies. This study first elaborated different channels of banking costs through descriptive statistics. Subsequently, the study evaluated the effect of sovereign risk on the cost of bank funding through regression analysis. Interestingly, it was observed over the last couple of years that sovereign debt has lost its risk-free status in some economies. Nonetheless, there have been a few studies on this aspect of sovereign debt. In this context, Panetta et al. (2011) evaluated the effect of sovereign risk concerns on the cost and availability of bank funding conditions.

More directly, investors' concerns about sovereign risk have increased particularly in the Eurozone, since sovereign debt has lost its risk-free status in different economies. Consequently, bank funding costs have risen sharply. Sovereign risk affects the cost and availability of bank funding through four key channels:

1. the asset channel holding of sovereign debt and its derivative positions have direct effects on bank balance sheets and profitability
2. sovereign downgrades tend to lower the rating of domestic banks
3. sovereign risk has affected banking costs through reduction in the value of collateral
4. sovereign risk has affected bank costs through reduced benefits from explicit and implicit government guarantees.

This analysis further revealed that the economic costs of the banking sector are generally significant, yet short lived.

Similarly, Ağca and Celasun (2012) analysed the borrowing costs behaviour of the overall corporate sector against sovereign debt. The portion of the banking sector in the overall corporate sector varies from country to country. For instance, this portion is significantly higher in India than in other emerging economies.[51] Using data from 15 emerging economies, Agca and Celasun (2012) applied panel regression analysis with fixed effects, and empirically investigated the borrowing costs behaviour of the overall corporate sector against sovereign debt. The key finding of this study was that sovereign defaults have increased corporate borrowing costs. Nonetheless, corporate borrowing costs behave differently in different economies depending on their defaults in the past. For instance, Agca and Celasun (2012) indicated that this cost was seven times higher in countries that had already experienced

[51] See Damji (2012) for further discussion on the banking sector of India.

sovereign defaults in the past, compared with those that had not. Further, this study reported that the yield spread increased by nine per cent as a result of one standard deviation increase in public external debt. In summary, fiscal vulnerability has transmitted into banks' borrowing costs through higher sovereign risks. The next section of the classified literature presents a synthesised discussion on the extension of this link to bank balance sheets.

2.3.2 Sovereign Defaults and Bank Balance Sheets

Government defaults have associated costs, with the key costs based on the fact that these defaults destroy the balance sheets of domestic banks (Gennaioli et al., 2014, p. 819). Most of the studies in this field were conducted after the recent financial crisis of 2007 to 2009, except for the study by the IMF (2002).[52] In this strand of literature, the IMF (2002) studied the four different cases of Russia, Ecuador, Pakistan and Ukraine. The governments of Russia and Ecuador decided to default on all or part of their debt, while the governments of Pakistan and Ukraine restructured the terms with creditors under the shadow of default. For this purpose, the IMF (2002) used the period of 1999 for the case of Ecuador and Pakistan, and 1998 for the case of Russia and Ukraine.

The key findings of this study elaborated the linkage between sovereign defaults and bank balance sheets. For instance, this study evaluated whether sovereign defaults first transmit into bank balance sheets and then spill over into corporations and households. In this context, the IMF (2002) provided three channels of transmission: (i) exchange rates, (ii) general economic distress and (iii) reducing the net present value of the restructured debt. Among these channels, the third channel was expected to have a significant effect on bank balance sheets. This study further indicated the key role of the banking system in propagating crises throughout the economy. In this transmission mechanism, the holding of government securities affects bank balance sheets (see Dinç, 2005). Along these lines, the IMF (2002) further revealed that the effect of sovereign debt crises is higher if a significant portion of restructured debt is held by domestic banks. This study proposed an alternative to deal with sovereign default by using swift recapitalisation to strengthen the bank's balance sheet. This could prevent the defaults from propagating into other sectors of the economy.

Further on this transmission mechanism, bank-specific characteristics and fundamentals play a significant role in individual banks' exposure to government default risk and currency, as

[52] These studies included Arteta and Hale (2008); Barajas, Basco, Juan-Ramon, and Quarracino (2007); Brutti (2011); Correa et al. (2014); and Gennaioli et al. (2014).

indicated in Barajas et al. (2007, p. 621). In particular, Barajas et al. (2007) provided useful channels of transmission on sovereign defaults and bank balance sheets through analysing the Argentine crisis. This descriptive analysis was based on several factors, including:

1. the balance sheet position of Argentine banks at different times, including January 1995 and September 2001[53]
2. the bank financing of the government
3. intermediation activities
4. deposit growth
5. cross-bank variations.

Among these factors, the first component provides more information on our main theme for this subsection. Another key finding of Barajas et al. (2007) was the variation in behaviours of banks during crises. This variation is possible because of a few banking fundaments, including profitability ratio, liquidity ratio and efficiency ratio.[54] This panel data estimation also revealed that depositors distinguish banks based on risks, which aligns with the theory of risk and return (see Brealey et al., 2012). In general, bank-specific characteristics and fundamentals play a significant role in individual banks' exposure to government default risk and currency.

Similarly, Arteta and Hale (2008) analysed the access of emerging markets' private credit to international debt markets during sovereign debt crises. Using a sample of 30 emerging economies, this study applied panel regression analysis with fixed effects to empirically investigate the access of private credit to the international debt market.[55] Arteta and Hale (2008) reported that sovereign defaults have a statistically significant negative effect on foreign credit extended to the private sector. More specifically, this study indicated the specific period of this negative effect. For instance, this effect was severe during sovereign defaults. Then, this effect vanished after two years because of restructuring the agreements. Additionally, this analysis revealed that this effect was concentrated in the non-financial sector of emerging economies, where exporting and non-exporting sectors behave differently. In this relationship, debt restructuring agreements are important because the magnitude of the effect depends on these agreements.

[53] January 1995 was the beginning of the sample period used in Barajas et al. (2007), while September 2001 was the period immediately after the Argentine crisis.
[54] See Nissim and Penman (2001) for more information on the accounting ratios.
[55] The focus of this study was the access of private credit by emerging economies during a crisis period.

Sovereign debt crisis, liquidity crisis and financial turmoil have some linkage because all these crises are related to banks. Brutti (2011) provided very specific empirical evidence on this linkage. Through using data from 28 manufacturing sectors in a cross-section of 59 developing economies, this study applied a panel regression analysis for this empirical investigation. The study focused on the direct channel through which sovereign defaults are transmitted into the banking sector.[56] Brutti (2011) reported that the direct channel works because of two key assumptions. First, government securities are the key source of liquidation for the domestic private sector. Second, the government is unable to discriminate between domestic and foreign creditors in the case of default. In general, the holding of government securities is the key factor behind the direct channel through which government defaults are transmitted into bank balance sheets.[57]

Another perspective on this linkage is sovereign credit rating and government support to banks. Sovereign defaults are less likely to transmit into the banking sector if the banking sector is supported by the government. In this regard, Correa et al. (2014) explored the joint effect of expected government support to banks and sovereign credit rating changes on bank stock returns using a traditional event study methodology for 37 economies. The results of this study indicated that sovereign credit rating downgrades have a large negative effect on the stock returns of those banks that receive stronger support from their respective governments. Further, the researchers analysed the difference between these effects on developing and developed economies, and the results suggested that this effect is stronger in advanced economies because governments are in a better position to provide support. Interestingly, one of the key findings of this study was that investors in the stock market used to perceive the linkage between sovereign defaults and domestic banks.

Recently, Gennaioli et al. (2014) investigated the capital structure of banks and the reaction of banks to sovereign defaults in the presence of high leverage. For this purpose, the study applied a fixed-effects model on a panel of 20 emerging and developed economies. The results of this study revealed a close association between sovereign defaults and financial markets. Gennaioli et al. (2014) evaluated that banks with high leverage become more vulnerable, especially when

[56] For a discussion on the indirect channel, see Cimadomo et al. (2014). Also see Krishnamurthy and Vissing-Jorgensen (2012) for empirical evidence from the US treasury bills.
[57] Along these lines, Hemming et al. (2003) empirically investigated whether the change in the net claims of the banking sector from the government contributed significantly to past crises.

they hold more government securities. Summarising this discussion, government defaults are costly because they destroy the balance sheets of domestic banks.

2.3.3 Fiscal Consolidation and Banking Stability

The above literature review has determined that government defaults are costly because they destroy bank balance sheets. In this interaction, fiscal consolidation plays a significant role by mitigating sovereign risk. This subsection of the literature review presents a synthesised discussion of this topic. A few studies have investigated the transmission mechanism between sovereign defaults and bank balance sheets (Arteta & Hale, 2008; Barajas et al., 2007; Brutti, 2011; Correa et al., 2014; Gennaioli et al., 2014). Both of these components are closely associated with fiscal consolidation and banking stability. For instance, fiscal consolidation is defined as any measure implemented with the intention to reduce the government budget deficit (Cimadomo et al., 2014, p. 79). Therefore, fiscal consolidation directly reduces sovereign risk and is transmitted into bank balance sheets. Despite this close linkage, there is a substantial lack of literature on the linkage between fiscal consolidation and the specific segment of the bank balance sheet, which is used as a key indicator of banking stability by financial regulatory bodies. These indicators are the key predictors of bank failures (Cimadomo et al., 2014, p. 76). Further, the Bank for International Settlements and other regulatory bodies use both of these key measures to measure banking stability.[58]

In regard to this linkage, we found only five studies (Agnello et al., 2015a, 2015b; Ardagna, 2009; Arezki et al., 2011; Cimadomo et al., 2014), and all these studies were conducted in developed economies. Ardagna (2009) was the first study to investigate the effect of large fiscal consolidation on financial market behaviour, using a traditional event study methodology on a panel of OECD economies. However, this study focused on the behaviour of stock prices. The key finding of Ardagna (2009) in relation to the current thesis was that the effect of fiscal consolidation depends on the initial fiscal position of the country. Similarly, Arezki et al. (2011) analysed the spillover effects of sovereign rating news on European financial markets. This study used credit default swaps and Greece credit rating announcements, along with VAR methodology. The relevant key finding was that sovereign rating downgrades have statistically significant spillover effects across financial markets and economies. Nonetheless, the magnitude of the spillover effect depends on the type of agency.

[58] See prudential standard APS 110-120 of Australian Prudential Regulation Authority (2015) for the case of Australia.

In line with Ardagna (2009), Agnello et al. (2015a) investigated the 'crisis-induced reform' hypothesis by applying a probit model on the annual data from a panel of non-OECD economies.[59] This study indicated that debt crises trigger financial reforms depending on the initial fiscal conditions.[60] This same group of researchers conducted a similar study (Agnello et al., 2015b) to investigate the effect of fiscal consolidation on the likelihood of financial reforms. By applying a rare events logistic regression model, as well as the traditional probit and logit models, on a panel of 17 economies, this study reported that large austerity plans are associated with promoting financial reforms. More directly, large austerity plans implemented through cuts on spending have significant effects, compared with tax hikes. The final study in this context (Cimadomo et al., 2014) analysed the influence of fiscal consolidation on banking stability in 17 developed economies, for which the newly compiled database on fiscal consolidation proposed by Devries et al. (2011) was available. The results of this study indicated that Tier-1 capital ratio increased by 1.5 per cent as a result of one per cent of GDP fiscal consolidation in two years. Additionally, the researchers reported that this improvement was due to portfolio rebalancing.

2.4 Literature Gaps and Remedies

We aimed to improve the existing literature in a few ways to overcome the issues in the fiscal vulnerability analysis literature and fiscal consolidation and banking stability literature. First, the available techniques are unable to identify the short-term episodes of fiscal vulnerability, especially when applied on a large sample of economies. We overcame this issue by extending the fiscal vulnerability analysis to a subsample through forward, backward and moving screening processes and threshold regression.[61] The single-threshold approach provides a straightforward cut-off of 90 per cent public debt to GDP, beyond which public debt may lead towards debt crises.[62] In a single-threshold framework, the main criticism is the assumption of debt–growth association across countries. Therefore, we included a country-specific threshold in our proposed fiscal vulnerability selection approaches. The existing literature has not incorporated the investment aspect of public debt in the fiscal vulnerability analysis. We

[59] We extended this analysis in Chapter 8 to empirically test this phenomenon in our setting.
[60] See the final section of Table 2.2 for details on these initial fiscal conditions.
[61] See Figure 5.1 (Chapter 5) for more details on these screening processes.
[62] Ninety per cent is a common threshold used in the literature. However, some studies provided 85 per cent as a common threshold.

attempted to overcome these issues by incorporating the value-at-risk and conditional-value-at-risk financial net worth of the country in our proposed fiscal vulnerability selection approach.

Despite the close linkage between fiscal consolidation and the banking sector, there is a substantial lack of literature on the linkage between fiscal consolidation and the specific segment of the bank balance sheet, which is used as the key indicator of banking stability by financial regulatory bodies. This linkage works through sovereign risk, whereby a higher amount of sovereign risk increases banking costs. We further conjectured that fiscal consolidation rebuilds market confidence and attracts institutional investors by including investment securities in their investment portfolio to achieve the required adequacy ratio for financial stability of the banking sector. Further, we contribute to the empirical literature by using the Bankscope database for a large sample of developing and developed economies. None of the previous studies provide evidence on the varying role of fiscal consolidation in the banking stability of vulnerable and non-vulnerable economies. This study fills this literature gap by providing evidence on the role of fiscal consolidation on the capital adequacy ratio of the banking sector from 53 selected economies. We further extend this evidence on vulnerable and non-vulnerable economies.

2.5 Concluding Remarks

This chapter has classified the existing literature into two broader categories of: (i) fiscal vulnerability and (ii) the transmission mechanism for fiscal consolidation and banking stability. We first identified the problems in the existing fiscal vulnerability techniques. For instance, the debt coefficient provides a single estimate over a period of time, yet the vulnerability in economies varies. Moreover, single-threshold and other alternative measures have associated issues, including the assumption of debt–growth association across countries, the increasing negative value of financial net worth, and ignoring the country-specific behaviour of fiscal variables. This study overcomes these issues through proposing a multi-approach method of selecting vulnerable economies.

The next section of this chapter revealed that fiscal vulnerability has transmitted into banks' borrowing costs through higher sovereign risks. This affects banking stability through destroying the bank balance sheet. Despite this close linkage, this literature review indicates that there is a substantial lack of literature examining the relationship between fiscal consolidation and bank balance sheets. This research extends the literature by providing empirical evidence from 53 selected economies. Finally, this chapter also discussed the gaps

in the literature and their remedies in regard to the way in which fiscal stances are transmitted into bank balance sheets.

CHAPTER 3. Framework of Analysis

3.1 Introduction

In this chapter, we first present a segment-wise analysis of fiscal vulnerability through public debt evolution. We then present the transmission mechanism through which fiscal consolidation increases the financial stability of the banking sector through mitigating sovereign risk. Fiscal vulnerability for a long period has associated consequences. For instance, the general public—especially the expected investors of government securities—recognise this situation and stop buying government securities. Among these institutional investors, banks are the major holders of government securities and are expected to shift their portfolio from government securities to private securities, which deteriorates their financial stability. In this interaction, fiscal consolidation rebuilds their confidence and plays a role in regaining their capital adequacy ratios—the key measures for banking stability. To cover all these aspects, the rest of this chapter is organised as follows. Section 3.2 discusses public debt evolution and fiscal vulnerability. Section 3.3 elaborates the mechanism of fiscal consolidation being transmitted into the banking sector, and Section 3.4 concludes this chapter.

3.2 Public Debt Evolution and Fiscal Vulnerability

The capital and revenue components of accumulated debt have different accounting treatments, whereby the capital component is classified as the liability in the balance sheet, and the revenue components are recorded in the trading and profit-and-loss account (income statement). This is the case for both individual and corporate agents. However, the debt analysis of an economy is different because an economy never retires and essentially lives forever. In this way, debt analysis differentiates economies from individuals. The debt of an individual is sustainable if it is feasible for that individual to repay the debt over her or his life. This is why large loans to individuals, such as mortgage loans, are always based on the financial health of the individual

and are extended after ensuring the individual's ability to repay the principle, as well as the interest amount, by their retirement. The debt scenario of a country is slightly different because an economy never retires and essentially lives forever. In this context, there is no reason that an economy must pay off its debts entirely. In this context, what is important for an economy is fiscal sustainability.[63] Therefore, the remainder of this section focuses on the fiscal sustainability of an economy in the framework of its debt analysis.

Ley (2009) found that the debt analysis of an economy can be better understood through the evolution process of public debt, where the stock of government debt at any time includes historical debt (plus interest), the overall balance and the ending stock of the high-power money. Mathematically, this can be expressed as:

$$PD_t = (PD_{t-1})(1 + i_t) - PB_t - \Delta HPM_t \quad (3.2.1$$

where PD_t, i_t, PB_t and HPM_t indicate the ending period stock of government debt, nominal interest rate, primary government balance and end of period stock of high-power money, respectively. Important in the debt analysis of any economy is fiscal sustainability, which indicates whether the government can service its debt. Fiscal sustainability considers the fulfilment of intertemporal budget constraints—specifically, whether an economy is able to pay the interest on its debt and honour the capital repayments when these payments are due. For this to be the case, we separate the debt service component from the principle amount of historical public debt (Equation 3.2.1) as follows:

$$PD_t = \underbrace{PD_{t-1}}_{Historical\ Public\ Debt} - \underbrace{(PB_t - i_t PD_{t-1})}_{Overall\ Balance} - \underbrace{\Delta HPM_t}_{Seignorage} \quad (3.2.2$$

In Equation 3.2.2, the overall or operating balance of the public sector is either budget deficit or surplus, where both of these possibilities of operating balance have different economic consequences.[64] Starting our debt analysis with budget deficit, Fischer and Easterly (1990, p. 130) discussed different ways of financing budget deficit for an economy, which can be categorised as: (i) issuing new debts, (ii) through monetised or (iii) using a mix of both of these options.[65] In this manner, a budget deficit does not help in the loan amortisation process of an

[63] See Mankiw and Taylor (2014) for further discussion on fiscal sustainability.
[64] We discussed cases where overall balance is either less than or greater than zero. The third case is a balanced budget, where the overall balance is zero. In this case, only the historical amount of public debt will be rolled over.
[65] $Budget\ deficit = money\ printing + (foreign\ reserve\ use + foreign\ borrowing) + domestic\ borrowing.$

economy; therefore, the amount of public debt is rolled over: $\left[\underbrace{PB + \Delta HPM < 0}_{rollover}\right]$.[66] Similarly, any gross amortisation due during the time will require a rollover, unless the government changes its fiscal policy to achieve budget surplus. As a result, the surplus component is used to amortise the public debt, where the stock of public debt is reduced: $\left[\underbrace{PB + \Delta HPM > 0}_{reducing\ stock\ debt}\right]$, which helps achieve the fiscal sustainability of an economy. In the third possibility of overall balance, if $Pb + \Delta HPM = 0$, then $PD = (1 + i)PD_{-1}$.

This process of gross amortisation depends on the government's ability to service or repay the public debt. This ability is quantified through a few measures, including: (i) government revenue, (ii) GDP and (iii) exports in the case of external debt. In this context, it is useful to concentrate on the ratio of public debt to a measure of scale of the economy. For this purpose, Equation 3.2.1 can be normalised through any of these quantitative measures; however, the most common measure is the nominal GDP (P_tY_t). Therefore, we focus on the government debt to GDP:

$$\frac{PD_t}{P_tY_t} = \frac{(PD_{t-1})(1+i_t)}{P_tY_t} - \frac{PB_t}{P_tY_t} - \frac{\Delta\, HPM_t}{P_tY_t} \quad (3.2.3$$

$$\frac{PD_t}{P_tY_t} = \frac{(PD_{t-1})}{P_{t-1}Y_{t-1}}\frac{(1+i_t)}{(1+g_t)(1+\pi_t)} - \frac{PB_t}{P_tY_t} - \frac{\Delta\, HPM_t}{P_tY_t} \quad (3.2.4$$

In the above equations, g_t and π_t indicate the real growth rate and inflation rate, respectively. Equation 3.2.4 can be rewritten as the *law of motion of the government debt-to-GDP* ratio, where ratios to GDP are denoted by the lowercase symbols (Ley, 2009):

$$pd_t = pd_{t-1}\frac{(1+i_t)}{(1+g_t)(1+\pi_t)} - (pb_t + \Delta hpm_t) \quad (3.2.5$$

Using the real rate of interest, r_t:

$$pd_t = pd_{t-1}\frac{\overbrace{(1+r_t)}^{\tau_t}}{(1+g_t)} - (pb_t + \Delta hpm_t)^{67} \quad (3.2.6$$

Here, the revenue generated from the money printing is treated as the source of financing. See the section on money printing in Fischer and Easterly (1990, p. 131).

[66] See Fischer and Easterly (1990) for more details on the interaction of printing money in this context.

[67] Here, τ is the discount factor, and is defined as $[(1 + r_t)/(1 + g_t)]$.

$$pd_t = \tau_t(pd_{t-1}) - (pb_t + \Delta hpm_t) \quad (3.2.7$$

Equation 3.2.7 truly represents the fundamental fiscal sustainability identity, with two assumptions: (i) it must be derived from the accounting identities and (ii) no behavioural intervention is allowed. Further, it is assumed that any seigniorage $\Delta\ hpm_t$ will be added in the pb_t.[68] Thus, starting from Time 0, as given in Ley (2009), the public debt will be as follows:

$$pd_1 = \tau_1 pd_0 - pb_1 \quad (3.2.8$$

$$pd_2 = \tau_2 pd_1 - pb_2 \quad (3.2.9$$

$$\cdots = \tau_2[\tau_1 pd_0 - pb_1] - pb_2 \quad (3.2.10$$

$$\cdots = \tau_2\tau_1 pd_0 - \tau_2 pb_1 - pb_2 \quad (3.2.11$$

$$pd_3 = \tau_3 pd_2 - pb_3 \quad (3.2.12$$

$$\cdots = \tau_3[\tau_2\tau_1 pd_0 - \tau_2 pb_1 - pb_2] - pb_3 \quad (3.2.13$$

$$\cdots = \tau_3\tau_2\tau_1 pd_0 - \tau_3\tau_2 pb_1 - \tau_3 pb_2 - pb_3 \quad (3.2.14$$

$$pd_4 = \tau_4 pd_3 - pb_4 \quad (3.2.15$$

$$\cdots = \tau_4[\tau_3\tau_2\tau_1 pd_0 - \tau_3\tau_2 pb_1 - \tau_3 pb_2 - pb_3] - pb_4 \quad (3.2.16$$

$$\vdots$$

$$pd_t = pd_0 \prod_{j=1}^{t} \tau_j - \sum_{j=1}^{t} pb_j \prod_{i=j+1}^{t} \tau_i \quad (3.2.17$$

To use Equation 3.2.17 for an analysis of more than five years, we can assume the constant discount factor and the balances, where this simplified version of Equation 3.2.17 can be interpreted as an average. By dropping the time superscripts from τ and pb:

$$pd_t = pd_0\tau^t - pb\sum_{i=0}^{t-1}\tau^i \quad (3.2.18$$

In public debt analysis, Equation 3.2.18 can be used for different purposes—for example, if a country wishes to achieve its target of debt ratio, $\bar{d}$, over a specific period. Target debt helps analyse the level of fiscal sustainability. Specifically, it helps determine the required level of

[68] See the section on money printing in Fischer and Easterly (1990, p. 131). Revenue from seigniorage varies from country to country and is relatively high in developing economies. Our set of economies includes developed, emerging and developing economies; therefore, we include seigniorage as a source of financing in the above discussion.

primary balance over a specific period. A lower required level of primary balance over a long period enhances the government's ability to service its debt. Conversely, a higher required level of primary balance for a long period deteriorates the ability of the government to service its debts, and ultimately leads to fiscal vulnerability. By extending our debt analysis along these lines, a simple solution to Equation 3.2.18 for primary balance gives the required average primary balance. First, considering the case where real interest rate is equal to the growth rate ($\tau = 1$), the required primary balance is:

$$pb = \frac{(pd_0 - \bar{d})}{T} \tag{3.2.19}$$

Equation 3.2.19 indicates that the primary balance should cover the total gap $(pd_0 - \bar{d})$ over the period of T.[69] However, the real interest rate and growth rate are not always equal in the real world. The dynamics of public debt and sustainability of primary balance (deficit in this case) are particularly affected by this difference between the growth rate and interest rate (Anand & Van Wijnbergen, 1989; Fischer & Easterly, 1990). Thus, it is preferable to consider cases where the real interest rate is different from the growth rate.

First, assume that the real interest rate is less than the growth rate ($\tau < 1$), where the public debt dynamics are stable. In this scenario, the required primary balance will be lower than the previous situation (given in Equation 3.2.19), as follows:

$$pb = \frac{pd_0\tau^t - \bar{d}}{\sum_{i=0}^{t-1}\tau^i} < \frac{(pd_0 - \bar{d})}{T} \tag{3.2.20}$$

In case of a greater growth rate, the amount of public debt will deteriorate and the primary deficits more than seigniorage revenue will be sustainable. A so-called 'Ponzi' finance or scheme of borrowing to serve the debt is possible.[70] This is normally the case in economies that are growing rapidly, such as China. The case of real interest rates being lower than growth rates provides an escape from public debt crisis for these economies. However, this is not true for all economies. For instance, there is no substantial difference between the current growth rate and interest rates in Australia.

[69] Alternatively, the primary balance should fill one T^{th} of the differential amount each year.
[70] Italian Charles Ponzi was a resident in Boston who made a substantial amount of money through pyramid investment schemes in 1920; however, he ended up in jail and later penniless. See Mankiw and Taylor (2014, p. 528) and Fischer and Easterly (1990) for further details.

Market forces tend to prevent real interest rates from remaining below the growth rate for a long period. A higher amount of public debt places pressure on the bond markets, which transmits into higher real interest rates and lower growth rates. If a faster growing economy exploits these favourable debt dynamics by borrowing excessively, the growth rate will eventually decline. Considering the world economy, the normal situation should be thought of as one in which real interest rates are higher than growth rates. It might be argued that a government can continue a Ponzi scheme through controlling domestic interest rates. However, the differential amount of controlled interest rates and long-term equilibrium rate will be a type of tax on bondholders. These investors will respond by investing their money elsewhere. As a result, the government will face difficulty in gaining new debt. Different economies, including Mexico and Argentina, have experienced this type of situation, along with capital flight (Cuddington, 1986). Venezuela is currently facing this situation. Given that Australian bonds are not exchange traded (exchange-traded treasury bonds and exchange-traded treasury indexed bonds), investors are expected to respond to this tax on bondholders.[71]

Conversely, if the real interest rate is greater than the growth rate ($\tau > 1$), the public debt dynamics will be unstable. In this scenario, the required primary balance will be greater than the previous situation (given in Equation 3.2.19), as follows:

$$pb = \frac{pd_0\tau^t - \bar{d}}{\sum_{i=0}^{t-1}\tau^i} > \frac{(pd_0 - \bar{d})}{T} \qquad (3.2.21$$

In this case, it is impossible for an economy to run permanent primary deficits where this amount exceeds the government revenue through seigniorage. This scenario requires the attention of policy makers, where: (i) the government is running primary deficits greater than the seigniorage revenue and (ii) real interest rates are greater than the growth rate. Under these fiscal conditions, the public debt to GDP ratio will continue to rise without limits. At some point, it will be difficult for the government to gain new debt and, ultimately, the government will have to cut the budget deficit. However, the ending point of this process depends on bondholders' expectations (Özatay, 2000). When the general public—especially the expected investors of bondholders' markets—recognise this situation, they will stop buying government securities and subsequently force the fiscal policy to change. Banks are the major holders of

[71] See the bonds section under 'Products' on the official website of the Australian Stock Exchange: http://www.asx.com.au/products/bonds/exchange-traded-agbs.htm. A recent phenomenon of exchange-traded bonds in the Australian Stock Exchange was not incorporated because the data for the analysis ranged only up to 2015.

government securities and will shift their portfolio from government securities to private securities, which deteriorates banking stability. The next section elaborates this transmission mechanism in detail.

3.3 Fiscal Consolidation and Banking Stability—Transmission Mechanism

Under these fiscal conditions, fiscal consolidation mitigates sovereign risk because government securities are perceived to be a safer investment. As a result, investors and banks have restored market confidence, and banks make changes to their investment portfolios. Theoretically, banks make changes to their portfolio for two main reasons: (i) investors' perception of sovereign risk and (ii) the probability of default in the interbank lending market. Dib (2010) explained the second type of change relevant to the probability of default.[72] In a typical economy, there are several investment projects that require initial investment. Those projects require funds that are usually provided by banks. Banks consist of all of the financial intermediaries that provide net credits in the interbank market. The most important function of banks (j) is to collect fully insured deposits $(D_{j,t})$ from households and businesses. To use these deposits, banks (j) pay the interest on the deposits' interest rate ($R_{j,t}^{D}$) to these households and businesses. These deposit interest rates should align with the cost of capital. Therefore, banks normally set these rates as a markdown of the required return on bank assets. Looking at investing activities, banks allocate this deposited money into two main categories. One portion of these deposits $(s_{j,t})$ is lent in the interbank market—interbank lending. The second portion of these deposits $(1 - s_{j,t})$ is allocated to government bonds. In this allocation, the portfolio of the J^{th} bank consists of the following two categories:

Interbank lending: $D_{j,t=}^{IB} s_{j,t}. D_{j,t}$

Government bonds: $B_t^{sb} = (1 - s_{j,t}) . D_{j,t}$

Therefore, the total deposits received, interbank lending and government bonds are three imperative components of the balance sheets of saving banks. Here, the gross nominal interbank lending rate (R_t^{IB}) is the rate paid on the interbank lending $(D_{j,t=}^{IB} S_{j,t}. D_{j,t})$. This lending rate is subject to a default probability of the interbank lending market (δ_t^D), as

[72] This section is extracted from Section 2.2.1 of Dib (2010).

discussed in Angbazo (1997).[73] The interbank lending rate clears the interbank market and is determined endogenously.[74] However, default probability operates as a key driver for portfolio rebalancing. A higher default probability in any of the investment categories encourages banks to rebalance their portfolios.[75] This requires investigating the drivers of the optimal allocation of deposits between these investment classes (interbank lending and government bonds). Depending on the nature of operations, saving banks and lending banks behave differently against these default probabilities. Therefore, both of these cases are discussed below.

Following Gerali, Neri, Sessa, and Signoretti (2010), the j^{th} saving bank faces the following individual supply function under imperfect substitution between deposits:

$$D_{j,t} = \left(\frac{R^D_{j,t}}{R^D_t}\right)^{\vartheta D} . D_t \qquad (3.3.1$$

where:

$D_{j,t}$ denotes the deposits provided to j^{th} saving bank

D_t denotes the total deposits

ϑD denotes the elasticity of substitution between the deposits of different types.

While adjusting the $R^D_{j,t}$, saving banks face the following quadratic adjustment costs, as given in Rotemberg (1982) and Dib (2010):

$$Ad^{R^D}_{j,t} = \frac{\varphi R^D}{2} . \left(\frac{R^D_{j,t}}{R^D_{j,t-1}} - 1\right)^2 . D_t \qquad (3.3.2$$

where $Ad^{R^D}_{j,t}$ is the adjustment cost and φR^D is the adjustment cost parameter, which is greater than zero.

As indicated in Equation 3.3.2, the adjustment cost is the spread between the policy rate (cash rate in Australia) and the deposit interest rate. Apart from this adjustment cost, it is further assumed that saving banks pay monitoring costs against their lending activities.[76] Moreover,

[73] At times, central bank liquidity facilities also affect the interbank lending rates. See Christensen, Lopez, and Rudebusch (2014) for further details.
[74] Interested readers can see Goodhart, Sunirand, and Tsomocos (2005), which provides the detailed risk assessment model for banks.
[75] These investment categories include interbank lending and government securities.
[76] See Chen (2001) for further details on monitoring costs.

this monitory cost depends on their deviation of the portion of total deposits lend in the interbank market from the target level, $\bar{s}$. Equation 3.3.3 provides the individual monitoring costs in the interbank market:

$$\Delta_{j,t}^{s} = \frac{\chi_s}{2}\left(\left(s_{j,t} - \bar{s}\right).D_{j,t}\right)^2 \quad (3.3.3$$

where:

χ_s denotes the steady-state value of monitory cost.

The optimisation problem of the J^{th} saving bank, as given in Dib (2010), is formally presented as follows:

$$\max_{\{s_{t,j},R_{j,t}^{D}\}} E_0 \sum_{t=0}^{\infty} \beta_b^t \lambda_t^b \left\{\left[s_{j,t}.R_t^{IB}(1-\delta_t^D) + \left(1 - s_{j,t}\right)R_t - R_{j,t}^{D}\right]D_{j,t} - Ad_{j,t}^{R^D} - \Delta_{j,t}^{s}\right\} \quad (3.3.4$$

The above Equation 3.3.4 is subject to Equations 3.3.2 and 3.3.3.

The term $s_{j,t}.R_t^{IB}(1-\delta_t^D) + \left(1 - s_{j,t}\right)R_t$ denotes the gross nominal return on the assets of the j^{th} saving bank. The discount factor is the stochastic process, where λ_t^b is the marginal utility of the consumption function of bankers.

The first-order conditions of this optimisation problem, in symmetric equilibrium, where $s_{j,t} = s_t$ and $R_{j,t}^{D} = R_t^{D}$ for all $t > 0$, with respect to s_t and R_t^{D}, are given as follows:

$$s_t = \bar{s} + \frac{R_t^{IB}(1-\delta_t^D) - R_t}{\chi_s.D_t}; \quad (3.3.5$$

$$\frac{1+\vartheta D}{\vartheta D}\left(R_t^D - 1\right) = s_t(R_t^{IB} - 1)(1-\delta_t^D) + (1-s_t)(R_t - 1) - \chi_s(s_t - \bar{s})^2 D_t - \frac{\varphi R^D}{\vartheta D}\left(\frac{R_t^D}{R_{t-1}^D} - 1\right)\frac{R_t^D}{R_{t-1}^D} + \frac{\beta_b \varphi R^D}{\vartheta D}\left(\frac{R_{t+1}^D}{R_t^D} - 1\right)\frac{R_{t+1}^D}{R_t^D} \quad (3.3.6$$

R_t^{IB} is defined as $R_t(1+\delta_t^D) + \chi_s(s_t - \bar{s})D_t$. It is important to note that the interbank lending rate (R_t^{IB}) includes a risk-free rate of return, which is a theoretical rate of return on any investment with no risk. Considering our total deposits, this risk-free rate of return is the opportunity cost of saving banks for not investing their deposits in risk-less securities—government bonds. Therefore, the interbank rate, R_t^{IB}, recompenses these saving banks against the default risk prevailing in this interbank market. Further, it also covers the average marginal

monitory cost of the interbank market. This interbank rate is linked with the financial conditions of an economy—for example, financial stress increases this rate through higher default risk.[77] The spread between the interbank rate and policy rate, $R_t^{IB} - R_t$, depends on two components: (i) the probability of default in the interbank market and (ii) the monitory cost. This spread is higher in the case of higher probability of defaults in the interbank market. In contrast, this spread is constant during normal periods.[78]

The condition given in Equation 3.3.6 elaborates the portion of total deposits allocated to interbank lending. This portion increases because of decreases in the probability of default in the interbank market. This increase in the portion of interbank lending will indirectly cause an expansion of credit supply in the interbank lending market. The higher amount of default probability, δ_t^D, in the interbank market will encourage saving banks to invest in government bonds and reduce the portion of s_t, the interbank lending. Equation 3.3.5 defines the deposit interest rate, which is the markdown of the average return on the assets of saving banks.

The second type of banks in the banking industry—lending banks (j)—refer to the borrower banks in the interbank market. These banks borrow from saving banks and raise their equity capital from these bankers to meet capital requirements. Recently, these banks have been more concerned about the regulatory capital, where risk-weighted assets play a significant role.[79] Therefore, we assume that these banks hold government securities against the capital valued at the capital price (Q_t^Z). Under certain financial conditions, these lending banks can gain benefits from a quantitative monetary easing policy, where they can receive money from the central bank. Further, lending banks have access to central banks to swap a fraction of these risky loans, extended to the firms, for government bonds from the central bank.

To provide loans to the firms, each lending bank, j, combines funds from the following sources:

1. loans from the saving banks in the interbank market—$D_{j,t}^{IB}$
2. any injection of money from the central bank—$m_{j,t}$
3. bank capital—$Q_t^Z . Z_{j,t}$

[77] See Arellano (2008) and Illing and Liu (2006) for further details on financial stress, default risk and their linkages with different income streams.
[78] Interested readers can see Huang, Zhou, and Zhu (2009) for a framework to assess the systemic risk of major financial institutions.
[79] Regulators are concerned about corporate social responsibility, especially after the GFC. They are asking for different capital requirements, including stress tests. For further details, see Kemper and Martin (2010) and Mishkin (2011).

4. swapping of assets with the central bank—$x_{j,t}$.

The balance sheet of lending banks will then be as follows (Table 3.1).

Table 3.1: Balance Sheet of Lending Banks

Assets	Liabilities
Loans	Interbank borrowing: $D_{j,t}^{IB}$
Government bonds: $B_{j,t}^{lb}$	Bank equity: $Q_t^Z.\ Z_{j,t}$
	Money injection by central banks: $m_{j,t}$
	Swapping of assets with central banks: $x_{j,t}$

According to Dib (2010), we assume that banks adopt Leontief technology to produce loans:

$$L_{j,t} = \min\{D_{j,t}^{IB} + m_{j,t}; k_{j,t}\left(Q_t^Z.Z_{j,t} + x_{j,t}\right)\}\tau_t \qquad (3.3.7$$

where $k_{j,t} \leq \overline{k}$, and, in this case, $k_{j,t}$ indicates the lending bank's optimum leverage ratio, while $\overline{k}$ denotes the regulatory leverage ratio (Prudential Standard APS 110-120 and Basel Framework III for the case of Australia)[80] and τ_t is the shock to the financial intermediation—any of the exogenous factors affecting the supply of credit and banks' balance sheets in the interbank market.

Equation 3.3.7 assumes that $m_t, x_t\ and\ \tau_t$ follow the AR (1) process. A positive shock will increase the demand for loans and investment. Banks must increase the leverage ratio and the bank capital; however, these tasks are costly for lending banks and will result in a higher lending rate to firms. In this framework, swapping the fraction of loans from risky to government bonds changes the composition of banks' assets.

Interbank borrowing, central bank money injection and financial intermediation shocks will result in the contraction or expansion of a bank's balance sheet. As observed above, banks shift the composition of their portfolio from private securities to government bonds as a result of fiscal consolidation.

[80] See Figure B1 (Appendix B) for Basel III phase-in arrangements.

Financial stability in terms of the banking sector implies that capital adequacy ratios (Tier-1 capital ratio and Tier-2 capital ratio) are improving by observing portfolio rebalancing. Consider these ratios as:

$$\text{Tier} - 1 \text{ Capital Ratio}_t = \frac{(\text{Equity}_t + \text{Retained earnings}_t)}{(\rho_0 D_t^f + \rho_1 D_t^c + \rho_2 S_t^i + \rho_3 S_t^g)} \quad (3.3.8$$

$$\text{Tier} - 2 \text{ Capital Ratio}_t = \frac{(\text{Equity}_t + \text{Retained earnings}_t + \text{Preferred Stock}_t + \text{Subordinated Bonds}_t)}{(\rho_0 D_t^f + \rho_1 D_t^c + \rho_2 S_t^i + \rho_3 S_t^g)} \quad (3.3.9$$

where D_t^f denotes the loans extended to firms at any particular time, D_t^c denotes the loans extended to consumers (such as mortgages), S_t^i denotes the investment securities at any particular time *t*, S_t^g denotes the government securities at any particular time *t*, and ρ_i denotes the risk weights allotted to different items. These risk weights will be given on the basis of implementation of the Basel Accords, which differs slightly from country to country. Generally, the Basel Accords allocate the risk weights of 100 per cent for investment securities, 50 per cent to mortgage loans, 20 per cent to the loans extended to firms and zero per cent to government securities (Bank for International Settlement, 2017).

In Equations 3.3.8 and 3.3.9, portfolio rebalancing as a result of fiscal consolidation will reduce risk-weighted assets because of the lower risk weights allocated to government securities by the Basel Accords. Accordingly, an increased capital adequacy ratio will bring financial stability to the banking sector. Similarly, Cimadomo et al. (2014) described two channels (direct and indirect channels) through which fiscal consolidation is transmitted into banking stability. The direct channel applies demand and supply rules on government bonds, while the indirect channel works through the macroeconomic effect. The direct channel establishes the link between fiscal vulnerability and the financial stability of the banking sector. This channel works through the demand and supply effects of government securities. During a period of fiscal adjustments, the supply of new government bonds is affected. More directly, fiscal consolidation decreases the supply of new government bonds. We call this the 'supply effect' in the direct channel.

At the same time, institutional investors consider fiscal consolidation a structural policy that helps avoid fiscal vulnerability and reinforces banking stability through mitigating sovereign risks. Therefore, institutional investors demand more government securities relative to other asset classes (the loans extended to firms, consumers and investment securities). We call this

the ‘demand effect’ in the direct channel. The demand effect prevails in most cases for the following reasons:

1. government securities are the key source of liquidation for the domestic private sector (Brutti, 2011)
2. safety and liquidity are two key determinants of the demand for government securities (Krishnamurthy & Vissing-Jorgensen, 2012)
3. the government is unable to discriminate between domestic and foreign creditors in case of default (Brutti, 2011).

In general, the holding of government securities is the key factor behind the direct channel.

Fiscal consolidation affects the supply and demand of government securities. Focusing on the composition of capital adequacy ratios, institutional investors make changes to their investment portfolio in response to structural changes in fiscal policy. These investors are expected to decrease (increase) the share of government securities over total assets if the supply (demand) effect prevails. Considering the supply side of government securities, fiscal consolidation deteriorates the supply of new government bonds, which decreases the share of government securities over total assets. This increases the risk-weighted assets because the Basel Accords allocate higher weights (ρ_0, ρ_1, ρ_2) to other asset classes. These risk-weighted assets are the denominators of the capital adequacy ratios (Tier-1 and Tier-2). Therefore, higher risk-weighted assets deteriorate the capital adequacy ratios of the banking sector. However, the demand effect prevails in most cases. Considering the demand side, institutional investors demand more government securities during periods of fiscal consolidation. The increased demand of government securities lowers the risk-weighted assets because the Basel Accords allocate lower risk weights, ρ_3, to government securities. These risk-weighted assets are the denominators of the capital adequacy ratios. Therefore, lower risk-weighted assets enhance the capital adequacy ratios of the banking sector. The method described in Equations 3.3.8 and 3.3.9 is similar to the direct method, where shifting from private securities to government securities (if the demand effect prevails) increases the Tier-1 and Tier-2 ratio, and hence the banking stability.

3.4 Concluding Remarks

This chapter first discussed fiscal vulnerability through public debt evolution. An economy is fiscally vulnerable if it is unable to pay the interest on its debt and honour the capital repayments when these payments are due. After netting off these payments, the overall or operating balance of the public sector is either a budget deficit or surplus. Both of these possibilities of overall balance have different economic consequences. In this context, the debt analysis of a budget deficit is more relevant[81] as compared to the accounting deficit, where different ways to finance the budget deficit of an economy can be categorised as: (i) issuing new debts, (ii) through monitised or (iii) using a mix of both of these options. Further, the differences between interest rates and growth rates play a significant role in public debt dynamics. For instance, if the real interest rates are greater than the growth rates, the public debt dynamics are unstable. In this case, it is impossible for an economy to run permanent primary deficits and, at some point, it will be difficult for the government to gain new debt. Ultimately, the government will have to cut the budget deficit. The end point of this process depends on the bondholders' expectations. When the general public—especially the expected investors of government securities—recognise this situation, they will stop buying government securities and subsequently force the fiscal policy to change.

Banks are the major holders of government securities and will shift their portfolio from government securities to private securities, which deteriorates their financial stability. Under these fiscal conditions, the government must adopt fiscal consolidation, which mitigates the sovereign risk because government securities are perceived to be a safer investment after fiscal consolidation. Consequently, investors and banks will gain restored market confidence and banks will make changes to their investment portfolios. Banks make changes to their portfolios for two main reasons: (i) investors' perception of sovereign risk and (ii) the probability of default in the interbank lending market. Considering the risk weights allocated by the Basel Accords and the respective regulatory bodies of different economies (such as the Australian Prudential Regulatory Authority for the case of Australia), the capital adequacy ratio will improve by lower risk-weighted assets. In this framework, fiscal consolidation increases banking stability by mitigating sovereign risk.

[81] For other alternatives from creative accounting, see Milesi-Ferretti and Moriyama (2006).

CHAPTER 4. Data Discussion and Construction of Variables

4.1 Introduction

In this chapter, we discuss the potential issues in the components of fiscal and financial variables, alongside the data sources used for this study's data collection. We used annual data from 1960 to 2015 for all 53 economies in the fiscal vulnerability analysis. This dataset was collected from different sources. The first part of this chapter elaborates these data sources and their relevant issues. We began the banking stability analysis by using aggregated level data from The Global Economy (TGE) from 1960 to 2017. We then extended our analysis by using bank-wise disaggregated data from the Bankscope database (Van Dijk & Fitch, 2014).[82] The Bankscope database provides consolidated and unconsolidated balance sheet data for all the individual banks. Consolidated balance sheet data were used for most of the analysis. However, using consolidated balance sheet data creates difficulty in differentiating the domestic effect of fiscal consolidation on parent companies. Therefore, we used unconsolidated balance sheet data in our banking stability analysis. Considering all this, we present all the relevant issues of these databases in this chapter. In the final part of this chapter, we provide the construction of variables, focusing on public debt and financial net worth.

Overall, the chapter is organised as follows. Section 4.2 presents the data sources and relevant issues related to the fiscal variables. Section 4.3 elaborates the country-specific data issues related to the fiscal variables. Section 4.4 presents different components of the public sector balance sheet data for all the selected economies. Section 4.5 provides a discussion on the disaggregated and aggregated datasets. Section 4.6 presents the construction of variables,

[82] Bankscope is a unique collection of bank-level data of 31,121 banks from different countries. This database is managed by the Bureau van Dijk, which is a private institution, and IBCA—an international rating agency.

including the fiscal and financial variables of the banking sector. Section 4.7 concludes this chapter.

4.2 Data Sources and Related Issues in Fiscal Variables

We collected annual data for fiscal variables from 1960 to 2011 using the database created by Mauro et al. (2013). This database includes an unbalanced panel of 55 economies from 1800 to 2011.[83] We could not include Bolivia and Iran because of an insufficient number of observations from 1960 onwards. However, we included the remaining 53 countries in our sample. These data contain government revenue, government expenditure, government primary expenditure, interest paid on public debt, government primary balance, gross public debt (all variables as a per cent of real GDP), real GDP growth rate and real long-term interest rates on government debt.[84] We further updated this dataset from the relevant data issues of the IMF Fiscal Monitor database for April 2016 (IMF, 2016), and World Economic Outlook online sources (IMF, 2015). Using these sources, we collected data from 2012 to 2015 on government revenue, government expenditure, government primary expenditure, interest paid on public debt, government primary balance, gross public debt (all variables as percentages to real GDP), real GDP growth rate and real long-term interest rates on government debt. It is important to note that government expenditure (per cent of GDP) given in Mauro (2013) are net of interest paid on public debt (per cent of GDP) while the general government total expenditure provided by the IMF (2015) includes interest payments. Therefore, data on government expenditures and revenues (both as a per cent of GDP) for the remaining period of 2012 to 2015 were collected from the IMF (2015).[85] During the period of data collection, the database from Mauro et al. (2013) provided information up to 2011. This database is updated at irregular intervals; however, we checked the frequency of the data updates and, as a result of the irregularity of these updates, we did not wait for the next release.

[83] These 55 economies included Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Denmark, the Dominican Republic, Finland, France, Germany, Ghana, Greece, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, South Korea, Mexico, the Netherlands, New Zealand, Nicaragua, Norway, Pakistan, Panama, Paraguay, Peru, the Philippines, Poland, Portugal, Romania, Russia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the UK, the US, Uruguay and Venezuela.

[84] See the section on data sources and basic statistics in Mauro et al. (2013) for the complete details of these variables and their sources.

[85] The measures of these data used in Mauro et al. (2013) and Mauro et al. (2015) are the same.

Therefore, we updated the Mauro et al. (2013) dataset by using other data sources, including the IMF, World Bank and World Economic Outlook data.[86] First, we updated government revenue, government expenditure and gross public debt (all as a percentage of GDP). However, different datasets have different treatments of interest paid on public debt in government expenditure. Specifically, the 'Data Sources and Basic Statistics' section of Mauro et al. (2013) indicates that data are extracted from the IMF (2015) where the government expenditure percentage of GDP is the net of interest paid on public debt as a percentage of GDP, while the general government total expenditure provided in the IMF (2015) includes interest payments (interest paid on public debt as a percentage of GDP). Therefore, subtracting government expenditure from the government revenue (percentage of GDP) from 2011 to 2015 gave the government primary balance (as a percentage of GDP) from 2011 to 2015. We used these data (primary balance) to compute the CAPB by applying the Hodrick–Prescott (Hodrick & Prescott, 1997) filter and econometric techniques.[87] We noticed some country-specific data issues in the fiscal variables, which are discussed in Section 4.3.

4.3 Country-specific Data Issues in Fiscal Variables

We noticed some inconsistencies in the names of countries and ensured that the data in both of the databases were for the same territory. For instance, the IMF (2015) provides fiscal variable data for Korea, while Mauro et al. (2013) provides fiscal variables for South Korea. We compared and observed that these values were almost similar. Therefore, we used the data from the IMF (2015) to update our dataset for the case of South Korea. We extracted the data on real GDP growth rate from 2012 to 2014 from World Bank data.[88] Some of the values were unavailable from the IMF, World Bank or World Economic Outlook (IMF, 2015). For example, the GDP of Argentina for 1960 and 1961 was unavailable in the World Bank database. Thus, we extracted the GDP of Argentina (constant 2005 US$) for 1960 to 1962 from IndexMundi (2015), and accordingly calculated the GDP (current US$) for 1960 and 1961. For the case of Bolivia, we could not find the value of the government primary balance for 1967. Therefore, we calculated this value using moving average. Similarly, data were unavailable until 1990 for China and Bulgaria. Consequently, we customised the sample range for China and Bulgaria from 1990 to 2014 to determine its vulnerability, while performing regression analysis for

[86] World bank data is available from 1960 onwards. Therefore, we restrict time period from 1960 to 2016 (the latest available).
[87] See Section 5.6 (Chapter 5) for these econometric techniques.
[88] The data for this entire series were taken from the World Bank, named as GDP (current US$).

China and Bulgaria. For the case of Australia, we used the *Australian System of National Accounts (ASNA) 1993 and 2008* (Australian Bureau of Statistics, 2018) for the guidelines on the components of public debt. We used the Maastricht definition of public debt as given in the *System of National Accounts (SNA) 2008* (United Nations Statistics Division, 2018), and *Government Finance Statistics Manual (GFSM) 2001* (IMF, 2001).

The Australian Government Finance Statistics (GFS) system, *ASNA 1993* and *ASNA 2008* include the net debt and two additional components, titled 'Unfunded Superannuation Liability' and 'Other Employee Entitlements and Provisions', to determine the net financial liabilities of Australia. These additional components are not incorporated in the IMF Manual or *SNA 1993*. Therefore, these components are irrelevant for the fiscal vulnerability analysis of other countries. There is a difference of opinion between the IMF Manual/*SNA 1993* for the rest of the economies and the Australian GFS system (*ASNA 1993* and *2008*). The first two manuals recommend that these two components should not be included as liabilities and should be reported as memorandum items in the balance sheets, as there is no pool of accumulated assets against these components to pay the benefits. In contrast, the Australian GFS system, *ASNA 93* and *ASNA 2008* treat these components on the liabilities side of balance sheets. Their relevant information is readily available in the public sector accounts (Australian Bureau of Statistics, 2005). Therefore, net financial liabilities are an appropriate measure of fiscal balance for the case of Australia.

To calculate net financial liabilities, we subtracted financial assets (cash and deposits, investment loans and placements, other non-equity assets, equity and advanced paid) from the Australian government liabilities (deposits held, advanced received, borrowing, unfunded superannuation liability, other employment entitlement and provisions, and other non-equity liabilities) (Australia Bureau of Statistics, 2005). We used the resultant series of net financial liabilities as an alternative measure of debt for the case of Australia only. All these changes are the result of the transition of the Australian government from cash accounting to accrual accounting. Accrual accounting records the revenues and expenses when they are incurred, irrespective of when the cash is exchanged (Funnell et al., 2012). The Australian Bureau of Statistics (2002) elaborated on the implementation of accrual accounting in the Australian GFS and national accounts. The Australian Bureau of Statistics (2002) is based on the OECD meeting of national account experts, which was held at Chateau de la Muette, Paris, from 8 to 11 October 2002. The Australian system for producing GFS was changed in the late 1990s

from a cash base to an accrual base of recording. However, its implementation issues of accrual base accounting were in process until 2002 (Australian Bureau of Statistics, 2002).

4.4 Public Sector Balance Sheet Data of All Selected Economies

This subsection discusses the data issues related to the public sector balance sheets of all 53 economies. We collected annual data on the variable of financial net worth from the OECD (2014, 2018), which calculated the net financial worth by subtracting financial liabilities from the financial assets. [89] Here, financial assets are classified into six major categories: (i) monetary gold and special drawing rights, (ii) currency and deposits, (iii) loans, (iv) shares and other equity, (v) insurance technical reserves and (vi) other accounts receivables. Among these financial assets, currency and deposits, securities and other shares, shares and other equity, and insurance technical reserves are further categorised into different financial components, as follows:

1. Currency and deposits consist of three main components: (i) currency, (ii) transferable deposits and (iii) deposits with others.
2. Securities other than shares include: (i) securities other than shares, except financial derivatives (short-term and long-term) and (ii) financial derivatives.
3. Loans extended to others are categorised into short- and long-term loans.
4. Shares and other equity consist of: (i) shares and other equity, except mutual funds shares (quoted shares, unquoted shares and other equity), and (ii) mutual funds shares.

[89] This dataset includes different sectors of the Australian economy, including: (i) financial corporations, (ii) non-financial corporations, (iii) household and non-profit institutions and (iv) the general government. We used the consolidated data from the general government financial balance sheet, which include all three segments of local, state and central government. Therefore, we use the term 'Australian general government' in this chapter. The Australian Government Treasury (1999) defines the 'general government' as the resident public entities that are mainly engaged in the production of goods and services outside the normal market mechanism for consumption by the government and general public. Here, the cost of production is mainly financed from tax revenue. Australian Government (2018) indicates that the six states and Northern Territory have established one further level of government, which is known as local government or local councils. This level of government handles community needs, such as waste collection, public recreation facilities and town planning. The social security fund (Sector S1314) is included in the general government balance sheets. Nevertheless, S1314 is not relevant for the case of Australia. Unfunded superannuation claims are included as liabilities under the Australian GFS, *ASNA 1993* and *ASNA 2008*, even though these components are mentioned only as a memorandum item in the IMF Manual and *SNA 1993*. These components are classified under 'New Equity of Household in Pension Funds', which represents the liabilities of the Australian general government to employees of the public sector as unfunded retirement benefits. The Australian Bureau of Statistics (2005) provides a complete classification of all the components of the Australian general government consolidated balance sheet. Further, mutual funds instruments (quoted and unquoted shares) are included under the subheading 'Share and Equity' on financial assets. Australian financial accounts were based on the *SNA 1993* until 31 December 2010. Since then, these accounts have been based on *SNA 2008* (United Nations Statistics Division, 2018). These data are compiled by the national statistical office, the Australian Bureau of Statistics.

5. Insurance technical reserves include: (i) net equity of households in life insurance and pension funds reserves, (ii) net equity of households in life insurance and pension funds reserves (net equity of households in life insurance reserves and net equity of households in pension funds) and (iii) prepayments of premiums and reserves against outstanding claims.

The second component in calculating financial net worth is financial liabilities, which are further classified into six major categories: (i) currency and deposits, (ii) securities other than shares, (iii) loans taken from other parties, (iv) shares and other equity, (v) insurance technical reserves and (vi) other accounts payables. Among these financial liabilities, currency and deposits, securities other than shares, shares and other equity, and insurance technical reserves are further categorised into five financial components.[90] In the cases of Argentina, Bulgaria and Ghana, because of unavailable data, the financial net worth was calculated using data on financial asset and liabilities from international financial statistics. Details of all the financial assets and liabilities used in this calculation are provided in Table C1 (Appendix C).

4.5 Issues Related to Aggregated (TGE) and Disaggregated (Bankscope) Datasets

We used aggregated and disaggregated data to analyse the effects of fiscal consolidation on financial stability. We collected annual data on the individual bank balance sheet items, including retained earnings, equity, preferred stock, subordinated bonds, government securities, loans extended to firms, investment securities, loans extended to consumers, total assets, return on total assets, and Tier-1 and Tier-2 capital ratios. We collected these annual data from 1990 to 2016 from the Bankscope database (Van Dijk & Fitch, 2014). However, we could not use the data for 2016 in the banking stability analysis because of the unavailability of some observations. Therefore, we used data from 1990 to 2015 in this analysis. We observed that the data on the financial variables, including Tier-1 and Tier-2 ratios, for some key Australian banks were not available in the Bankscope database. Thus, we relied on Bloomberg to extract these financial variables (Bloomberg, 2016). The Bankscope database is a unique collection of bank-level data of 31,121 banks from different countries. We collected the bank-level data for our selected countries. However, we could not use the data of all the banks for our selected countries because of the unavailability of capital adequacy ratios. Therefore, we were left with

[90] These financial components are the same as given above for the case of financial assets, except the third one, in which loans payable to others are categorised into short- and long-term loans.

the 739 banks from our selected countries, where 41 per cent of the banks were commercial banks. The other categories of banks included:

1. commercial banks (309)[91]
2. investment banks (37)
3. saving banks (22)
4. private banking and asset management companies (36)
5. investment and trust corporations (five)
6. bank holdings and holding companies (249)
7. specialised governmental credit institutions (10)
8. real estate and mortgage banks (31)
9. finance companies (10)[92]
10. clearing institutions and custody (two)
11. group finance companies (two)
12. securities firms (four)
13. micro-finance institutions (one)
14. multilateral government banks (one)
15. cooperative banks (14)
16. others (still to be classified as per Bankscope classification) (six).

In our sample, 75 per cent of the banks fell under two categories: (i) commercial banks and (ii) bank holdings and holdings companies. The complete details of all banks are provided in Table C2 (Appendix C). The parent companies or subsidiaries in some cases might have their branches in different countries, while their figures are included in a consolidated balance sheet, which makes it very difficult to differentiate the domestic effect of fiscal consolidation on the parent company. The Bankscope database includes the consolidated and unconsolidated individual bank balance sheet data. Generally, the consolidated balance sheet data are used for different financial analysis. However, no previous study has used the branch-level balance sheet data of Bankscope in a fiscal analysis. We use these data for the first time to analyse the effects of fiscal consolidation on the financial stability of the banking sector.[93] The consolidated balance sheets of multinational banks include the consolidated values of assets

[91] The number in brackets indicates the number of banks included in the sample.
[92] Bankscope further classifies finance companies as credit card, factoring and leasing companies.
[93] Favero, Giavazzi, and Flabbi (1999) used the unconsolidated bank balance sheet data for the transmission mechanism of monetary policy in Europe.

and liabilities for all subsidiaries. Similarly, the consolidated income statements include the consolidated values of all income and expenses for all subsidiaries. Our concern was to analyse the domestic effect of fiscal consolidation on banking stability. The domestic effect cannot be analysed from the consolidated financial statements of multinational banks. Therefore, we used the unconsolidated individual bank balance sheet data. As a result of some consolidation issues in the financial statements of parent companies, we decided to use the unconsolidated individual bank balance sheet data. In summary, to analyse the domestic effects of fiscal consolidation episodes on banking stability, we used the unconsolidated bank balance sheets for all 53 economies.

However, Table C2 (Appendix C) indicates that the disaggregated dataset for 34 of 47 economies covered less than 20 per cent of their banking sectors. Therefore, we also decided to use country-wise aggregated data of banking stability indicators. TGE provides these aggregate data from 1960 to 2017. We collected these aggregated data on the capital adequacy ratios, z-scores and stock market capital (alternate measure of financial stability). TGE provides a composite measure of capital adequacy ratio under the umbrella of banking system stability. This composite measure is named the 'banking system regulatory capital to risk-weighted assets' in TGE database. TGE defines this as the ratio of total regulatory capital to risk-weighted assets. The z-score measures the probability of default of the banking system of any country. More specifically, this index compares the buffer of the banking system with the volatility of its return on assets. The banking system buffer includes the return on assets and ratio of equity to assets. Here, return on assets and equity and assets are the country-wise aggregated values calculated from the bank-by-bank unconsolidated financial statement data of Bankscope. Stock market capitalisation is taken as a per cent of GDP. Stock market capitalisation—sometimes known as market value—is the market price of shares multiplied by the outstanding shares of listed domestic firms. Here, it might be important to note that the primary business of some unit trusts, investment funds and companies is to invest in the shares of other listed companies. These businesses were excluded from the list of domestic companies.

4.6 Construction of Variables

We categorised all variables used in this thesis into: (i) fiscal variables used in the fiscal vulnerability analysis and (ii) financial variables of the banking sector used in the banking stability analysis. Therefore, the remainder of this section is categorised into two parts to discuss the fiscal variables and financial variables of the banking sector.

4.6.1 Fiscal Variables

Gross public debt (per cent of GDP) was used in the fiscal vulnerability analysis of all 53 economies. The concept of gross debt is defined in Chapter 7, Section F on Memorandum Items, and Subsection 1 on Debt of the IMF GFS[94] (IMF, 2001) as follows:

> Debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. Thus, all liabilities in the GFS system are debt except for shares and other equity and financial derivatives. (Paragraph 7.142)

We calculated primary balance, which is the government revenue minus government expenditure (without the amount of interest paid on public debt). Further, we calculated GVAR and YVAR by following Mauro et al. (2015):

$$\mathrm{GVAR_t} = (\mathrm{G} - \mathrm{G^{tr}})/\mathrm{y} \qquad (4.6.1.1$$

$$\mathrm{YVAR_t} = \left(1 - (\mathrm{Y^{tr}}/\mathrm{Y})\right)(\mathrm{G^{tr}}/\mathrm{y}) \qquad (4.6.1.2$$

where G is the government expenditure, G^{tr} is the trend in government expenditure, Y is the GDP, Y^{tr} is the trend in GDP and y is the real GDP growth rate. We used Hodrick and Prescott's (1997) filter to determine the trends in government expenditures and GDP. These trended values were then used in the above equations to determine GVAR and YVAR for all 53 economies. Data on the output gap for OECD economies were collected from *Economic Outlook Number 99*, June 2016. For the rest of the economies, the output gap was calculated as the deviation of actual GDP from potential GDP as a per cent of potential GDP. For this purpose, we used the data already applied in the fiscal vulnerability analysis. For interest rates, the data on the real long-term interest rate on government debt were used, which were initially extracted for the period up to 2011 from the database created by Mauro, Romeu, Binder, and Zaman (2013). These data were further updated from the relevant data issues of the IMF Fiscal Monitor database from April 2016 (IMF, 2016) and World Economic Outlook online sources (IMF, 2015).

[94] The GFS refers to the statistical system that collects, compiles, processes and disseminates the government finance statistics (Australian Government Treasury, 1999).

4.6.2 Financial Variables

We applied total assets, Tier-1 and Tier-2 capital ratios, and return on assets as the financial variables of the banking sector. Tier-1 and Tier-2 capital ratios were already discussed in Chapter 3 (see Equations 3.3.8 and 3.3.9, respectively). The Bankscope database provided the details of total assets as constructed for this database purpose. In this classification, total assets were broadly classified into loans, other earning assets and non-earning assets. Table 4.1 provides the complete details of the components included in the total assets of the individual banks for all 53 economies. Next, the total return on assets was calculated as follows.

$$Return\ on\ Assets = \frac{Total\ profit\ aftet\ interest\ and\ tax}{Total\ assets\ (as\ given\ in\ table\ 4.3\ )} \qquad (4.6.2.1$$

Return on assets for the individual banks of all 53 economies was provided in the Bankscope database (Van Dijk & Fitch, 2014). We used these data for our banking stability analysis of all economies. Some variables were not available in the Bankscope database; therefore, we extracted those banking variables from Bloomberg database (Bloomberg, 2016). The details of the total assets as constructed in Bankscope are provided in Table 4.1.

Table 4.1: Total Assets as Used in the Bankscope Database

Assets	
Loans	**Other earning assets (continued)**
Residential mortgage loans	At-equity investments in associates
Other mortgage loans	Other securities
Other consumer/retail loans	Total securities
Corporate and commercial loans	Memo: Government securities included above
Other loans	Memo: Total securities pledged
Less: Reserves for impaired loans/NPLs	Investments in property
Net loans	Insurance assets
Gross loans	Other earning assets
Memo: Impaired loans and advances to customers included above	Total earning assets
Memo: Loans at fair value included above	**Non-earning assets**
Memo: Loans to the public sector	Cash and due from banks
Memo: Total impaired loans and assets	Memo: Mandatory reserves included above
Memo: Total impaired loans	Foreclosed real estate
Other earning assets	Fixed assets
Loans and advances to banks	Goodwill
Memo: Impaired loans and advances to banks	Other intangibles
Reverse repos and cash collateral	Current tax assets
Trading securities and at face value through income	Deferred tax assets
Derivatives	Discontinued operations
Available for sale securities	Other assets
Held to maturity securities	Total assets

Source: Extracted from the Bankscope database (Van Dijk & Fitch, 2014).

4.7 Concluding Remarks

For this empirical investigation, we used fiscal, financial and banking variables for all 53 economies. We used country-wise annual data for the fiscal vulnerability analysis, and bank-wise annual data for the banking stability analysis. We used different databases, including the IMF Fiscal Monitor database for April 2016 (IMF, 2016), World Economic Outlook (IMF, 2015), a database created by Mauro et al. (2013), the Bankscope database (Van Dijk & Fitch, 2014) and Bloomberg database (Bloomberg, 2016). First, we updated the dataset on the fiscal variables created by Mauro et al. (2013). For this purpose, we used the data from their original source (IMF, World Bank and World Economic Outlook data), as mentioned in Mauro et al. (2013). Later, we used data on primary balance to calculate the CAPB using the HP filter. We

then observed and resolved some country-specific issues using data from the IMF (2015).[95] We used these datasets in the fiscal vulnerability analysis. Our proposed fiscal vulnerability selection approach used the country-wise data from the countries' respective public sector balance sheets. We collected these annual data from the OECD (2014, 2018).

For the banking stability analysis, we used annual data from different financial and banking variables, including retained earnings, equity, preferred stock, subordinated bonds, government securities, loans extended to firms, investment securities, loans extended to consumers, total assets, return on total assets, and Tier-1 and Tier-2. The annual data from 1990 to 2016 were extracted from the Bankscope database. This database provides both consolidated and unconsolidated bank balance sheets. In most cases, consolidated data are used for different analyses. However, it is very difficult to differentiate the domestic effect of fiscal consolidation on a parent company. Therefore, we decided to use the unconsolidated balance sheet data for this analysis. We further noted some sampling issues with the disaggregated level data from Bankscope. Therefore, we finally used aggregated level data from 1960 to 2017 collected from TGE.

[95] The latest version available at the time of data collection.

CHAPTER 5. Empirical Strategy and Methods of Estimation

5.1 Introduction

The purpose of this chapter is twofold. First, this chapter proposes the methodology to assess the fiscal vulnerability among the selected countries, and introduces the techniques to investigate the role of fiscal consolidation in the financial stability of the banking sector. To identify the countries that are vulnerable to debt crisis, we introduce a fiscal vulnerability selection procedure for the sample of 53 selected economies. Second, we extend the empirical strategy to determine the fiscal consolidation episodes by applying the CAPB approach. These cyclical components are computed through two different approaches: (i) HP filter and (ii) econometric techniques. Finally, this chapter presents an empirical strategy to determine the role of these fiscal consolidation episodes for the banking stability of all 53 economies. The rest of the chapter is organised as follows. Sections 5.2 to 5.4 provide the empirical strategy for our proposed fiscal vulnerability selection procedure. Section 5.5 discusses the empirical strategies for the alternative approaches of fiscal vulnerability used in this analysis. Section 5.6 presents the methodological notes on the fiscal consolidation episodes, while Section 5.7 elaborates on the empirical strategy to measure the influence of fiscal consolidation episodes on banking sector stability. Finally, Section 5.8 presents the concluding remarks on the empirical strategy discussed in this chapter.

5.2 Assessing Fiscal Vulnerability

The evolution process of public debt (Section 3.2) provides the debt determinants of primary surplus (public debt to GDP), where the regression results provide sufficient information on the long-term fiscal sustainability of an economy. However, the regression of primary surplus exclusively on debt determinants will produce inconsistent estimators because of omitted

variable bias.[96] To avoid potential omitted variable problems, the tax smoothing model of Barro (1979) captures the non-debt determinants of primary surplus (level of temporary government spending and business cycle indicator).[97] Thus, we first applied the model proposed by Bohn (1998), which incorporates both the debt and non-debt determinants of the primary balance. We also incorporated the appropriate dummy variables in Bohn's (1998) model to account for possible structural breaks:

$$S_t = \beta_0 + \beta_1 d_t + \beta_2 GVAR_t + \beta_3 YVAR_t + \beta_4 D_i + \varepsilon_t \quad (5.2.1$$

where S_t is the ratio of primary surplus to GDP, d_t is the ratio of public debt to GDP, *GVAR* is the level of temporary government spending, *YVAR* is the business cycle indicator, D_i refers to the vector of break dummies and ε_t refers to the error term.[98] The non-debt determinants of primary surplus (GVAR and YVAR) capture any unusual variations in government spending and output, respectively. From the above model, as in Bohn (1998), a significant negative value of β_1 indicates that public debt to GDP is unsustainable over the specified period; hence, the economy is vulnerable to debt crisis.

To examine the time series property of the key variables in the presence of structural breaks, we used breakpoint unit root tests (innovative outlier and additive outliers), alongside three conventional unit root tests (Augmented Dickey–Fuller, Phillips–Perron and Kwiatkowski–Phillips–Schmidt–Shin). The Chow breakpoint test was performed on Equation 5.2.1 to identify the common breaks in the model. Based on these identified breaks, the appropriate break dummies, D_i, were subsequently introduced in the model. The estimated β_1 (negative and significant) from Equation 5.2.1 was used as a first step to determine the fiscal vulnerability.

5.3 Forward, Backward and Moving Screening Processes

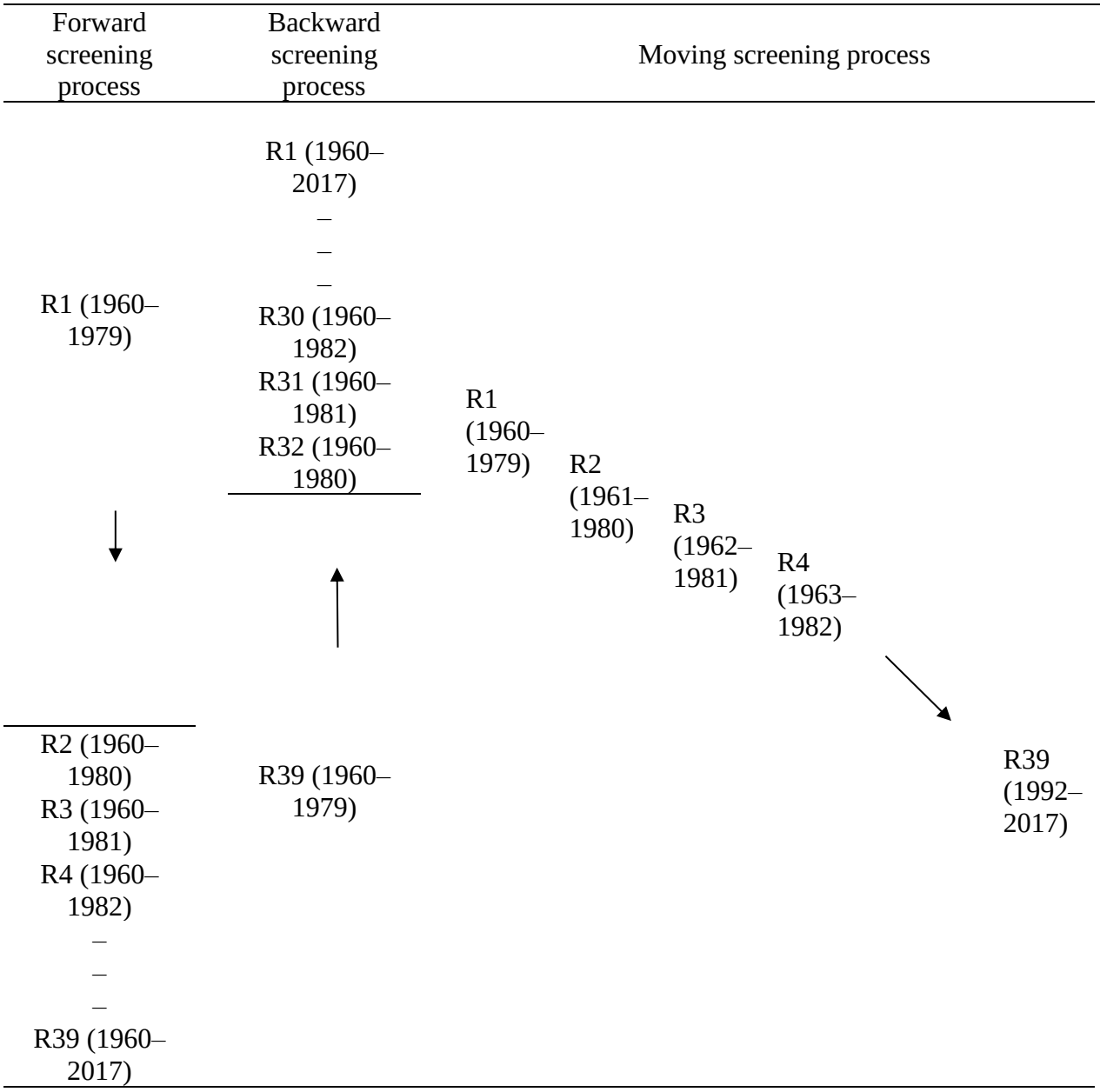
The degree of vulnerability measured by β_1 in Equation 5.2.1 was assumed to remain constant over the sample period (annual observations from 1960 to 2014). The statistical significance of β_1 may be misleading when the sample for the period of vulnerability is pooled with the non-vulnerability period. To overcome this problem, the model was systematically estimated for subsample (window) periods of at least 20 observations through forward, backward and

[96] The non-debt determinants of the primary balances are omitted from the analysis.
[97] The key feature of this policy is that tax rates should depend on the level of debt and permanent government spending only.
[98] See Section 4.6.1 for the construction of GVAR and YVAR.

moving screening processes. In each of these three processes, 33 different regressions were estimated for each country.

The first regression in the *forward* screening process was estimated with the subsample of the first 20 observations (1960 to 1979). The second regression covered the estimation window for the period from 1960 to 1980 (subsample of first 21 observations). In the subsequent regressions, we added one observation at a time until the estimation window covered the full sample (1960 to 2017). For the *backward* screening process, the first regression was based on the full sample. The second regression was estimated by removing the first observation (estimation window covered the observations from 1961 to 2017). The subsequent regressions were estimated by removing one initial observation at a time until the final 20 observations were used in the estimation window (1992 to 2017). In the *moving* screening process, the first 20 observations were used in the first regression, and then the initial observation in the subsample was replaced with the subsequent observation until the thirty-ninth regression. Figure 5.1 summarises the forward, backward and moving screening processes. These results enabled us to identify the period of vulnerability in the subsamples. These three screening processes were used as a second step to determine the fiscal vulnerability.

Figure 5.1: Forward, Backward and Moving Screening Processes



5.4 Threshold Regression

To some extent, the three screening processes discussed above eliminate the problem of detecting a vulnerable economy as non-vulnerable. However, the above procedure may not completely avoid the identification problem (vulnerable versus non-vulnerable) because some of the vulnerable period can be nullified by a non-vulnerable period within the subsample. To overcome this problem, we extended our analysis to a country-specific threshold regression model for the specification in Equation 5.2.1. The model supposed that economic time series can be modelled as belonging to a number of distinct regimes, where the regimes are

characterised by different conditional distributions of the process. Accordingly, this allows for flexibility in the model parameters through regime-switching behaviour. In the present case, the model assumed that the behaviour of β_1 changes once a series enters a different regime. The parameters in Equation 5.2.1 are expected to vary depending on a country-specific debt-to-GDP ratio. This approach eliminates the problem of assuming a single threshold, regardless of the size of the economy.

Consider $m-1$ thresholds, and the implied m-regime representation of an ergodic stationary process:

$$S_t = \begin{cases} \beta_{10} X_t^{'} + \delta_1 d_t + \varepsilon_{1t}, & \text{if } d_t \le r_1 \\ \beta_{11} X_t^{'} + \delta_2 d_t + \varepsilon_{2t}, & \text{if } r_1 < d_t \le < r_2 \\ \beta_{12} X_t^{'} + \delta_3 d_t + \varepsilon_{3t}, & \text{if } r_2 < d_t \le < r_3 \\ \quad \vdots & \\ \beta_{1m} X_t^{'} + \delta_m d_t + \varepsilon_{mt}, & \text{if } r_{m-1} < d_t \le < r_m \end{cases} \qquad (5.4.1$$

The delay parameter, denoted by d_t, and the thresholds, r_1 , r_2, … r_{m-1}, are the parameters that yield the nonlinear structure of the model. Using the sequential procedure developed by Strikholm and Teräsvirta (2006), the model had a maximum of two regimes for the sample of countries in our analysis. Moreover, threshold regression was performed with an ordinary coefficient covariance matrix using the threshold specification of Bai–Perron tests of $L + 1$ versus L, which sequentially determined the threshold at 15 per cent trimming percentage. Hence, the model is:

$$S_t = \beta_{11} X_t^{'} + \delta_1 d_t + \varepsilon_{1t} \qquad if\ d_t < r_1 \qquad (5.4.2$$

$$S_t = \beta_{12} X_t^{'} + \delta_2 d_t + \varepsilon_{2t} \qquad if\ d_t \ge r_1 \qquad (5.4.3$$

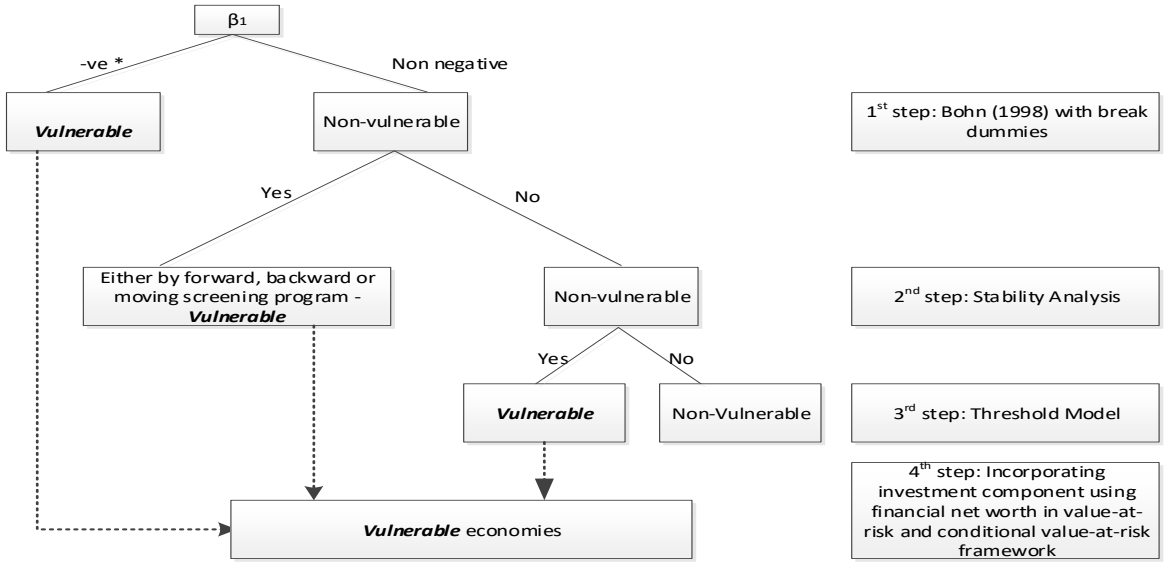
where S_t is the ratio of primary surplus to GDP, d_t is the ratio of public debt to GDP, X_t is the vector of the control variables (GVAR and YVAR) and r_1 is the threshold value of public debt to GDP. Since threshold is a piecewise and locally linear model, ordinary least squares (OLS) can be used to estimate Equations 5.4.2 and 5.4.3 as long as the threshold parameters are known. Hansen (2000) noted that the OLS estimator is also the maximum likelihood estimator when ϵ is independent and identically distributed. The results from the threshold model provide the

country-wise threshold level of public debt to GDP, beyond which increasing public debt may significantly diminish primary surplus, leading towards fiscal crisis.

We were able to identify the economies vulnerable to debt crisis by applying all three techniques: Bohn (1998) with dummies (the first step in our proposed fiscal vulnerability selection procedure), stability analysis (*forward*, *backward* and *moving* screening—the second step in our proposed fiscal vulnerability selection procedure) and threshold regression (the third step in our proposed fiscal vulnerability selection procedure). The existing literature has focused on the single threshold level of public debt to GDP to be 90 per cent (Reinhart & Rogoff, 2010) and 86 per cent (Cecchetti et al., 2011) for fiscal vulnerability. However, our procedure provides a country-specific threshold level of public debt to GDP. We incorporated the investment components of the public sector in the fourth step because gross public debt has not dealt with the investment aspects of rising debt. In particular, gross public debt ignores the accumulation effect of financial and real assets, which contributes to the growing net worth of a government. These investment aspects improve the balance sheet of a government. For this purpose, we calculated the financial net worth in value at risk (VaR) and conditional value at risk (CVaR) (see Appendix D and Figure D1) for all countries, and tested the individual economies against these values. Finally, if financial net worth in this framework for any country was positive, then this economy could finance future interest and debt payments in many ways other than taxation. Therefore, we categorised these economies as non-vulnerable to debt crisis. Conversely, if the financial net worth (VaR or CVaR) was negative, we categorised this economy as vulnerable.[99] This fiscal vulnerability selection procedure is provided in Figure 5.2 below.

[99] For example, if the financial net worth in this framework is greater than -10 per cent, the capital investment cannot generate enough revenue to finance the interest on debt in the long term. For further details on this benchmark of -10 per cent, see Section 6.3 (Chapter 6).

Figure 5.2: Fiscal Vulnerability Selection Procedure



5.5 Alternative Approaches to Fiscal Vulnerability

In addition to the above approaches, we used some alternative measures, including the fiscal vulnerability index and financial net worth/balance sheet approach. We aimed to compare the results of these alternative approaches with the results of our fiscal vulnerability selection procedure. This comparison aimed to determine whether these alternative approaches can be applied as standalone techniques in fiscal vulnerability analysis.

5.5.1 Fiscal Vulnerability Index

The fiscal vulnerability index transforms public debt (per cent of GDP) into a standardised z-score by subtracting the group average of public debt from an individual country's value, and then standardising the value by dividing its corresponding standard deviation, as suggested in Baldacci et al. (2011). It can be shown as follows:

$$Fiscal\ Vulnerabiltiy\ Index = \frac{d_t - \mu}{\delta} \qquad (5.5.1.1$$

where d_t is the public debt to GDP at time t, μ is the sample mean of public debt to GDP, and σ represents the corresponding standard deviation. A positive value for the fiscal vulnerability index for a country indicates that this economy is vulnerable to debt crisis and its public debt reduces primary balance. As expected, we observed some conflicting results from this approach

in comparison with the above-mentioned approach of threshold regression in our proposed setup. These conflicting results were mainly due to the assumed homogenous association between debt and growth across the countries, as pointed out in Égert (2015).

5.5.2 Financial Net Worth/Balance Sheet Approach

Conventional approaches to fiscal vulnerability emphasise the stock of public debt outstanding; however, Barnhill Jr and Kopits (2004) reported that outstanding public debt is a less obvious indicator of fiscal risk for the following reasons[100]:

1. contingent liabilities
2. nature and magnitude of quasi-fiscal operations
3. government guarantees
4. revenue structure.

Following Barnhill Jr and Kopits (2004), we applied the financial net worth approach by incorporating yearly public sector balance sheets, which is a widely neglected macro-fiscal measure, as given in Makin and Pearce (2016, p. 2).[101] Theoretically, the use of government borrowing can be broadly classified into revenue expenditure and capital expenditure. Revenue expenditures are incurred to finance budget deficits or for running expenditures. Capital expenditures are incurred to finance public investment in the form of productive infrastructure. In this context, government borrowing to finance deficit increases public debt and worsens the balance sheet of the public sector. Conversely, government borrowing for public investment increases assets and improves the government balance sheet (Makin & Pearce, 2016). Under these fiscal conditions, a government with a higher net public worth can convert some of its non-financial assets into financial assets to pay any obligation from the debt position. Alternatively, the government can use the income from non-financial assets—including land, public trading enterprises or other property—to pay its debt obligations.[102]

Different measures of government financial position have been used in the existing literature.[103] These measures can be broadly categorised as net public worth and net financial worth. We

[100] See Hemming and Petrie (2002) for further discussion on the fiscal risk analysis.
[101] For details on net financial worth, see 'Appendix D: Investment Aspect of Public Debt'.
[102] See Makin and Pearce (2016, pp. 1–2) and Abelson (2012, p. 427) for a discussion on net public worth policies in fiscal vulnerability analysis.
[103] For example, the net public worth of the government is a preferred measure by some researchers (Bohn, 1992; Buiter, 1985; Mellor, 1996). Mellor (1996) further suggested using change in net worth to assess the fiscal policy of a government. Makin and Pearce (2016) also examined net worth and the financial net worth of the

used net financial worth[104] instead of net public worth because the data on net public worth for most of the developing economies were unavailable. However, the financial net worth of OECD economies changed significantly as a result of the recent global financial crises of 2007 to 2009 (OECD, 2015, p. 60).[105] Therefore, it was preferable to use the worst-case value of financial net worth to identify an economy as vulnerable to debt crisis. Barnhill Jr and Kopits (2004) applied similar worst values to assess the fiscal sustainability of Ecuador, using its balance sheet data from 1995 to 2002. Complete details on the VaR and CVaR approaches and their applicability for financial net worth are discussed below.

5.5.3 Financial Net Worth under VaR and CVaR—Approaches and Measurement

Determining the worst value over a time horizon is a common phenomenon for financial risk managers. The history of determining the worst-case value dates back to Till M Guldimann (head of global research at JP Morgan) in the late 1980s, when he created the term 'value at risk'. His team needed to decide whether to invest in long bonds or cash. Investing in long bonds generates stable income, while investing in cash keeps the market value constant. The JP Morgan group ultimately decided that value risk was better than earning risk, which led to the use of VaR (Jorion, 2007, p. 18). In the current study, we calculated financial net worth in VaR and CVaR using historical simulation, and used these values to identify vulnerable economies.

Following Jorion (2007, p. viii), VaR identifies the worst loss over a target horizon that will not be expected with a given level of confidence. The VaR of a complex portfolio can be measured through: (i) the delta-normal approach and (ii) the full valuation method. The delta-normal approach computes the variance and correlation between the securities for all risk factors, assuming that all assets returns are normally distributed. The full valuation method, such as historical simulation or Monte Carlo simulation, should be used for nonlinear instruments (Jorion, 2007, p. 14). Historical simulation uses a historical time series to calculate the variance and covariance of the risky variables. The Monte Carlo simulation uses analytical models, where these models specify the manner in which variables change over time. Over the

government to assess the growing level of public debt. Further, Robinson (2002) and Abelson (2012) included net financial liability in the list of key measures for the government's financial position.

[104] These values of financial net worth were calculated from the public sector balance sheets of each country.

[105] For example, the average value of financial net worth decreased to -65 per cent of GDP in 2013, compared with the pre-crisis value of -38.1 per cent of GDP.

last decade, VaR has been used to measure and manage different types of risk, including operational, credit, liquidity and natural disaster risks.

As well as financial institutions, different regulators—including the US Federal Reserve, US Securities and Exchange Commission, regulator of the European Union and Basel Committee on Banking Supervision—use VaR as the benchmark risk measure to evaluate financial risk in different institutions (Huisman, Koedijk, & Pownall, 1998). Further, non-financial corporations and asset managers use VaR as a risk management technique (Jorion, 2007, p. 10). Barnhill Jr and Kopits (2004) were the first to use VaR and CVaR techniques to assess the fiscal sustainability of Ecuador. Using data from 1995 to 2002, this study reported that a significant risk of government financial failure stems from volatility in the exchange rate, interest rates, oil prices and output. The selection of Ecuador among emerging economies was primarily because of the availability of balance sheet data (Barnhill Jr & Kopits, 2004, p. 38). This study calculated the VaR of the portfolio or balance sheet data of Ecuador using the full valuation method in the form of Monte Carlo simulation, rather than local valuation method.[106] The objective of applying VaR and CVaR in our study was different from Barnhill Jr and Kopits (2004). Our objective was to calculate the worst possible value of financial net worth for each economy to identify vulnerable economies. We then compared these results with our main approach, including threshold regression. Given that we did not use complete government balance sheet data, the full valuation method in the form of Monte Carlo simulation was not required. Therefore, the simulation was performed on the historical time series of financial net worth from 1960 to 2014 to determine the VaR and CVaR.

For computational purposes, the financial net worth was arranged in descending order because our objective was to determine the worst value of financial net worth over the horizon, following the definition by Jorion (2007, p. 8). The financial net worth VaR at a 90 per cent confidence interval is the *nth* value of the sorted financial net worth.[107] This *nth* value is calculated as follows:

$$nth\ value = [(1 - 0.90)(\text{number of observations of financial net worth})] \qquad (5.5.3.1$$

For example, if the number of observations (financial net worth) is 100, then the tenth value $[(1 - 0.90)(100)]$ will be the financial net worth at VaR 90 per cent. Similarly, CVaR is the

[106] Monte Carlo simulation is appropriate for the balance sheet or portfolio of the public sector.
[107] We also calculated the VaR and CVaR at 95 per cent and 99 per cent, and compared the results with 90 per cent. There was no significant difference in the results.

average amount of loss in the worst 10 per cent of cases. This is the average of the first value to the *nth* value of financial net worth, where the *nth* value is calculated using Equation 5.5.3.1.

From the above example, CVaR 90 per cent will be the average of the first 10 values of financial net worth, keeping in mind that financial net worth series is arranged in descending order. Figure D1 in Appendix D presents a graphical explanation of VaR and CVaR. The results indicated that the maximum loss of 90 per cent VaR and 90 per cent CVaR on this portfolio was -0.40 and -0.45, respectively. The financial net worth at VaR and CVaR (90 per cent) was calculated for all 53 economies included in the sample. Positive values of the calculated financial net worth indicated the financial health of the economy. We categorised an economy as vulnerable if its calculated value was less than -10.[108] It might be argued that an economy with any negative financial net worth should be categorised as vulnerable. We extended this range because non-financial assets were not included in the value of financial net worth.

5.6 Methodological Notes to Fiscal Consolidation Episodes

This subsection presents the methodological note to determine fiscal consolidation episodes, which were further used in the panel regression analysis to investigate the role of fiscal consolidation in the banking stability for the panel of all sample countries and subsamples of vulnerable and non-vulnerable economies. Fiscal consolidation is measured through CAPB. In the empirical literature, different approaches are available to calculate CAPB. Following Mirdala (2013), CAPB can be calculated by eliminating the cyclical components (C^c) of each budgetary category (revenue and expenses) from the primary government balance (PGB)[109] as follows:[110]

$$\mathrm{CAPB_t} = \mathrm{PGB_t} - \mathrm{C_t^c} = \mathrm{PGB_t} - \sum_{i=1}^{n} \mathrm{C_{i,j}^c} \qquad (5.6.1$$

In addition, $C_{i,j}^{c}$ is the cyclical component of each budgetary category (revenue and expenses) which can be calculated through two different approaches. One is based on a simple HP filter, and the second is based on an econometric approach, where the cyclical component, $C_{i,j}^{c}$, of each budget category will be calculated as follows:

$$\mathrm{C_{i,j}^c} = \mathrm{AGB_{i,j}} \,.\, \mathrm{e_i} \,.\, Out_t^{p} \qquad (5.6.2$$

[108] See Section 6.3 (Chapter 6) for further details on the benchmark of -10.
[109] Primary government balance is the net of interest payable.
[110] This section is extracted from Section 4, Fiscal Consolidation of Mirdala (2013).

where $AGB_{i,j}$ is the actual government balance, e_i indicates the elasticity of each budget category on an individual basis. Normally, these budget categories include gross expenditure and revenue of general government. Out^p in the 5.6.2 represents the output gap (per cent of GDP). Existing literature has frequently used the econometrics techniques to measure the elasticities of these budgetary categories (Bouthevillain et al., 2001; Altar, Necula, and Bobeica, 2010). Gunaydın and Ulku (2002) applied the vector error correction model (VECM) to estimate income elasticities. A similar methodology was applied by Mirdala (2013). Both of these approaches are elaborated below.

Following Hodrick and Prescott (1997) [111], the basic idea is to decompose the fiscal variables into the following components:

1. trend—a slowly-evolving secular trend
2. cycle—a transitory deviation from the trend, classified as a cycle.

In this framework, any time series is the sum of growth and cyclical component.[112] Hodrick and Prescott (1997) used the sum of the square of its second difference as a measure of smoothness of growth. In this framework, a cycle is a deviation from growth, where its average is zero over a long period. The researchers presented the following programming problem to determine the growth component:

$$\min_{\{g\}_{t=-1}^{T}} \left\{ \sum_{t=1}^{T} {C^c}_t^2 + \lambda \sum_{t=1}^{T} [(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2 \right\} \qquad (5.6.3$$

When ${C^c}_t = y_t - g_t$, the solution series will be smoother in the case of a higher value of λ.[113] We used these cyclical components in Equation 5.6.1 to measure CAPB.

Under econometric techniques, the cyclical component of each budget category is calculated using Equation 5.6.2. In this setup, the individual elasticities of the budgetary categories are calculated with econometric techniques following Mirdala (2013). Here, it is expected that each individual fiscal variable and real output are cointegrated, with the methods of Johansen (1988, 1991) and Johansen and Juselius (1990) used to estimate the long-term equilibrium relationship

[111] HP is still the most frequently used filter in the latest empirical literature, despite its two main issues: (i) poor estimation at the end of the series and (ii) spurious cycle in the case of time series analysis (Mirdala, 2013, p. 9).
[112] Growth component and trend are referred to interchangeably in this discussion.
[113] Historically, this approach was used to construct mortality tables. Further, the actuarial scientists has been using this approach for different purposes and they called it Whittaker–Henderson Type A method (Whittaker, 1922).

between individual fiscal variables and real output. The method introduced by Johansen is based on the unrestricted VAR:

$$X_t = \eta + A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_p X_{t-p} + \mu_t \quad (5.6.4$$

where:

η = the $n\ x\ 1$ vector of constants

X_t = the $n\ x\ 1$ vector of variables (individual fiscal variable and real output)

A_i = the $n\ x\ n$ coefficient matrix

μ_t = $\mu_t \sim N_n(0, \Sigma_\mu)$ is $n\ x\ 1$, the vector of exogenous shock to the model.

The VECM can be obtained by rearranging the VAR representation given in Equation 5.6.4:

$$\Delta X_t = \eta + \pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \mu_t \quad (5.6.5$$

where:

$\pi = \sum_{i=1}^{p} A_i - I$, and I is $n\ x\ n$ identity matrix

$\Gamma_i = -\sum_{j=i+1}^{p} A_j$

ΔX_t: the $n\ x\ 1$ vector of 1st difference.

The estimated $\Gamma\ and\ \pi$ from the VECM are $n\ x\ n$ matrices consisting of coefficients that hold short- and long-term dynamic adjustment to the changes in X_t, respectively.

The elasticities for the fiscal variables were calculated using the coefficients derived from Equation 5.6.5. The resulting CAPB was used to estimate the fiscal consolidation episode. The existing literature defines fiscal consolidation as: (i) cold shower when CAPB improves by at least 1.5 per cent in one year and (ii) gradual consolidation that occurs over a period of three years if CAPB is not deteriorated by more than 0.5 per cent of GDP in each and every year (Alesina & Perotti, 1995).

Alesina and Ardagna (2010) suggested using one benchmark year to identify multiple year consolidation episodes, and further identified that there is no reason to consider one definition superior to others if the results remain broadly the same in both cases. Alternatively, there are

some other definitions of fiscal consolidation.[114] Alesina and Ardagna (2010) identified three types of fiscal adjustment episodes. Mirdala (2013) used two of these measures, slightly revised by Barrios, Langedijk, and Pench (2010): (i) cold shower where CAPB improves by at 1.5 per cent of GDP and (ii) gradual consolidation where CAPB will not deteriorate by more than 0.5 per cent of GDP (Mirdala, 2013). For this research, we decided to define fiscal consolidation episodes as a period in which the CAPB improves by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year.

5.7 Measuring the Influence of Fiscal Consolidation on Banking Stability

After identifying the episodes of fiscal consolidation, their influence on banking stability was analysed through the estimation model of Cimadomo et al. (2014):

$$W_{ij,t} = \sum_{s=1}^{k} \beta_s W_{ij,t-s} + \sum_{s=0}^{k} \gamma_s FC_{i,t-s} + \sum_{s=0}^{k} \delta_s Z_{t-s} + \mu_j + \rho_t + \varepsilon_{ij,t} \quad (5.7.1$$

where *i, j, t* denotes the country, bank and time, respectively, and $W_{ij,t}$ indicates the measures used for the financial stability of the banking sector. Following the guidelines of the Australian Prudential Regulation Authority (APRA) and the Basel framework, these measures are the Tier-1 and Tier-2 capital ratios introduced in Chapter 3 in Equations 3.3.8 and 3.3.9. Z_t indicates the bank-specific controls (total assets and return on assets) and country-specific macroeconomic controls (output gap, debt to GDP and long-term interest rates) at time *t*. FC_i is an indicator variable used for fiscal consolidation episodes, and $\rho_t$is the time-specific fixed effect. Further, we used the alternative aggregated measures of financial stability (banking system regulatory capital to risk-weighted assets and z-scores) alongside stock market capitalisation in the aggregated analysis. For this purpose, we used the following model:

$$W_t = \rho_{0a} + \beta_a W_{t-1} + \gamma_a FC_{i,t} + \delta_a Z_t + \varepsilon_t \quad (5.7.2$$

A positive sign for γ indicates financial stability as a result of fiscal consolidation through portfolio rebalancing. Our empirical model defined by Equation 5.7.1 includes the lagged dependent variable, which is due to the adoptive expectations of investors. For the case of adoptive expectations, forecasts of future events are imperfect and have some systematic errors

[114] Alternatively, there are other definitions of fiscal episodes. For example, the OECD defines the episode as an improvement in CAPB by at least one per cent of potential GDP either in one year or in two consecutive years, where at least 0.5 per cent of this improvement occurs during the first of these two years (Stephanie, Mike, Eckhard, & Christophe, 2007). Fiscal consolidation is associated with improvement in CAPB. The episode stops if there is no further improvement in CAPB or if the CAPB is less than the 0.2 per cent of GDP during one period, and then begins deteriorating.

(Eyler, 2009, p. 148). In this case, the standard fixed-effects panel regression might be subject to the Nickell (1981) bias.

Anderson and Hsiao (1981) proposed the instrumented variable estimation using the second lag of the dependent variable as an instrument, which is uncorrelated with the error term. Similarly, the other lags of dependent variables (financial stability in this case) can be used as an instrument. Additionally, other regressors can be used as an instrument for themselves if these regressors are strictly exogenous.[115] We used the Arellano and Bond estimators that use lagged values of the variables to construct large number of instruments, which is consistent in this framework (see Cimadomo et al., 2014). However, we estimated Equation 5.7.1 in two distinct ways. First, we estimated the equation for the case of different panels of the economies for: (i) all economies, (ii) all vulnerable economies and (iii) all non-vulnerable economies.[116] Second, we estimated Equation 5.7.1 for each economy using bank-wise financial statement data. There was variation in the number of observations across countries. Roodman (2009, p. 128) provided guidelines to collapse all instruments into a few instruments within the Arellano–Bond framework to achieve robust efficient estimates. Our time period was fixed over the sample, ranging from 1990 to 2015 ($T = 25$).[117] However, the cross-sectional unit, N, varied from 1 to 739. For instance, there are 739 banks in the case of the US, yet only one bank in a few cases, such as Venezuela. For such cases, Roodman (2009) suggested that, if T is larger than N, the dynamic panel estimation bias becomes insignificant, and the standard fixed-effects estimator is appropriate. For these cases, the number of instruments in system generalised method of moments (GMM) in differences tends to explode with the time. As a result of the smaller N, the autocorrelation and cluster-robust standard errors may be unreliable (Roodman, 2009, p. 128). To overcome this problem, we used standard fixed effects for cases where N was less than 25 (Roodman, 2009). The difference and system GMM models were applied in all other cases where appropriate. To ensure the robustness of our findings, we applied the fixed-effects estimation for the models by: (i) including the lagged dependent variable and (ii) excluding the lagged dependent variable.

[115] These regressors can also be used in other cases. See Section 9.4, Chapter 9, from Cameron and Trivedi (2010). Also see Holtz-Eakin, Newey, and Rosen (1988) for further discussion.
[116] These economies are classified as vulnerable and non-vulnerable using any fiscal vulnerability analysis.
[117] We could not use the data for 2016 because of the unavailability of some observations.

5.8 Concluding Remarks

We first applied a fiscal vulnerability selection procedure (Figure 5.2) to identify the vulnerable economies among the sample of 53 selected economies. Further, we identified the fiscal consolidation episodes as a period in which the CAPB improved by at least 1.5 per cent of GDP per year, or a period of two consecutive years in which the CAPB improved by at least one per cent of GDP per year. These fiscal consolidation episodes were used in the following section to examine their influence on banking stability for all economies. In this setting, our baseline equation included the lagged dependent variable to incorporate the adoptive expectations of the investors, as the financial stability in the previous period was expected to have a significant effect on the financial stability in the current period. In the presence of adoptive expectations, the standard fixed-effects panel regression could be subject to Nickell bias. To overcome this problem, we used the GMM estimation procedure proposed by Arellano and Bond (1991). We observed higher variation in years (T) and the number of banks (N) in our large sample of 53 economies. In particular, the number of banks (N) varied from one to 739 for each country. If T was larger than N during the analysis, the dynamic panel bias became insignificant and standard fixed-effects models could be used. In the next chapter, we follow these guidelines and procedures to: (i) identify the economies that are vulnerable to crisis, (ii) identify the fiscal consolidation episodes and (iii) examine the effect of fiscal consolidation on banking stability.

CHAPTER 6. Fiscal Vulnerability Analysis

6.1 Introduction

In continuation of the public debt evolution (Section 3.2, Chapter 3) and empirical strategy for assessing fiscal vulnerability (Section 5.2, Chapter 5), this chapter presents the fiscal vulnerability analysis for the 53 economies. Fiscal vulnerability is a situation in which the government is exposed to the possibility of failing to achieve the aggregate objectives of the fiscal policy (Hemming & Petrie, 2002, p. 161). The existing literature follows debt analysis to quantify fiscal vulnerability.[118] We propose a fiscal vulnerability selection procedure by incorporating investment components in the traditional debt analysis of fiscal vulnerability. Using this proposed selection procedure, we categorise the selected economies into vulnerable and non-vulnerable. We compare the results of our proposed fiscal vulnerability selection procedure with the results of other alternative techniques (fiscal vulnerability index and financial net worth VaR and CVaR). We also compare our results with the available country ratings conducted by different rating agencies, including Standard & Poor's Financial Services (S&P), Moody's Corporation and Fitch Group.

This empirical analysis contributes to the existing literature in a few ways. First, we propose the fiscal vulnerability selection procedure (Figure 5.2, Chapter 5) by incorporating the investment component of public debt that can be applied to a large sample of developing, emerging and developed economies. Second, using our proposed procedure, we categorise a large set of 53 economies into vulnerable and non-vulnerable. Third, we provide the appropriate level of public debt to GDP for each country, which may be the tipping point to cause fiscal vulnerability to fiscal crisis. The remainder of this chapter is organised as follows.

[118] See Bohn (1998) and Reinhart and Rogoff (2010) for further details on the debt analysis of fiscal vulnerability.

Section 6.2 presents a debt analysis of fiscal vulnerability, which is further bifurcated into the traditional approach, stability analysis and country-specific threshold. Section 6.3 presents the investment components analysis of fiscal vulnerability, while Section 6.4 discusses the results of alternative approaches, and presents a comparison of our results with the country rating announced by different rating agencies. Finally, Section 6.5 concludes this chapter.

6.2 Debt Analysis of Fiscal Vulnerability

6.2.1 Traditional Approach

In this section, we classify the sample of 53 economies into vulnerable and non-vulnerable using our fiscal vulnerability selection procedure. Prior to estimating Equation 5.2.1 (Section 5.2, Chapter 5), we tested and ensured that all variables were either stationary or transformed into stationary series if they were nonstationary. For this purpose, we applied the three most commonly used unit root tests on the relevant variables—the Augmented Dickey–Fuller (ADF), Phillips–Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. These three tests are differentiated by the fact that the null hypothesis for ADF and PP is the alternative hypothesis for KPSS. In particular, the former are derived under the null hypothesis of unit roots, while the latter is derived under the stationarity null hypothesis. We report the unit test results of these three tests in Table E1 (Appendix E).

Perron (1989) revealed that unit root and structural changes are closely associated. Similarly, Martin, Hurn, and Harris (2013) indicated that there is a strong tendency not to reject the null hypothesis of the unit root by ignoring structural changes in the data.[119] Therefore, researchers should keep in mind that conventional unit root tests, including ADF, PP and KPSS, are biased towards the false unit root in the presence of structural breaks. We expected structural breaks in our data; therefore, we applied the breakpoint unit root tests (innovative outlier) on the relevant variables for all countries included in the sample.[120] We present the results of the breakpoint unit root tests in Table E2 (Appendix E). Columns 1 and 2 of Table E2 present the country and variable names, respectively. Column 3 presents the test statistics of innovative outliers. Columns 4 and 8 provide the one-time break date of the breakpoint unit root tests in

[119] See Section 17.8 on structural breaks in Martin et al. (2013) for further details.
[120] We consider four basic models for our data with a one-time break, as suggested in Perron (1989). These models include: (i) a model with a one-time change in level for non-trending data, (ii) a model with a one-time change in level for trending data, (iii) a model with a change in both level and trend and (iv) a model with a change in trend. Further, we consider the innovational outlier version of the four models. The innovational outlier model assumes that the break occurs gradually.

the level and first difference, respectively. Columns 5 and 6 provide the trend and break specification of the innovation outliers in the level, respectively. Similarly, Columns 9 and 10 provide the trend and break specification of the innovation outliers in the first difference, respectively.

The identified breaks in the breakpoint unit root tests were further investigated to incorporate the breaks in Equation 5.2.1 (Section 5.2, Chapter 5). Tests for structural changes and parameter instability in regression models derive from Chow (1960), who used F-statistics to test for regime change at a priori known dates. Later, Quandt (1960) and Andrews (1993) modified the Chow framework to incorporate all possible breakdates. Bai (1997) and Bai and Perron (1998) further extended the Quandt–Andrews framework to allow multiple unknown breakpoints.[121] We applied the Bai and Bai–Perron approach of the multiple-breakpoint test for Equation 5.2.1 (Section 5.2, Chapter 5). We estimated a maximum of five breakdates for each country where breakdates were applicable. We report the results of the multiple-breakpoint test in Table E3 (Appendix E). Columns 2 and 3 of Table E3 present the country name and maximum number of estimated breaks, respectively. Columns 4 and 5 present the test specification method and selected breaks criterion, respectively.[122] In some cases, different criteria gave different break years. We report only the maximum number of breaks in Column 3 of Table E3. However, we included dummies in Equation 5.2.1 (Section 5.2, Chapter 5) for all break years identified using the multiple-breakpoint test. However, we excluded the statistically insignificant dummies from Equation 5.2.1 for further analysis.

To identify vulnerable economies, Table 6.1 presents the parameter estimates from the empirical Equation 5.2.1 (Section 5.2, Chapter 5). In particular, we present the result of the debt coefficient (public debt to GDP) based on Bohn's (1998) approach for all economies in Column 2 of Table 6.1. A negative and significant coefficient implies that the economy is vulnerable to debt crisis. For example, Canada is vulnerable to crisis because the estimated coefficient for Canada is negative and significant (-0.20). Based on Bohn's (1998) approach,

[121] The Bai (1997) and Bai and Perron (1998) approach to structure break testing was implemented as a multiple-breakpoint test in EViews 10.

[122] We applied all five test specifications, including: (i) Bai–Perron tests of $L + 1$ versus L sequentially determined breaks, (ii) Bai tests of breaks in all recursively determined partitions, (iii) Bai–Perron tests of 1 to M globally determined breaks, (iv) Bai–Perron tests of $L + 1$ versus L globally determined breaks and (v) comparing information criteria for 0 to M globally determined breaks. Further, we applied six break selection criteria, including: (i) sequential F-statistic determined breaks, (ii) significant F-statistic largest breaks, (iii) UDmax determined breaks, (iv) WDmax determined breaks, (v) Schwarz criterion selected breaks and (vi) significant F-statistic largest breaks. We included the dummies in Equation 5.2.1 (Section 5.2, Chapter 5) against all breaks identified through these test specification methods and break selection criteria. We applied residual and stability diagnostics for all cases and ensured that none of the time series properties is violated.

we identified 30 of 53 economies as vulnerable to debt crisis.[123] This approach was the first step of our fiscal vulnerability selection procedure (Figure 5.2, Chapter 5). The result implied that public debt to GDP significantly decreased the primary balances of these countries.

6.2.2 Stability Analysis (Forward, Backward and Moving Screening)

It is important to note that the above results were for the entire period of analysis. However, it is likely that an economy could be vulnerable for a specific subsample. In such cases, the results based on the full sample period of a specific country could be misleading when the subsample of the vulnerable period is combined with the non-vulnerable period. To overcome this problem, we proposed employing stability analysis using forward, backward and moving screening processes, as displayed in Figure 5.1 (Chapter 5). This was the second step in our proposed fiscal vulnerability selection procedure (Figure 5.2, Chapter 5). For this purpose, as discussed in Chapter 5, we estimated 39 different regressions for each country and for each screening method to identify specific episodes of fiscal vulnerability.

Figure E1 in Appendix E plots the test statistics corresponding to the coefficient of debt to GDP rate for the above proposed screening processes. These screening processes successfully identified the years in which economies appeared vulnerable, when the downward spike was below the lower bound (from 95 per cent confidence interval). Interestingly, the results of these screening process indicated that 39 (nine additional) economies were vulnerable at some point in time.[124] It is clear from these analyses that the Bohn (1998) model based on the full sample period is misleading because the period of vulnerability is nullified by the period of non-vulnerability when they are merged. It is important to note that Pakistan was identified as a non-vulnerable economy by Khan and Saqib (2007) using Bohn's (1998) model. Interestingly, our results based on Bohn (1998) are consistent with their findings. However, the results based on the forward, backward and moving screening processes are controversial and add additional insight to this problem. In these screening processes, the model was systematically estimated for the subsample periods of at least 20 observations through forward, backward and moving processes. For the case of Pakistan, all three screening processes identified episodes of vulnerability (see Figure E1, Appendix E). However, the results based on screening processes

[123] These were Australia, Austria, Belgium, Canada, Colombia, Denmark, Finland, France, Germany, Greece, Honduras, Hungary, Iceland, Ireland, Israel, Italy, Japan, New Zealand, Nicaragua, Panama, Peru, Portugal, South Africa, South Korea, Spain, Sweden, Switzerland, Thailand, the UK and the US.

[124] The nine additional economies identified through the forward, backward and moving screening processes were Argentina, the Dominican Republic, India, Indonesia, Mexico, the Netherlands, Norway, Pakistan and Paraguay.

could be misleading if the subsample itself had both vulnerable and non-vulnerable periods. To overcome this problem, we used a threshold regression approach to help identify the threshold level at which the public debt to GDP decreases the primary balances, which eventually leads towards fiscal crisis. This also enabled us to achieve the second objective of our study.[125] This was the third step in our proposed fiscal vulnerability selection procedure (Figure 5.2, Chapter 5).

[125] See Section 1.6 (Chapter 1) for details of the research objectives.

Table 6.1: Country-wise Results of Fiscal Vulnerability

Approaches to identify fiscal vulnerability/Country	Bohn 1998 Approach (debt co-eff)	Threshold Regression (Public Debt % of GDP)						Financial Net Worth in CaR and CVaR Approach		Fiscal Vulnerability Index
		No Threshold Co-eff	Threshold 1	Co-eff (Dp<Th)	Obs	Co-eff (Dp=>Th)	Obs	FNW (VaR)	FNW (CVaR)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Argentina	0.01	0.01						-2.92	-2.97	76.46
Australia	-0.09*		22.38	-0.16	21	-0.1127	35	-19.86	-34.31	34.44
Austria	-0.21***						31	-47.03	-69.63	71.83
Belgium	-0.12***		84.06	-0.00	21	-0.31***	35	-101.51	-147.19	126.92
Brazil	0.07	0.07						-6.7	-6.91	68.06
Bulgaria	0.03	0.03						-4.67	-4.88	104.33
Canada	-0.20***						19	-72.29	-109.29	95.16
Chile	0.17		14.97	1.60**	17	2.88***	25	-0.19	-11.57	51.9
China	0.04**							-1.87	-1.94	25.84
Colombia	-0.11**							-88.38	-132.36	38.54
Costa Rica	-0.01		38.61	0.02	27	-0.00	22	-36.09	-36.09	114.01
Denmark	-0.12*		27.54	-0.16	19	-0.17**	36	-26.17	-40.03	67.98
Dominican Republic	0.01		38.47	-0.03	29	-0.05	8	-0.49	-0.64	62.53
Finland	-0.26***		33.94	0.13	31	-0.34***	25	29.22	42.49	55.73
France	-0.24***		21.16	-0.06	16	-0.29***	40	-67.18	-99.63	82.32
Germany	-0.39***							-50.31	-71.98	73.11
Ghana	- 0.01		33.59	-0.06	27	-0.01	27	-10.89	-10.9	86.47
Greece	-0.09**		71.68	-0.16	29	-0.05	26	*-108.32*	*-153.47*	*144.89*
Haiti	0.04							-6.75	-6.84	133.15
Honduras	-0.09**							-14.5	-18.28	96.46
Hungary	-0.40**							-63.52	-90.19	101.82

continued…

Table 6.1 (…continued): Country-wise Results of Fiscal Vulnerability

Approaches to identify fiscal vulnerability/Country	Bohn 1998 Approach (debt co-eff)	Threshold Regression (Public Debt % of GDP)						Financial Net Worth in CaR and CVaR Approach		Fiscal Vulnerability Index
		No Threshold Co-eff	Threshold 1	Co-eff (Dp<Th)	Obs	Co-eff (Dp=>Th)	Obs	FNW (VaR)	FNW (CVaR)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Iceland	-0.14***							-57.38	-81.95	82.07
India	-0.01		70.12	-0.09	42	-0.02	14	-9.63	-10.16	77.85
Indonesia	-0.01		34.38	0.01	20	-0.04	25	107.35	142.91	60.52
Ireland	-0.12**							-73.36	-114.24	107.75
Israel	-0.08***							-76.9	-137.78	154.32
Italy	-0.17***							-107.76	-158.69	121.55
Japan	-0.24***		195	-0.07*	47	-0.32***	9	-118.86	-188.95	220
Mexico	0.02		53.98	-0.05	48	0.01	8	-34.26	-60.84	56.8
Netherlands	-0.06		75.5	-0.08	46	0.27	8	-42.76	-61.85	75.74
New Zealand	-0.19***							5.53	5.52	68.05
Nicaragua	-0.01*							-0.17	-0.27	225.39
Norway	-0.05		49.08	-0.04	46	0.07	10	80.63	102.44	52.74
Pakistan	-0.02		72.92	0.05	34	0.01	14	-10.08	-16.6	78.77
Panama	-0.14*		26.21	-0.43	10	-0.23***	37	2.84	2.97	99.48
Paraguay	-0.03		45.49	-0.04	31	-0.02	11	18.68	19.85	57.11
Peru	-0.06**		34.51	-0.07	18	-0.02	28	0.69	0.64	49.93
Philippines	-0.00		15.87	-0.23	11	-0.01	43	-1.54	-2.08	66.34
Poland	-0.08							-33.91	-49.15	61.95
Portugal	-0.24***		44.45	-0.31	21	-0.22***	34	-70.7	-108.11	93.32
Romania	-0.06	-0.06						-2.55	-2.71	31.04
Russian Federation	0.06							-1.21	-1.27	59.86

continued…

Table 6.1 (…continued): Country-wise Results of Fiscal Vulnerability

Approaches to identify fiscal vulnerability/Country	Bohn 1998 Approach (debt co-eff)	Threshold Regression (Public Debt % of GDP)						Financial Net Worth in CaR and CVaR Approach		Fiscal Vulnerability Index
		No Threshold Co-eff	Threshold 1	Co-eff (Dp<Th)	Obs	Co-eff (Dp=>Th)	Obs	FNW (VaR)	FNW (CVaR)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
South Africa	-0.15***		30.61	0.12	7	-0.16**	45	-4.55	-4.69	45.93
South Korea	-0.22***		21.62	-0.18	42	-0.44***	14	33.15	58.51	33.44
Spain	-0.30***						15	-58.59	-87.54	67.48
Sweden	-0.33***		42.74	-0.08	29	-0.18***	24	-6.18	-13.49	69.85
Switzerland	-0.15***		60.52	0.01	26	-0.07	10	-13.35	-20.79	63.72
Thailand	-0.05**							-2.32	-2.36	47.53
Turkey	-0.10		32.69	0.22	15	-0.14**	26	-1.51	-1.53	52.09
UK	-0.45***		51.63	-0.09	33	-0.45***	22	-74.24	-104.62	94.61
Uruguay	-0.01	-0.01						-3.58	-3.64	90.14
USA	-0.47***							-106.46	-150.15	95.19
Venezuela	-0.03		46.45	-0.03	39	-0.03	15	-14.71	-14.79	64.78

*Note: This table presents the estimates of five approaches used to identify the vulnerable economies. Column 2 presents the result of Bohn's (1998) approach, where the coefficient of public debt to GDP in Equation 5.2.1 (Section 5.2, Chapter 5) is reported. Columns 3 to 8 present the results of threshold regression. For the case of five economies, we could not identify the threshold of public debt to GDP. Column 3 reports the results for these cases. The results of these cases are identical to those reported in Column 2 of this table. Column 4 presents the threshold value. Columns 5 and 7 report the parameter estimates at the threshold values (before and after the threshold values), respectively. Columns 9 and 10 present the results of financial net worth in VaR and CVaR. Likewise, Columns 11 and 12 provide the results of public debt overhang in VaR and CVaR. Column 13 provides the value of the fiscal vulnerability index calculated using Equation 5.5.1.1 (Section 5.5.1, Chapter 5). *, ** and *** indicate statistical significance at 10, five and one per cent, respectively.*

6.2.3 Country-specific Threshold

Threshold regression analysis allows the parameter estimates to vary across different regimes. For the cases with no identified significant thresholds, the model collapsed down to the traditional Bohn (1998) model. We present the results of the threshold regression in Columns 3 to 8 of Table 6.1. For some cases, we could not capture any threshold, and the parameter estimates were identical to those reported in Column 2 of Table 6.1. We report these estimates in Column 3 of Table 6.1. For the remaining cases, the optimal number of regimes was identified as two, and the parameter estimates were expected to be different across two regimes. These regimes were driven from a specific threshold value of debt-to-GDP ratios. Column 4 reports these threshold values where the parameter estimates were expected to be different. The parameter estimates at these threshold values (before and after the threshold values) are reported in Columns 5 and 6 of Table 6.1.

We estimated the threshold regression for all countries included in the sample. The threshold regression identified different thresholds for 11 economies, beyond which the economy may slip into fiscal crisis. These 11 economies were Denmark, Finland, France, Japan, Panama, Portugal, South Africa, South Korea, Sweden, Turkey and the UK. These thresholds ranged from a minimum of 21.16 per cent to a maximum of 84.06 per cent of public debt to GDP for the case of France and Belgium, respectively. We noted that eight of these 11 economies were commonly identified as vulnerable economies by all three approaches.[126] We also noted that 10 of these 11 economies were commonly identified as vulnerable by Bohn's approach and threshold regression.[127] Interestingly, we identified Turkey as a vulnerable economy using only threshold regression. Given that the threshold regression allows flexibility in model parameters through regime-switching behaviour, it identified Turkey as vulnerable to debt crisis when the debt level exceeded 30.69 per cent of GDP. By adding Turkey, we identified a total of 40 economies as vulnerable to debt crisis using the first three procedures of our fiscal vulnerable selection procedure. These economies were Argentina, Australia, Austria, Belgium, Canada, Colombia, Denmark, the Dominican Republic, Finland, France, Germany, Greece, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, New Zealand, Nicaragua, Norway, Pakistan, Panama, Paraguay, Peru, Portugal, South Africa, South

[126] These eight economies were Denmark, Finland, France, Panama, Portugal, South Africa, Sweden and the UK.
[127] These 10 economies were Denmark, Finland, France, Japan, Panama, Portugal, South Africa, South Korea, Sweden and the UK.

Korea, Spain, Sweden, Switzerland, Thailand, Turkey, the UK and the US. Our proposed approaches add additional insight to the problem, and indicate that policies based on the single threshold of 90 percentage of debt to GDP can be critically substituted with a country-specific threshold level of debt to GDP ratio.

6.3 Investment Component Analysis of Fiscal Vulnerability

In the fourth step, we analysed the financial net worth (VaR and CVaR) of all 40 vulnerable economies to incorporate the investment component of the public sector balance sheet.[128] We present the values of financial net worth (VaR and CVaR) in Columns 9 and 10 of Table 6.1. It was interesting to note that the values of financial net worth (VaR and CVaR) for 26 out of 40 vulnerable economies were negative.[129] These negative values of financial net worth (VaR and CVaR) reconfirmed the fiscal vulnerability of these economies. However, the remaining 14 economies were expected to be able to finance future interest and debt payments in many ways other than taxation. For this purpose, Section 5.5.3 (Chapter 5) provides a benchmark value of financial net worth (VaR and CVaR) to identify an economy as vulnerable to debt crisis. We observed in Section 5.5.3 (Chapter 5) that an economy is categorised as vulnerable if its calculated value is less than -10.[130] Columns 9 and 10 of Table 6.1 indicate that the financial net worth (VaR) of Argentina, the Dominican Republic, Finland, Indonesia, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, South Africa, South Korea, Thailand and Turkey was -2.92, -0.49, 29.22, 107.35, 5.53, -0.17, 80.63, 2.84, 18.68, 0.69, -4.55, 33.15, -2.32 and -1.51, respectively. Similarly, the financial net worth (CVaR) of Argentina, the Dominican Republic, Finland, Indonesia, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, South Africa, South Korea, Thailand and Turkey was -2.97, -0.64, 42.49,

[128] Incorporating an investment component is more relevant to economies identified as vulnerable under debt analysis. Debt analysis ignores the appropriate classification of rising debt, where the investment aspect of public debt improves the government balance sheet. Therefore, the higher financial net worth of these economies indicates that they are able to finance future interest and debt payments in many ways other than taxation. Further, the investment aspect of public debt is more relevant in fiscal vulnerability analysis for countries using accrual accounting for the fiscal policy measure. For instance, Marti (2006) identified that the fiscal framework of New Zealand has been purely based on accrual budgeting since the fiscal year 1993 to 1994 (also see Khan & Mayes, 2009). This framework is prepared under generally accepted accounting principles. In this framework, net worth is one of the key fiscal aggregates calculated from the consolidated financial statements for the central government. By 2009, 16 countries shifted from cash accounting to accrual base. Except for Colombia, the rest of the economies had shifted towards accrual base accounting (Khan & Mayes, 2009).

[129] These 26 economies included Australia, Austria, Belgium, Canada, Colombia, Denmark, France, Germany, Greece, Honduras, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Pakistan, Portugal, Spain, Sweden, Switzerland, the UK and the US.

[130] This benchmark value is also elaborated in the next Section 6.4 ('Alternative Approaches and Comparison with Country Rating').

142.91, 5.52, -0.27, 102.44, 2.97, 19.85, 0.64, -4.69, 58.51, -2.36 and -1.53, respectively. These results indicate that the governments of these economies can use non-taxation approaches—including selling financial assets—to finance future interest and debt payments. Therefore, we categorised these economies as non-vulnerable. Overall, we classified a total of 26 economies as vulnerable economies based on our proposed fiscal vulnerability selection procedure.[131]

6.4 Alternative Approaches and Comparison with Country Rating

We further analysed the results of alternative techniques of fiscal vulnerability available in the literature. We present the values of financial net worth (VaR and CVaR) in Columns 9 and 10 in Table 6.1, respectively. We present the fiscal vulnerability index calculated using Equation 5.5.1.1 (Section 5.5.1, Chapter 5) in Column 11 of Table 6.1. The alternative measure, financial net worth or balance sheet approach identified 29 of 53 economies as vulnerable to debt crisis.[132] At this stage of analysis, we considered two aspects. First, non-financial assets were not included in the financial net worth calculation. Second, we used the worst value of financial net worth by employing VaR and CVaR. As a result of these two factors, we had some leverage to determine the benchmark for financial net worth. To search for this benchmark of financial

[131] These 26 economies included Australia, Austria, Belgium, Canada, Colombia, Denmark, France, Germany, Greece, Honduras, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Pakistan, Portugal, Spain, Sweden, Switzerland, the UK and the US. Australia was included in these 26 vulnerable economies using our fiscal vulnerability analysis. For the case of Australia, we incorporated country-specific aspects. For this purpose, we used two other measures of public debt in consideration of the Australian GFS system: *ASNA 1993* and *ASNA 2008*. Based on the criticism of Eisner and Pieper (1984) and Soos (2016), it is important to review the results of Australian general government public debt after incorporating offsetting accounts. For this purpose, we used data on net debt from 1970 to 2016. We used net debt as an alternative measure of public debt in Equation 5.2.1 (Section 5.2, Chapter 5). The debt coefficient of net public debt (β_2 = -0.86, $p < 0.01$) was highly significant, which revealed that the Australian economy was vulnerable to debt crisis, even after adjusting offsetting accounts from gross public debt. The key criticism of Soos (2016) of Australian public debt is invalid. Soos (2016) identified two periods when the Australian general government was a net creditor. The key problem with this explanation is that the net debt of Australia started increasing during both periods. For instance, the Australian general government became a net debtor from 1976, and its level increased to the level of 18.10 per cent in 1995. Similarly, the Australian general government became a net debtor from 2009, and its level of net debt increased to the level of 17.30 per cent in 2015. Therefore, the rising level of Australian public debt cannot be justified through offsetting accounts. Our results based on net public debt indicate that the current level of net public debt is vulnerable to sovereign debt crisis. We also analysed the results of another alternate approach of net financial liabilities of the Australian general government. We used data of net financial liabilities from 1990 to 2016. We employed net financial liabilities as an alternative measure of public debt in Equation 5.2.1 (Section 5.2, Chapter 5). The value of the net financial liabilities coefficient (β_2 = -0.29, $p < 0.01$) was significant, which revealed that the Australian general government net financial liabilities—including unfunded superannuation liabilities—are also vulnerable to sovereign debt crisis. In summary, the Australian economy is vulnerable to debt crisis using all three measures when its public debt to GDP reaches its optimal level of 23.41.

[132] Using the financial net worth approach, the following economies were found to be vulnerable to debt crisis: Australia, Austria, Belgium, Canada, Colombia, Costa Rica, Denmark, France, Germany, Ghana, Greece, Honduras, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Pakistan, Poland, Portugal, Spain, Switzerland, the UK, the US and Venezuela. Specifically, the financial net worth (VaR) of these economies was less than the benchmark of -10.00.

net worth, we used our fiscal vulnerability selection procedure as the main approach. We compared the financial net worth (VaR and CVaR) of all 53 economies with the results of the fiscal vulnerability selection procedure. We attempted to identify the maximum number of economies that were either identified as vulnerable or non-vulnerable under financial net worth (VaR) and our main approach. Maximum economies as correctly identified when financial net worth of a country is -10.00. Here, a correctly identified economy means that this economy was identified as vulnerable or non-vulnerable using financial net worth and our main approach. This gave us a benchmark of -10.00 for financial net worth (VaR). Using this benchmark, an economy was vulnerable if its financial net worth (VaR) was less than -10.00, and an economy was non-vulnerable if its financial net worth was greater than -10.00.[133] However, this benchmark should be used carefully. We recommend using it in a similar way as applied in the fourth step of our fiscal vulnerability selection procedure (Figure 5.2, Chapter 5). For example, if an economy is identified as vulnerable using the first three steps of our fiscal vulnerability selection procedure (debt analysis), then compare its financial net worth (VaR) with our benchmark of -10.00. If the financial net worth of this economy is less than -10.00, then categorise this economy as vulnerable. In this manner, an economy is considered vulnerable after incorporating public investment in the public debt analysis, as suggested in the existing literature (Abelson, 2012; Gruber, 2016; Makin & Pearce, 2016; Mellor, 1996). Conversely, if the financial net worth of an economy is greater than -10.00, then categorise this economy as non-vulnerable. For example, in our case, this included Argentina, the Dominican Republic, Finland, Indonesia, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, South Africa, South Korea, Thailand and Turkey. Conversely, 24 economies were non-vulnerable because their financial net worth (VaR) was either positive or greater than -10.00.[134] Comparing these results with the results of our proposed fiscal vulnerability selection approach indicated that 34 economies were correctly identified and the remaining 19 economies were incorrectly identified.[135]

[133] Contradictory results for a few economies are elaborated at the end of this section.
[134] The 24 non-vulnerable economies were Argentina, Brazil, Bulgaria, Chile, China, the Dominican Republic, Finland, Haiti, Indonesia, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, the Philippines, Romania, the Russian Federation, South Africa, South Korea, Sweden, Thailand, Turkey and Uruguay.
[135] Australia, Austria, Belgium, Canada, Colombia, Denmark, France, Germany, Greece, Honduras, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Pakistan, Portugal, Spain, Switzerland, the UK and the US were correctly identified as vulnerable economies using all approaches. Similarly, Brazil, Bulgaria, Chile, China, Haiti, the Philippines, Romania, the Russian Federation and Uruguay were correctly identified as non-vulnerable economies using the financial net worth approach and our fiscal vulnerability selection criteria. Conversely, Argentina, the Dominican Republic, Finland, Indonesia, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, South Africa, South Korea, Sweden, Thailand and Turkey were incorrectly

We further extended the analysis to the fiscal vulnerability index, where a positive value for a country indicated that this economy was vulnerable to debt crisis. We identified 22 of 53 economies as vulnerable using the results of the fiscal vulnerability index.[136] We compared these results with the results of our proposed fiscal vulnerability selection approach, and 35 economies were correctly identified.[137] Table 6.1 summarises the complete results of all techniques for all economies. This table reveals some controversies between the results of our fiscal vulnerability selection approach and the alternative techniques. For instance, the fiscal vulnerability index identified seven (Austria, Denmark, France, Honduras, Iceland, Mexico and Sweden) of 26 vulnerable economies as non-vulnerable economies. This may be because the fiscal vulnerability index is based on the sample mean, which is sensitive to the inclusion of the sample selection of countries. Theoretically, the public finance variables of each economy in a large sample of developing, emerging and developed economies behave differently (Alesina & Ardagna, 2010). Nonetheless, in the fiscal vulnerability index technique, the public debt is compared with the sample mean, rather than a country-specific fiscal variable, such as fiscal balance. The public debt of these seven economies was less than the sample mean, yet not necessarily unsustainable.[138] Consequently, we recommend that these alternative approaches cannot be applied as standalone approaches to assess the fiscal vulnerability of a large sample. This finding aligns with Égert (2015).

Then, we compared the results of the two alternative approaches with each other. For instance, comparing the results of the fiscal vulnerability index and the financial net worth indicated that the financial net worth results incorrectly identified 11 economies as non-vulnerable (Chile,

identified as non-vulnerable under this approach. Likewise, Costa Rica, Ghana, Poland and Venezuela were incorrectly identified as vulnerable under this approach. Here, an incorrectly identified economy means that either this economy was vulnerable in the financial net worth approach and non-vulnerable in our main approach, or non-vulnerable in the financial net worth approach and vulnerable in our main approach.

[136] A positive value of the fiscal vulnerability index indicates that the debt of the country is higher than the average debt of the countries included in the sample. Belgium, Bulgaria, Canada, Costa Rica, Greece, Haiti, Hungary, India, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Nicaragua, Pakistan, Panama, Poland, Portugal, the UK, Uruguay and the US were identified as vulnerable by the fiscal vulnerability index technique.

[137] Correctly identified: (i) Argentina, Belgium, Greece, Hungary, India, Ireland, Israel, Italy, Japan, the Netherlands, Pakistan, Portugal, the UK and the US as vulnerable; (ii) Brazil, Canada, Chile, China, the Dominican Republic, Finland, Ghana, Indonesia, Norway, Paraguay, Peru, the Philippines, Romania, the Russian Federation, South Africa, South Korea, Thailand, Turkey and Venezuela as non-vulnerable. Incorrectly identified: (i) Australia, Austria, Colombia, Denmark, France, Germany, Honduras, Iceland, Mexico, Spain, Sweden, and Switzerland as non-vulnerable; (ii) Bulgaria, Costa Rica, Haiti, New Zealand, Nicaragua, Panama, Poland and Uruguay as vulnerable.

[138] If the fiscal vulnerability index of a country is negative, the country is vulnerable under this technique (as a standalone technique). However, this negative value of the fiscal vulnerability index only indicates that the public debt of the country is less than the sample mean of public debt. Therefore, this technique (as a standalone technique) cannot be exclusively used for fiscal vulnerability analysis.

China, Finland, Haiti, India, New Zealand, Nicaragua, the Russian Federation, Sweden, Thailand and Turkey).[139] The financial net worth (VaR) of these economies was as follows: Chile (-0.19), China (-1.87), Finland (29.22), Haiti (-6.75), India (-9.63), New Zealand (5.53), Nicaragua (-0.17), the Russian Federation (-1.21), Sweden (-6.18), Thailand (-2.32) and Turkey (-1.51). Interestingly, the financial net worth of all these economies was negative, except for Finland and New Zealand, yet greater than our benchmark of -10.00. Following our benchmark of -10.00, all these economies had a financial net worth (VaR) greater than -10.00.[140] These results indicate that our benchmark of -10.00 for financial net worth (VaR) also works for the standalone approach; however, we recommend using it with care.[141]

Next, we also compared our results with the available country ratings conducted by different rating agencies, including S&P, Moody's and Fitch Group. We present the country rating by Moody's, Fitch and S&P in Columns 2 to 4 of Table 6.2, respectively. We also present the country outlook by Moody's, Fitch and S&P in Columns 5 to 7 of Table 6.2, respectively. In contrast with our findings, we observed that Canada, Chile, China, Denmark, Sweden and the UK had a stable outlook.[142] This was mainly because of other factors considered in determining the sovereign credit rating by Fitch Group, Moody's and S&P (Mellios & Paget-Blanc, 2006).[143] Chile and Denmark were highlighted in the forward and moving screening process

[139] Here, financial net worth (VaR and CVaR) is used as a standalone approach.

[140] One possible reason for this controversy could be that the non-financial assets of these economies are not generating sufficient revenue to cover their fiscal expenses. In these cases, negative financial net worth provides enough information to categorise these economies as vulnerable. We also analysed the contradictory results for the case of non-vulnerable economies using the fiscal vulnerability index. In this panel, six (Bulgaria, Costa Rica, the Netherlands, New Zealand, Panama and Uruguay) of 23 non-vulnerable economies were identified as vulnerable using the fiscal vulnerability index. In these cases, the public debt was higher than the sample mean, which does not necessarily indicate that this amount of public debt is unsustainable. Further, we compared these results with the results of all other techniques. In four of these six cases, the results were consistent and non-vulnerable. Consequently, the fiscal vulnerability index was unable to correctly identify these economies. Nonetheless, in the other two cases (Costa Rica and the Netherlands), the fiscal vulnerability index identified both economies as vulnerable and their financial net worth as negative. In this panel, the financial net worth (in the VaR and CVaR framework) of 24 economies was either positive or greater then -10, which could safely identify the non-vulnerable economies because non-financial assets were not included in financial net worth. However, the financial net worth for 10 economies (Australia, Colombia, Costa Rica, Germany, Ghana, Indonesia, the Netherlands, Spain, Switzerland and Venezuela) of 23 non-vulnerable economies was worse than -10. A possible reason for a negative financial net worth worse than -10 is a scenario in which these economies have a higher portion of public investment in non-financial assets than in financial assets. As a result, the returns from these non-financial assets—such as land, property and public enterprises—will be higher. The government is using these returns to pay off the debts, along with debt services. Net public worth (which includes all financial and non-financial assets) is expected to be positive for these economies. However, data on net public worth for all 53 economies were not available. Consequently, we recommend using this approach with care, especially for a large sample.

[141] See discussion on the use of benchmark in Section 6.3 ('Investment Component Analysis of Fiscal Vulnerability').

[142] Only Chile and China had a positive outlook according to S&P and Moody's, respectively.

[143] These other factors included per capita income, inflation rate, real exchange rate, government income and default history.

as vulnerable for the period 1983 and 1990; however, these years were not covered by the above rating agencies.

The discussion above indicates that any of the standalone approaches may not correctly help distinguish between vulnerable and non-vulnerable economies. Therefore, we emphasise the use of our proposed fiscal vulnerability selection procedure (Figure 5.2, Chapter 5) to investigate fiscal vulnerability in economies. By applying our proposed fiscal vulnerability selection procedure, we identified 26 out of 53 economies as vulnerable to debt crisis (see Table 6.1) with different threshold levels where public debt reduced the primary balance.

Table 6.2: Sovereign Credit Rating of the Vulnerable Economies by Moody, Fitch, and S&P

Country	MOODYS RATING	Fitch RATING	S&P RATING	MOODYS OUTLOOK	FITCH OUTLOOK	S&P OUTLOOK
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Austria	Aaa	AAA	AAA	STABLE	STABLE	WATCH NEGATIVE
Belgium	Aa1	AA+	AA	RUR-	NEGATIVE	WATCH NEGATIVE
Canada	Aaa	AAA	AAA	STABLE	STABLE	STABLE
Chile	Aa3	A+	A+	STABLE	STABLE	POSITIVE
China	Aa3	A+	AA-	POSITIVE	STABLE	STABLE
Denmark	Aaa	AAA	AAA	STABLE	STABLE	STABLE
France	Aaa	AAA	AAA	STABLE	STABLE	WATCH NEGATIVE
Greece	Ca	CCC	CC	DEVELOPING	--	NEGATIVE
Hungary	Baa3	BBB-	BBB-	NEGATIVE	NEGATIVE	WATCH NEGATIVE
Iceland	Baa3	BB+	BBB-	NEGATIVE	STABLE	STABLE
India	Baa3	BBB-	BBB-	STABLE	STABLE	STABLE
Ireland	Ba1	BBB+	BBB+	NEGATIVE	NEGATIVE	WATCH NEGATIVE
Israel	A1	A	A+	STABLE	STABLE	STABLE
Italy	A2	A+	A	NEGATIVE	NEGATIVE	WATCH NEGATIVE
Japan	Aa3	AA	AA-	STABLE	NEGATIVE	NEGATIVE
Mexico	Baa1	BBB	BBB	STABLE	STABLE	STABLE
Pakistan	B3	--	B-	STABLE		STABLE
Portugal	Ba2	BBB-	BBB-	NEGATIVE	NEGATIVE	WATCH NEGATIVE
Russia	Baa1	BBB	BBB	STABLE	POSITIVE	STABLE
Sweden	Aaa	AAA	AAA	STABLE	STABLE	STABLE
Thailand	Baa1	BBB	BBB+	STABLE	STABLE	STABLE
Turkey	Ba2	BB+	BB	POSITIVE	POSITIVE	POSITIVE
UK	Aaa	AAA	AAA	STABLE	STABLE	STABLE
United States	Aaa	AAA	AA+	NEGATIVE	STABLE	NEGATIVE
Country	MOODYS RATING	Fitch RATING	S&P RATING	MOODYS OUTLOOK	FITCH OUTLOOK	S&P OUTLOOK
Austria	Aaa	AAA	AAA	STABLE	STABLE	WATCH NEGATIVE

Note: This sovereign credit rating is as of December 2011, since the data used for the vulnerability analysis were available up to December 2011. This ranking was extracted and arranged for the countries identified as vulnerable. AAA and Aaa indicate top notch. Ba1, Ba2, BB, BB+, B-, B2, B3, Ca, CC and CCC indicate junk bonds. A, A-, A+, A1, A2, AA, AA-, AA+, Aa1, Aa3, Baa1, Baa3, BBB, BBB- and BBB+ indicate under observation. 'RUP' indicates 'rating under review'.

6.5 Concluding Remarks

In this chapter, we first classified the sample of 53 economies as vulnerable and non-vulnerable using our fiscal vulnerability selection procedure (Figure 5.2, Chapter 5). In particular, we extended our analysis from the conventional debt approach to the investment approach, and selected countries commonly identified by both approaches as vulnerable to fiscal crisis. For this purpose, we initially used Bohn's (1998) model, which identified 30 economies as vulnerable to debt crisis (the first step of our fiscal vulnerability selection procedure). However, these results could be misleading when the sample for the period of vulnerability is pooled with the non-vulnerability sample, as one sample would nullify the effects of the other. Therefore, studies exclusively relying on this approach are unable to correctly identify some vulnerable economies. To overcome this problem, we systematically extended these estimates to subsample through forward, backward and moving screening processes. These results revealed that 39 (nine additional) of 53 economies were identified as vulnerable to debt crisis at some point in time (second step). It could be argued that these screening processes may not completely avoid the identification problem because some vulnerable periods can be nullified by non-vulnerable periods within the subsample. Therefore, we extended our analysis to country-specific threshold regression, which can endogenously determine the period at which a country is vulnerable to crisis. This analysis provided 11 country-specific thresholds beyond which an economy becomes vulnerable to debt crisis. However, 10 of these economies were also commonly identified as vulnerable during the first and third steps of our fiscal vulnerability selection criteria. The results of the threshold regression identified an additional one economy as vulnerable (third step). Consequently, a total of 40 out of 53 economies were identified as vulnerable. In addition to the econometrics results of the debt analysis, we analysed the financial net worth (VaR and CVaR) of these 40 vulnerable economies to incorporate the investment component of the public sector balance sheet. Finally, we classified a total of 26 economies as vulnerable, in which public debt reduced primary surplus. The results also confirmed that none of the alternative approaches (fiscal vulnerability index and financial net worth/balance sheet approach) may be considered reliable for gauging the fiscal vulnerability of an economy. However, our fiscal vulnerability selection procedure may be an appropriate methodology to investigate fiscal vulnerability alongside a country-specific optimal level of public debt to GDP.

CHAPTER 7. Fiscal Consolidation and Banking Sector Stability

7.1 Introduction

Following methodological notes to fiscal consolidation (Section 5.6, Chapter 5), this chapter first presents the analysis of fiscal consolidation for 53 economies. Fiscal consolidation is defined as a deliberate attempt to reduce government budget deficit (Cimadomo et al., 2014). The existing literature suggests two approaches to analyse fiscal consolidation: narrative techniques (Devries et al., 2011) and quantitative measures using CAPB.[144] Narrative techniques use historical records of governments' intentions to reduce excessive public spending. As a result of the unavailability of source documents of narrative technique (Devries et al., 2011) for all 53 economies, we relied on the CAPB measure to calculate fiscal consolidation episodes. However, we used narrative technique for reconciliation purposes where the source data were available on: (i) convergence and stability programs submitted by the authorities to the European Commission, (ii) OECD and IMF reports, (iii) budget speeches and (iv) central bank reports. Based on this rigorous reconciliation, we decided to use quantitative measures to gauge fiscal consolidation episodes. Using CAPB, we further applied broader and narrow definitions to determine the fiscal consolidation episodes. We defined fiscal consolidation as a period in which CAPB improves by at least 1.5 per cent of GDP in a year, or improves by at least one per cent of GDP per year in a period of two consecutive years (Ardagna, 2009). Using this definition, we defined fiscal consolidation episodes for all 53 economies.

We then used these identified episodes in the banking stability analysis. For this purpose, we followed the transmission mechanism of fiscal consolidation and banking stability (Section 3.3,

[144] See Alesina and Ardagna (2010), Alesina and Perotti (1995) and Ardagna (2009) for further details.

Chapter 3) and empirical strategy of measuring the influence of fiscal consolidation on banking stability (Section 5.7, Chapter 5). In particular, we applied Equation 5.7.1 (Section 5.7, Chapter 5) on three different panels for: (i) all economies, (ii) vulnerable economies and (iii) non-vulnerable economies. This analysis indicated that fiscal consolidation improves capital adequacy ratios, particularly for vulnerable economies. The remainder of this chapter is organised as follows. Section 7.2 provides the analysis of fiscal consolidation for the 53 economies. Section 7.3 discusses the role of fiscal consolidation in the financial stability of vulnerable and non-vulnerable economies. Section 7.4 concludes the chapter.

7.2 Fiscal Consolidation Analysis

In this section, we calculate fiscal consolidation episodes to analyse their role in banking sector stability. We determined the fiscal consolidation episodes from 1990 to 2017 because data on banking stability were available from 1990 onwards. We used these fiscal consolidation episodes in the banking stability analysis. To calculate fiscal consolidation episodes, we required CAPB. We calculated CAPB from 1988 to 2017 for all 53 economies using Hodrick and Prescott's (1997) filter and econometric techniques (Section 5.6, Chapter 5). We compared these CAPB with the results of the narrative technique (Devries et al., 2011). Fiscal consolidation episodes measured through narrative technique were available for the selected countries up to 2007 in Devries et al. (2011). In this comparison, we compared the fiscal consolidation episodes (calculated using Hodrick and Prescott's [1997] filter and econometric techniques] with the episodes of narrative technique. This comparison indicated that fiscal consolidation episodes calculated using Hodrick and Prescott's (1997) filter were more consistent with the fiscal consolidation episodes of the narrative technique (Devries et al., 2011). This narrative technique is sometimes known as a descriptive approach or narrative approach. Based on the results from the comparison, we used cyclical components measured through Hodrick and Prescott (1997) for the rest of the analysis.

We used broader and narrow approaches to calculate fiscal consolidation episodes. Using the values of CAPB measured using Hodrick and Prescott (1997), we calculated fiscal consolidation episodes through a broader approach and a narrow approach. In the broader approach, we analysed the changes in CAPB by taking the first and second differences of CAPB. If the first or second difference of CAPB was positive for a specific time, we classified that period as the fiscal consolidation episode. In the narrow approach, a fiscal consolidation episode was a period in which the CAPB improved by at least 1.5 per cent of GDP in a year,

or a period of two consecutive years in which the CAPB improved by at least one per cent of GDP per year. We compared these periods of fiscal consolidation episodes (under the broader approach) for some specific countries with the fiscal consolidation episodes measured through narrative technique (Devries et al., 2011). For this purpose, we considered the Australian case where data for the narrative technique were available. These source data included: (i) convergence and stability programs submitted by the authorities to the European Commission, (ii) OECD and IMF reports, (iii) budget speeches and (iv) central bank reports. Table F1 (Appendix F) provides the first and second differences of CAPB for the period from 1986 to 2015 for the case of Australia. We found 14 episodes of fiscal consolidation from 1988 to 2015 where the first or second difference of CAPB was positive.

We compared these episodes with the fiscal consolidation episodes defined under the narrative technique proposed by Devries et al. (2011). Interestingly, our broader approach identified all the episodes identified under the narrative technique. However, we could not compare fiscal consolidation episodes from 2008 onwards because Devries et al. (2011) only provided fiscal consolidation episodes until 2007. Contradictory findings were observed in 1989, 1992, 1993, 2002, 2004 and 2007, where there was a positive change in the CAPB by 7.61, 66.00, 21.78, 11.76, 8.73 and 16.93 per cent, respectively. The narrative technique did not identify these years as an episode of fiscal consolidation. A possible explanation for the contradictory result in 1993 is that the positive change of 21.78 per cent is where the CAPB changes from -63.46 per cent to -41.68 per cent. However, the rest of the positive changes identified during 1989, 2002, 2004 and 2007 were positive values of CAPB. These findings suggest that our calculated CAPB aligns with the narrative technique, which also considered positive change as an episode without any benchmark. This comparison revealed that both approaches (broader and narrow) can be used to calculate fiscal consolidation episodes. Therefore, we present the results for the financial stability analysis under both approaches.

The intuition behind these approaches is the same when CAPB improves. However, our concern was analysing the role of these episodes for banking stability. Market confidence is not expected to be restored in a fiscal vulnerable economy because of minor positive change in CAPB (Agnello et al., 2015a; Ardagna, 2009; Arezki et al., 2011).[145] The existing literature has also used specific changes in the CAPB (Alesina & Ardagna, 2010; Alesina & Perotti, 1995;

[145] For instance, banks are not expected to rebalance their portfolio if CAPB improves from -63.46 per cent to -41.68 per cent, as occurred in 1993 for the case of Australia.

Ardagna, 2009; Barrios et al., 2010; Mirdala, 2013), instead of using only the first and second positive change in the CAPB. We did not exclusively rely on the broader approach to measure fiscal consolidation episodes because market confidence is not expected to be restored without a constant improvement (Agnello et al., 2015a; Ardagna, 2009). For banking stability analysis, we primarily used the narrow approach to calculate fiscal consolidation episodes, where a fiscal consolidation episode is a period in which the CAPB improves by at least 1.5 per cent of GDP in a year, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year. Using this definition, the fiscal consolidation episodes of all 53 economies are given in Table F2 (Appendix F).[146] However, we used the broader approach as an alternate approach in financial stability analysis.

7.3 Fiscal Consolidation and Banking Sector Stability

This section provides the results and discussion on the influence of fiscal consolidation on banking stability for all 47 economies.[147] We categorise this section into descriptive and panel analysis. In the descriptive analysis section, we discuss the descriptive statistics of the banking and fiscal variables used in the study. In the panel analysis section, we discuss the role of fiscal consolidation for three panels: (i) all economies, (ii) all vulnerable economies and (iii) all non-vulnerable economies.[148]

[146] We further used the fiscal consolidation episodes with a broad and narrow approach in the banking stability analysis. We observed a statistically significant influence of fiscal consolidation episodes (narrow approach) on the banking stability of the selected economies. These results align with the existing literature (Agnello et al., 2015a; Ardagna, 2009; Arezki et al., 2011). Some of these economies were not included in the banking stability analysis because of lack of available banking sector data in the Bankscope database. Costa Rica, the Dominican Republic, Panama, Paraguay and Uruguay were not included in the banking stability analysis because of the lack of available financial statements on their banking sector in the Bankscope database. In Table F3 (Appendix F), we present fiscal consolidation of 54 economies.

[147] As a result of the unavailability of data on banking sectors, we could not carry seven economies from the fiscal vulnerability analysis. These seven economies were Honduras, India, Nicaragua, Paraguay, Poland, Turkey and Uruguay. We included 47 economies in our panel analysis. Additionally, we included Hong Kong in the analysis. As a result, the panel of 47 economies included Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Denmark, the Dominican Republic, Finland, France, Germany, Ghana, Greece, Haiti, Hong Kong, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, New Zealand, Norway, Pakistan, Panama, Peru, the Philippines, Portugal, South Korea, Romania, the Russian Federation, South Africa, Spain, Sweden, Switzerland, Thailand, the UK, the US and Venezuela.

[148] The panel of all economies included 47 economies. The classification of vulnerable and non-vulnerable economies was based on our fiscal vulnerability analysis in Sections 6.2 and 6.3 (Chapter 6). *Twenty-four economies were included in the panel of vulnerable economies:* Australia, Austria, Belgium, Canada, Colombia, Greece, Denmark, France, Germany, Hungary, Iceland, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Pakistan, Portugal, Spain, Sweden, Switzerland, the UK and the US. *Twenty-three economies were included in the panel of non-vulnerable economies:* Argentina, Brazil, Bulgaria, Chile, China, Costa Rica, the Dominican Republic, Finland, Ghana, Haiti, Hong Kong, Indonesia, New Zealand, Norway, Panama, Peru, the Philippines, South Korea, Romania, the Russian Federation, South Africa, Thailand and Venezuela.

7.3.1 Descriptive Analysis

We provide the summary statistics for all banking and fiscal variables for all 47 economies in Table 7.1. We considered 739 banks in our analysis. We further categorised this table into three subsamples: (i) first sample with all 47 economies, (ii) second sample with vulnerable economies and (iii) third sample with non-vulnerable economies. We considered bank-specific banking variables to analyse the role of fiscal consolidation on banking stability. We observed that the Tier-2 ratio (M = 16.65, SD = 86.45) was slightly higher than the Tier-1 (M = 14.57, SD = 82.79) in the full sample of Table 7.1. We found substantial variation in both measures of banking stability. To analyse the source of variation, we further investigated the variation between the banks and within the banks.[149] In both cases, we observed higher variation for the case of between banks than within banks. Banks have different capital structures, including equity, retained earnings, other classes of stocks and subordinated bonds (Cimadomo et al., 2014). Along these lines, Mishkin (2000) indicated that banks have different capital structure because of the higher cost of holding capital.[150] Further, the variation between Tier-1 and Tier-2 indicates a slightly higher variation in Tier-2. We then analysed the variation in capital adequacy ratios in the subsamples. We observed a slightly higher variation in Tier-2 for the case of vulnerable economies (M = 13.69, SD = 24.38) than with the non-vulnerable economies (M = 13.27, SD = 18.76). One of the possible reasons for the higher variation in Tier-2 is the other classes of capital, including preferred stocks and subordinated bonds.[151] Further, the minimum and maximum values of both ratios indicate that the banks had invested in different asset classes.[152]

[149] Variation between the banks was calculated across the sample of banks. However, variation within the banks was calculated across the sample period from 1990 to 2016.
[150] Bank managers prefer to hold less capital. In these cases, the amount of bank capital is determined by the bank capital requirements (also see Gropp & Heider, 2010).
[151] Sometimes, it includes revaluation reserves, subordinated term debt, hybrid capital instruments, undisclosed reserves and general loan-loss reserves.
[152] This is the only difference between Tier-1 and Tier-2. As given in Equation 3.3.9 (Section 3.3, Chapter 3), Tier-2 included equity, retained earnings, preferred stock and subordinated bonds. Another possible reason for this variation is risk-weighted assets. As indicated above, banks have different classes of assets, and these assets are subject to change subject to trade-off between risk and return.

Table 7.1: Descriptive Statistics

	Mean	SD	Min	Max	Obs.
All Economies					
Tier-1	14.57	82.79	0.16	499.84	7430
Tier-2	16.65	86.45	0.06	499.84	8180
Size	8.17	2.00	0.75	16.49	11594
Return on Assets	0.91	2.74	-70.72	53.42	11468
Output Gap	-0.67	5.48	-55.63	47.3	18475
Debt to GDP	71.02	35.11	4.10	229.61	16303
Interest Rates	2.62	1.60	-0.22	14.47	16303
CAPB	-0.42	2.77	-13.32	16.41	18475
Vulnerable Economies					
Tier-1	13.69	24.38	0.06	499.84	6779
Tier-2	15.58	23.81	0.16	499.84	7132
Size	8.01	1.91	0.75	15.21	10100
Return on Assets	0.87	2.25	-45.92	53.42	9974
Output Gap	-0.72	2.54	-24.80	28.63	16025
Debt to GDP	74.80	34.26	10.83	229.61	14579
Interest Rates	2.81	1.42	-1.30	11.86	14579
CAPB	-0.79	2.5	-13.32	6.93	16025
Non-vulnerable Economies					
Tier-1	13.27	18.76	0.81	470.1	651
Tier-2	16.73	7.40	1.48	93.00	1048
Size	9.15	2.31	1.22	16.49	1494
Return on Assets	1.16	4.89	-70.72	32.53	1494
Output Gap	-0.28	13.58	-55.63	47.30	2450
Debt to GDP	39.08	24.30	4.10	164.97	1724
Interest Rates	1.02	2.02	-0.26	14.47	1724
CAPB	2.04	3.08	-6.67	16.41	2450

Note: Size indicates the log of total assets of the individual banks. Return on assets was calculated as the return on average assets of the individual bank. Average assets were calculated by taking the average of the beginning and ending assets. The value of beginning assets was the book value of assets on the balance sheet of the last year. Debt was the public debt to GDP. Interest rates were the long-term interest rates. CAPB indicates the cyclically adjusted primary balance.

Next, we found that the size (log of total assets) of all the banks included in the sample was less volatile (M = 8.17, SD = 2.00) because of the lower variation within the banks (M = 8.17, SD = 0.58). A possible explanation for this is the portion of fixed assets in the total assets.[153] In contrast, the variation of total assets between the banks (M = 8.40, SD = 1.49) was slightly higher than the variation of total assets within the banks. This variation arose because some banks have higher volatile assets if they have invested in financial assets. Further, the life of the banks is also expected to have a significant influence on the variation of total assets between the banks. Moreover, new banks are expected to have higher variation in their total assets than older banks.

Next, we analysed the return on assets, which is calculated as the return on average assets. Return on assets was comparatively stable for all 739 banks of all economies (M = 0.91, SD = 2.74). However, the variation within the banks (M = 0.91, SD = 2.31) was slightly higher than the variation between the banks (M = 0.91, SD = 1.49). This suggests that the banks had been changing their corporate strategies over the sample period because of internal and external factors. The overall minimum value indicated the period of losses (net losses after interest and tax). Conversely, banks had return on assets up to 53.42. Higher profits are expected to be helpful during a period of fiscal consolidation. Banks can easily investment in government securities without worrying about the lower return.

Turning now to the fiscal variables, the last three variables were country-wise variables; therefore, the variation within the country indicated the overall variation. Similarly, the maximum and minimum values within the country represented the overall values. Among these variables, the public debt to GDP ratio (M = 71.02, SD = 35.11) provided useful information about the average public debt over the period for all the economies. The higher variation was within the countries, which was mainly attributable to the episodes of fiscal consolidation. There was no substantial variation in the rest of the statistics. We extended our analysis to the second subsample. Further, the public debt to GDP ratio (M = 74.80, SD = 34.26) provided useful information about the average public debt over the period, which was higher than the panel of non-vulnerable economies (M = 39.08, SD = 24.30).

[153] Total assets are broadly categorised into fixed and current assets. Fixed assets normally remain fixed over the period within the banks. This variation is within the banks; thus, it is expected that the proportion of fixed assets in the total assets of banks is higher. However, all these assets are not included in the risk-weighted assets used for capital adequacy ratios. These risk-weighted assets are defined by the Basel Accords.

7.3.2 Panel Analysis

To analyse the effect of fiscal consolidation on the banking stability of all 47 economies, we categorised the economies into vulnerable and non-vulnerable based on our fiscal vulnerability analysis (Sections 6.2 and 6.3, Chapter 6). We considered three panels: (i) all economies, (ii) all vulnerable economies and (iii) all non-vulnerable economies. We report the results of our baseline regressions (Equation 5.7.1, Section 5.7, Chapter 5) using Roodman collapse for all three cases in Table 7.2. The first row in the panel of all economies indicates the results of Equation 5.7.1 (Section 5.7, Chapter 5) for the case where Tier-1 was the banking stability variable (dependent variable). The results for Tier-2 are reported in the second row of the panel for all economies. We report the estimated coefficients corresponding to the fiscal consolidation for all three panels in Column 2 of Table 7.2. We report the estimated coefficients for all other independent variables in the subsequent columns.

Table 7.2: Role of Fiscal Consolidation in Banking Stability – Vulnerable and Non-Vulnerable Economies

Panel	CAR	FC	Total Assets	ROA	Output Gap	Debt to GDP	Interest rates	Constant	Obs.
(1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
All Economies	Tier-1	0.36**	-0.41**	-1.92**	-0.11	-0.00	-0.176	6.33**	6371
	Tier-2	0.28	-0.28	-2.27*	0.015	-0.00	-0.166	4.85	6978
Vulnerable Economies	Tier-1	0.58**	-0.45**	-2.27**	-0.02	0.00	-0.20	6.51**	5879
	Tier-2	0.55**	-0.5**	-2.84*	0.01	-0.01	-0.27	7.725**	5739
Non-vulnerable Economies	Tier-1	-0.11	-0.40	0.30	-0.22	-0.01	-0.01	16.44	579
	Tier-2	-0.08	-1.48	0.97***	-0.03	0.04	0.24	27.56***	964

*Note: Roodman collapse results of Tier-1 and Tier-2 capital regression. Column 2 indicates the capital adequacy ratios. The first and second rows in each panel report the regression results, where Tier-1 and Tier-2 are the dependent variables, respectively. A fiscal consolidation episode is measured as a period in which the CAPB improves by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year (Ardagna, 2009). We labelled this 'FC1' in this section. Alternatively, we used CAPB as a measure of fiscal consolidation. In Column 3, we report the results of the alternate measure. Column 5 indicates the return on assets, which is calculated as the return on average assets of the individual bank. In Column 7, debt is the public debt to GDP. In Column 8, interest rates are the long-term interest rates. *, ** and *** indicate statistical significance at 10, five and one per cent, respectively.*

Using Roodman collapse, we found that the standard capital adequacy ratio, such as Tier-1 ratio, improved by 0.36 percentage points in the presence of fiscal consolidation for the panel of all 47 economies.[154] These results align with the findings in Cimadomo et al. (2014).[155] However, Cimadomo et al. (2014) discussed both possibilities of the banking stability due to fiscal consolidation including demand and supply effects. Focusing on bank balance sheets, institutional investors are expected to increase (decrease) the share of government securities over the total assets if the demand (supply) effect prevails.[156] Our empirical evidence suggests that the demand effect prevails, and institutional investors prefer government securities in their investment portfolio. This results in lower risk-weighted assets because of the increased proportion of government securities. These risk-weighted assets are the denominators of capital adequacy ratios. Therefore, lower risk-weighted assets enhance the capital adequacy ratios of the banking sector. The results of the control variables indicated that small banks and less profitable banks have improved their capital adequacy ratios.[157] Ardagna (2009) claimed that initial fiscal conditions are important in the role of fiscal consolidation.[158]

However, there is no empirical evidence on the role of fiscal consolidation in banking stability considering the initial fiscal stance of any economy. We tested the role of fiscal consolidation in the banking stability of a large sample by considering their initial fiscal conditions. For this purpose, we categorised our large sample of 47 economies into vulnerable and non-vulnerable

[154] These findings align with the existing literature (Agnello et al., 2015a; Ardagna, 2009; Arezki et al., 2011).
[155] Cimadomo et al. (2014) reported a 1.35 percentage point increase in the total capital ratio in response to the episode of fiscal consolidation. However, their sample included 17 industrialised economies for which a dataset constructed by the IMF in Devries et al. (2011) was available. Further, their sample covered 1994 to 2009.
[156] The direct channel works through the demand and supply effects of government securities. Fiscal consolidation decreases the supply of new government bonds—supply effect. At the same time, institutional investors consider fiscal consolidation a structural policy that improves long-term fiscal sustainability. A related lower perceived risk increases the demand for government securities—demand effect.
[157] The results of total assets (δ_{s1} = -0.41, $p < 0.05$) for the case of Tier-1 capital adequacy ratio indicated that some of the banks had more risky assets in their portfolio of total assets. Another possible explanation is that the small banks had different portfolios than the large banks, and had improved their capital adequacy ratio. Similarly, the estimates of return on assets (δ_{s2} = -1.92, $p < 0.05$; δ_{s2} = -2.27, $p > 0.10$) for the case of Tier-1 and Tier-2, respectively, indicated that less profitable banks had improved their capital adequacy ratios. Another possible explanation of these estimates is that return on assets varies against different classes of bank assets. Return on assets includes all four classes of bank assets: (i) the loans extended to firms at any time, (ii) the loans extended to consumers (such as mortgages), (iii) the investment securities at any time *t* and (iv) government securities. In calculating return on assets, all assets are treated equally.
[158] In contrast, it is also relevant to state that fiscal consolidation—in terms of reducing government expenditures—may also decrease aggregate demand and banking sector profitability. Nevertheless, Ardagna (2009) advocated that the consequences of fiscal consolidation largely depend on an economy's initial fiscal stance, and are not severe for fiscally vulnerable economies. He argued the costs of vulnerable economies to be lower than the losses in situations of severe banking and financial crisis. Ardagna also reported a decline in stock market prices during periods of loose fiscal policy, and a rise during periods of substantial fiscal tightening. In other words, these results depend on the initial fiscal position of each country, as well as the type of fiscal consolidation. Similar suggestions were provided in Agnello et al. (2015b) that large austerity plans are associated with promoting banking reforms in vulnerable economies.

economies. Among these 47 economies, we classified 24 economies as vulnerable and 23 economies as non-vulnerable.[159] Our results suggest that the standard capital adequacy ratio improves significantly in response to fiscal consolidation episodes in a panel of vulnerable economies, compared with a panel of non-vulnerable economies.[160] This finding aligns with the existing literature (Agnello et al., 2015b; Ardagna, 2009; Arezki et al., 2011; Cimadomo et al., 2014). Overall, the demand effect prevails because of fiscal consolidation.

In vulnerable economies, Tier-1 and Tier-2 improved with 0.58 and 0.55 percentage points, respectively, because of fiscal consolidation.[161] We observed a substantial improvement in capital adequacy ratios against fiscal consolidation for the panel of vulnerable economies, compared with the panel of all economies. Among the capital adequacy ratios, we observed a higher improvement in Tier-2, which included equity, retained earnings, cumulative perpetual preferred stock and subordinated debt. These results indicated that investors of other securities—including preferred stock and subordinated debts—are more concerned with sovereign risk, especially in vulnerable economies. However, investors of all securities holders in vulnerable economies react more to the fiscal consolidation episodes.[162]

Investors in vulnerable economies are very concerned about changes in the risks associated with government securities. Therefore, the demand effect prevails, and empirical evidence supports this effect by indicating higher capital adequacy ratios. Investors know that financial reforms are more likely to occur when the general economic conditions of an economy deteriorate. In this context, sovereign debt restructuring in a vulnerable economy also favours financial reports (see Agnello et al., 2015a). Vulnerable economies have more threat of sovereign credit rating downgrades and the widening of spreads for sovereign bonds and credit default swaps. One possible reason of this threat is the holding of foreign sovereign debt by

[159] *Twenty-four vulnerable economies:* Australia, Austria, Belgium, Canada, Colombia, Greece, Denmark, France, Germany, Hungary, Iceland, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Pakistan, Portugal, Spain, Sweden, Switzerland, the UK and the US. *Twenty-three non-vulnerable economies:* Argentina, Brazil, Bulgaria, Chile, China, Costa Rica, the Dominican Republic, Finland, Ghana, Haiti, Hong Kong, Indonesia, New Zealand, Norway, Panama, Peru, the Philippines, South Korea, Romania, the Russian Federation, South Africa, Thailand and Venezuela.

[160] See Section 2 of Table 7.2 for these results. These results also justify the crisis-induced reform hypothesis, as empirically tested in Agnello et al. (2015a). For more discussion, see Drazen and Grilli (1993).

[161] This indicates that the banks of the vulnerable economies shifted their portfolio from private securities to government securities because of fiscal consolidation episodes. Government securities are less risky; thus, the Basel Accords allot them less weight. Considering this risk-weighting, the capital adequacy ratio improves.

[162] These findings align with Arezki et al. (2011). For instance, they observed a higher systematic spillover effect in the case of Greece among the Eurozone countries. They linked this aspect with the sovereign rating, while our classification is based on the empirical investigation of fiscal vulnerability. This further suggests that investors are very concerned about the risk associated with government securities.

domestic banks (Arezki et al., 2011). Therefore, domestic banks and investors in vulnerable economies are expected to react drastically to episodes of fiscal consolidation. The empirical evidence from the panel of 24 vulnerable economies confirmed this situation, since the standard capital adequacy ratios, including Tier-1 and Tier-2, improved with 0.58 and 0.55 percentage points, respectively.[163] The estimates of total assets (δ_{s1} = -0.50, $p < 0.05$) and return on assets (δ_{s2} = -2.84, $p < 0.1$) for Tier-2 also indicated that smaller and less profitable banks in vulnerable economies improved their capital adequacy ratios as a result of the fiscal consolidation episodes. However, the effect on the small banks was only obvious when Tier-2 was used as a capital adequacy ratio. One possible reason for this is that large banks invested more in equity shares because they can afford the risk to some extent. Conversely, small banks in vulnerable economies invest more in less risky securities, including cumulative perpetual preferred stock and subordinated debt, in addition to their equity stock and retained earnings.[164]

We then extended our analysis for the panel of 23 non-vulnerable economies.[165] The results of this analysis indicated that none of the capital adequacy ratios was statistically significant against the fiscal consolidation episodes. These results align with the existing literature (Agnello et al., 2015a, 2015b; Arezki et al., 2011), since the fiscal consolidation episodes are considered significantly different by the investors of non-vulnerable economies. They are not as concerned about the risks associated with government securities. One possible explanation for this situation is that this risk is not visible in their economies. These investors know that financial reforms because of fiscal consolidation are unlikely to occur when the fiscal conditions of an economy are good. Examining the other banking variables, the return on assets is significantly positive, which makes sense in the case of non-vulnerable economies. For instance, investors in non-vulnerable economies make changes to their portfolio. Institutional investors prefer to shift towards private securities. The return of these securities is high compared with government securities. Therefore, the return on assets improves, which does not incorporate the risk associated with these securities. Conversely, the banking stability ratios incorporate the associated risks. Therefore, the risk-weighted assets of these banks improve significantly, which is the key component (denominator) of these capital adequacy ratios. In

[163] These results are for fiscal consolidation using the narrow approach, where a fiscal consolidation episode is defined as a period in which the CAPB improves by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year.
[164] The rest of the control variables were not significant. However, the behaviour of these variables changed in the case of the non-vulnerable panel.
[165] Argentina, Brazil, Bulgaria, Chile, China, Costa Rica, the Dominican Republic, Finland, Ghana, Haiti, Hong Kong, Indonesia, New Zealand, Norway, Panama, Peru, the Philippines, South Korea, Romania, the Russian Federation, South Africa, Thailand and Venezuela.

summary, the results of the vulnerable and non-vulnerable panels suggest that the standard capital adequacy ratio improves significantly in vulnerable economies, compared with non-vulnerable economies.

7.4 Concluding Remarks

In this chapter, we conducted a fiscal consolidation analysis and examined its role in the financial stability of the banking sector of 53 economies. Based on a rigorous reconciliation, we finally decided to apply a quantitative approach of fiscal consolidation using CAPB. In this quantitative analysis, we calculated fiscal consolidation episodes, where CAPB improves by at least 1.5 per cent of GDP in a year, or by at least one per cent of GDP per year in a period of two consecutive years (Ardagna, 2009). We calculated 202 fiscal consolidation episodes in our selected economies. We used these episodes in our next panel analysis. Applying Arellano–Bond dynamic panel data estimation, Roodman collapse and straightforward fixed effects, our results of panel analysis suggested that fiscal consolidation improved banking stability by 0.36 percentage points across the full sample of selected countries. These findings were followed by a 0.58 percentage point improvement in banking stability (Tier-1) in the subsample of vulnerable economies. Conversely, the results of the fiscal consolidation were not significant (statistically) for the case of the non-vulnerable economies. These findings suggest that fiscal consolidation improves capital adequacy ratios, particularly in vulnerable economies.

CHAPTER 8. Fiscal Consolidation and Financial Sector Stability: Aggregated and Disaggregated Analysis

8.1 Introduction

In continuation of Chapter 7, this chapter extends the role of fiscal consolidation in financial sector stability by conducting aggregated and disaggregated analysis. The purpose of this chapter is to provide further insight to fiscal consolidation with respect to banking and financial sector stability. Fiscal vulnerability increases corporate borrowing costs, which behave differently in different economies.[166] Therefore, a country-specific analysis adds further value and should be useful for policy makers. We divided the country-specific analysis into aggregated and disaggregated analyses. In the aggregated analysis, we used TGE aggregated annual data from 1960 to 2017 for the capital adequacy ratio, z-scores and stock market capitalisation. In the disaggregated analysis, we used bank-wise disaggregated data for the capital adequacy ratio, including Tier-1 and Tier-2. We included all the banks for which these data were available from the Bankscope database.[167] This chapter also presents the implications of the aggregated and disaggregated analysis. Overall, the results of the aggregated and disaggregated analyses are consistent with our panel analysis. The remainder of this chapter is organised as follows. Section 8.2 discusses the aggregated analysis of the role of fiscal consolidation in financial sector stability, while Section 8.3 presents the disaggregated analysis of the role of fiscal consolidation in financial sector stability. Section 8.4 presents the

[166] See Agca and Celasum (2012) for further details on the linkage between fiscal defaults and corporate borrowing costs.

[167] Table C2 (Appendix C, Chapter 4) provides the details of all banks included in our disaggregated analysis. These were the maximum number of banks in the Bankscope database on 14 October 2014 for which the capital adequacy ratios were available. We extracted these capital adequacy ratios from the capitalisation section of Summary Analytics of Bankscope database.

implications of the aggregated and disaggregated analysis, while Section 8.5 concludes this chapter.

8.2 Aggregated Analysis

We conducted the country-specific analysis by using aggregated and disaggregated data on the banking and financial variables. We first used TGE annual data from 1960 to 2017 for the capital adequacy ratio, z-scores and stock market capitalisation. TGE database aggregates capital adequacy ratios and z-scores by using underlying bank-by-bank unconsolidated data from the Bankscope database. Due to the use of aggregated data, we call next subsection as the aggregated analysis on the impact of fiscal consolidation on the banking stability. We included all vulnerable and non-vulnerable economies in our aggregated analysis because the aggregated data were available for all 53 economies.[168] We used Equation 5.7.2 (Section 5.7, Chapter 5) for the aggregated analysis, and report the results in Table G1 (Appendix G). We used two measures of fiscal consolidation (FC-I and FC-II) in the aggregate analysis. In Table G1 (Appendix G), Column 2 represents the fiscal consolidation measures, where fiscal consolidation is measured as a period in which the CAPB improved by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improved by at least one per cent of GDP per year (Ardagna, 2009). We labelled this strictly defined episode 'FC-I'. Further, we used the change in CAPB as an alternate measure of fiscal consolidation, and labelled this 'FC-II'. Columns 5 to 7 of Table G1 (Appendix G) present the results of the aggregate analysis using data from TGE database. *TGE_Total_Tier* indicates the banking system regulatory capital to risk-weighted assets, as defined by TGE database. *TGE_Z-score* indicates the z-score as defined by TGE database, and *TGE_SMC* indicates the stock market capitalisation as defined by TGE database.

We found mixed evidence from the aggregated analysis of all 53 economies. We observed that fiscal consolidation enhanced the financial stability of 18 economies.[169] These results are

[168] We used the vulnerable and non-vulnerable classification from the fiscal vulnerability analysis (see Section 6.3) where 26 of 53 economies were vulnerable.

[169] These 18 economies included Belgium (γ_{a1} = 1.93, p > .05; γ_{a2} = 0.64, p > .01), China (γ_{a1s} = 62.34, p > .05), Colombia (γ_{a1} = 2.44, p > .10), Costa Rica (γ_{a1s} = 1.82, p > .05), Denmark (γ_{a1z} = -1.27, p > .10), Finland (γ_{a1z} = -4.94, p > .01), France (γ_{a1} = 0.47, p > .05), Germany (γ_{a2z} = -2.18, p > .01), Greece (γ_{a2s} = 16.94, p > .05), Iceland (γ_{a2} = 0.36, p > .05), India (γ_{a1s} = 89.53, p > .01), Ireland (γ_{a1} = 1.67, p > .05; γ_{a2} = 0.10, p > .10), Mexico (γ_{a2z} = -1.87, p > .05), Peru (γ_{a1s} = 12.87, p > .10), Romania (γ_{a2s} = 3.53, p > .10), Spain (γ_{a1s} = 29.85, p > .05; γ_{a2s} = 5.46, p > .05), Uruguay (γ_{a2z} = -0.15, p > .10) and the US (γ_{a1} = 0.93, p > .05; γ_{a2} = 0.19, p > .05; γ_{a2s} = 5.28, p > .10). γ_{a1}, γ_{a2}, γ_{a1z}, γ_{a2z}, γ_{a1s} and γ_{a2s} indicate fiscal consolidation 1 using total tier, fiscal consolidation 2 using total tier, fiscal consolidation 1 using z-score, fiscal consolidation 2 using z-score, fiscal consolidation 1 using stock market capitalisation and fiscal consolidation 2 using stock market capitalisation, respectively.

consistent with Cimadomo et al. (2014), Panetta et al. (2011), Agca and Celasun (2012), Akitoby and Stratmann (2008) and Gennaioli et al. (2014). Most of these economies were European, and Panetta et al. (2011) specifically stated that investors' concerns about sovereign risk have increased in the Eurozone. As a result, bank funding costs have risen abruptly through some channels.[170] The results of all three measures indicated that the assets channel holdings of government securities were the most relevant to our first measure of risk-weighted regulatory capital. Further, this channel transmits into bank balance sheets and profitability. Considering all this, the investors in these economies are highly concerned with sovereign risk. Our results indicate that positive fiscal signals have increased the demand for government securities in Belgium, Colombia, France, Ireland and the US, and demand effect prevails in these economies. For the rest of the above economies, fiscal consolidation enhanced banks' profitability and balance sheet size because we observed a significant influence of fiscal consolidation on the z-score and stock market capitalisation. For the case of Germany, the next section will discuss some special issues and the concerns of Wolfgang Schauble, the German Finance Minister (see Section 8.3, disaggregate analysis).

Conversely, we observed that fiscal consolidation deteriorated the financial stability of 11 economies.[171] Recently, the financial regulatory authorities of these economies were seriously concerned about the capital requirements. For example, the APRA and Otoritas Jasa Keuangan (OJK) have frequently raised the capital requirements for the cases of Australia and Indonesia, respectively.[172] Very little is discussed in the existing literature about this negative effect. The key possible reasons for the negative effect include the prevailing supply effect and investment in foreign financial securities. Investors of these economies are sometimes interested in investing their money in elsewhere. As a result, governments face difficulty in issuing new bonds to gain new debts. For example, Argentina faced this situation alongside capital flight (Cuddington, 1986). We could not find any previous studies examining this issue except Ardagna (2009), Agnello et al. (2015a, 2015b) and Arezki et al. (2011). According to Ardagna (2009), the initial fiscal stance of an economy is important in terms of fiscal consolidation for

[170] These channels included: (i) an asset channel, which indicated that the holding of sovereign debt and their derivative positions have direct effects on returns and banking size; (ii) lessening in the value of collateral; (iii) sovereign downgrades tend to lower the rating of domestic banks; and (iv) reduced benefits from explicit and implicit government guarantees.

[171] These 11 economies included Australia (γ_{a1} = -0.95, p > .05), Austria (γ_{a1} = -1.54, p > .05), the Dominican Republic (γ_{a1} = -2.52, p > .10), Ghana (γ_{a1z} = 1.13, p > .10), Hungary (γ_{a1} = -1.09, p > .05), Indonesia (γ_{a2} = -0.93, p > .10), Norway (γ_{a1} = -1.07, p > .10; γ_{a1s} = -21.38, p > .05; γ_{a2s} = -2.72, p > .10), Panama (γ_{a1} = -2.82, p > .05; γ_{a2} = -0.56, p > .05), Portugal (γ_{a2} = -0.26, p > .05), Turkey (γ_{a1} = -5.43, p > .05; γ_{a1s} = 8.90, p > .10) and the UK (γ_{a1} = -1.24, p > .01).

[172] See Sipahutar and Suhartono (2018) for further details on the capital requirements in Indonesia.

financial stability. This strand of literature reveals that institutional investors in vulnerable economies are expected to behave differently to institutional investors in non-vulnerable economies. Further, the effect of fiscal consolidation also depends on the demand and supply effect.[173] We observed that the above-mentioned economies included vulnerable and non-vulnerable economies. Following Ardagna (2009), we extended our aggregate analysis to incorporate the initial fiscal stance of all 53 economies, which further enabled us to achieve our fifth research objective.[174]

For this purpose, we analysed the effect of fiscal consolidation on the financial stability of vulnerable and non-vulnerable economies separately. We report these results in Columns 3 and 4 of Table G1 (Appendix G). These results of the aggregated analysis revealed mixed evidence on the role of fiscal consolidation on financial stability. We observed a positive and statistically significant effect of fiscal consolidation for 12 of 26 vulnerable economies.[175] These results align with the literature.[176] For the first alternative measure of financial stability (banking system regulatory capital to risk-weighted assets), the demand side prevailed for the 12 vulnerable economies. This indicates that institutional investors are very concerned about the risk associated with government bonds. Sovereign debt restructuring favours financial stability in these economies, as indicated in Angellano et al. (2015a). Nonetheless, we observed that fiscal consolidation worsened the financial stability in the five vulnerable economies of Australia (γ_{a1} = -0.95, $p > .05$), Austria (γ_{a1} = -1.54, $p > .05$), Hungary (γ_{a1} = -1.09, $p > .05$), Portugal (γ_{a2} = -0.26, $p > .05$) and the UK (γ_{a1} = -1.24, $p > .01$).[177] Holding of government securities by foreign investors is one possible factor deteriorating risk-weighted regulatory capital. Further, this negative effect may be due to the supple effect.[178]

[173] See Section 3.3 (Chapter 3) for further details on the demand and supply effect.
[174] See Section 1.6 (Chapter 1).
[175] These economies include Belgium (γ_{a1} = 1.93, $p > .05$; γ_{a2} = 0.64, $p > .01$), Colombia (γ_{a1} = 2.44, $p > .10$), Denmark (γ_{a1z} = -1.27, $p > .10$), France (γ_{a1} = 0.47, $p > .05$), Germany (γ_{a2z} = -2.18, $p > .01$), Greece (γ_{a2s} = 16.94, $p > .05$), Iceland (γ_{a2} = 0.36, $p > .05$), India (γ_{a1s} = 89.53, $p > .01$), Ireland (γ_{a1} = 1.67, $p > .05$; γ_{a2} = 0.10, $p > .10$), Mexico (γ_{a2z} = -1.87, $p > .05$), Spain (γ_{a1s} = 29.85, $p > .05$; γ_{a2s} = 5.46, $p > .05$) and the US (γ_{a1} = 0.93, $p > .05$; γ_{a2} = 0.19, $p > .05$; γ_{a2s} = 5.28, $p > .10$).
[176] For example, see Agnello et al. (2015b), Ardagna (2009), Arezki et al. (2011), Agca and Celasun (2012), Akitoby and Stratmann (2008), Cimadomo et al. (2014), Panetta et al. (2011) and Gennaioli et al. (2014).
[177] Interestingly, we noted that this effect was observed only for the capital adequacy ratio measure. We did not observe this effect for the other alternative measures (z-score and stock market capitalisation). This could be because of the aggregation procedure. We could not further explore the aggregation procedure because TGE database did not provide the details of the banks included in the aggregation process.
[178] For instance, we observed only one fiscal consolidation episode (narrow approach, FC-I) for the case of the UK.

We then extended our aggregated analysis to the economies categorised as non-vulnerable in our fiscal vulnerability analysis (see Section 6.3). In the results of the non-vulnerable economies, we observed that fiscal consolidation deteriorated the financial stability of the six economies of the Dominican Republic (γ_{a1} = -2.52, p > .10), Ghana (γ_{a1z} = 1.13, p > .10), Indonesia (γ_{a2} = -0.93, p > .10), Norway (γ_{a1} = -1.07, p > .10; γ_{a1s} = -21.38, p > .05; γ_{a2s} = -2.72, p > .10), Panama (γ_{a1} = -2.82, p > .05; γ_{a2} = -0.56, p > .05) and Turkey (γ_{a1} = -5.43, p > .05; γ_{a1s} = 8.90, p > .10). Overall, we observed this effect for the case of capital adequacy ratio, followed by the second alternative measure of z-score. Some of this evidence contrasts with the recent changes by financial services authorities.[179] However, these results indicate that the supply side prevails in these six non-vulnerable economies. Considering the initial fiscal conditions of these economies, these results align with the existing literature (Agnello et al., 2015a, 2015b; Arezki et al., 2011) because sovereign debt restructuring is viewed differently in non-vulnerable economies. Their investors are not as concerned about the risk associated with government bonds. Nonetheless, we observed a positive effect of fiscal consolidation in six of 27 non-vulnerable economies: China (γ_{a1s} = 62.34, p > .05), Costa Rica (γ_{a1s} = 1.82, p > .05), Finland (γ_{a1z} = -4.94, p > .01), Peru (γ_{a1s} = 12.87, p > .10), Romania (γ_{a2s} = 3.53, p > .10) and Uruguay (γ_{a2z} = -0.15, p > .10). Interestingly, this effect was not observed in the capital adequacy ratio, except for Finland. This effect was mainly observed in the stock market capitalised. Stock market capitalisation, sometimes known as market value, is the market price of shares multiplied by the outstanding shares of listed domestic firms.[180] Our results suggest that shareholders in China, Costa Rica, Peru and Romania make changes to their portfolio because of sovereign debt restructuring. These results align with Ardagna (2009) and Correa et al. (2014). However, we can further investigate the reasons for this occurrence, particularly when considering capital adequacy and z-score because of their aggregated data.

Overall, we observed one inconsistency when comparing these results with our main results. Our key results indicated that the standard capital adequacy ratio improved significantly in the vulnerable economies, compared with the non-vulnerable economies. In this aggregate analysis, we observed that the capital adequacy ratio deteriorated in five of the vulnerable economies—Australia, Austria, Hungary, Portugal and the UK. As already mentioned above, this could be due to the prevailing supply effect, investment in foreign financial securities and the

[179] See Sipahutar and Suhartono (2018) for further details.
[180] The primary business of some unit trusts, investment funds and companies is to invest in the shares of other listed companies. These institutions were excluded from the list of domestic companies.

aggregation procedure. We could not further explore the aggregation procedure because TGE database did not provide the details of the banks included in the aggregation process. Therefore, we extended our analysis to the bank-wise data extracted from the Bankscope database. We labelled this analysis the 'disaggregated analysis', which is presented in Section 8.3 below.

8.3 Disaggregated Analysis

We present the results on the effect of fiscal consolidation on the banking stability of vulnerable economies in Table G1 (Appendix G).[181] Column 2 presents the results of the fiscal consolidation measures (FC-1 and FC-II). FC-I was measured as a period in which the CAPB improved by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improved by at least one per cent of GDP per year (Ardagna, 2009). Further, we used the change in CAPB as an alternate measure of fiscal consolidation and labelled this FC-II. Columns 3 and 4 present the results of the disaggregated analysis, where *BS_CAR* indicates the capital adequacy ratios using Bankscope data. In particular, Columns 3 and 4 present the results of Equation 5.7.1 (Section 5.7, Chapter 5), with Tier-1 and Tier-2 used as the banking stability variables (dependent variables) against the fiscal consolidation, respectively. We employed the panel data regression models for each country, where the banks acted as a cross-sectional unit for time from 1990 to 2016. In this panel analysis, the number of observations varied from country to country because they depended on the availability of the branch-wise data from the financial statements.[182]

[181] We estimated both fixed-effect panel data models and the GMM method proposed by Arellano and Bond (1991) through Roodman (2009) collapse to analyse the role of fiscal consolidation and banking sector stability. We observed higher variation in time (*T*) and the number of banks (*N*) in our sample for the 28 economies, where the number of banks (*N*) varied from one (Venezuela) to 739 (US). In cases of higher variation between *T* and *N*, it is suggested that, if *T* is large than *N*, the dynamic panel bias becomes insignificant, and a straightforward fixed-effects estimator works better (Roodman, 2009). Further, we used Hausman test (Hausman, 1978) and its results are consistent with the suggestions of Roodman (2009, p. 128). We followed these guidelines in the country-specific analysis of 28 economies. We applied Roodman collapse (collapse function of *xtabond2* in Stata) for the case of France, Japan and the US. We applied Arellano–Bond for the case of Brazil, Germany, Greece, Hungary (Tier-1), Indonesia, Mexico and the UK. We applied the straightforward fixed-effects estimator for the case of Canada, Denmark, France (Tier-2), Hungary (Tier-2), Ireland, Israel, Italy, the Netherlands, New Zealand, Norway, Portugal, South Korea, the Russian Federation, Sweden, Switzerland, Thailand and Venezuela. For the case of France, the numbers of observations were different for Tier-1 and Tier-2. We observed that Roodman collapse worked for Tier-1, since we had data for 32 banks. However, Roodman collapse and Arellano–Bond estimations did not work for Tier-2. Further, we could not apply the Tier-1 model for the case of Portugal because of the unavailability of data. For the case of dynamic models, lagged dependent variables were statistically significant at five per cent.

[182] Depending on the volume of the banking industry and the data management in this industry, the analysis of the US was based on 3,943 observations in the case of Tier-2 and 3,126 observations in the case of the Tier-1. Conversely, only eight observations for Tier-1 were available for the case of Venezuela.

We found mixed evidence when extending this empirical investigation to the country-specific analysis. We were left with 28 economies for the country-specific analysis.[183] Among these 28 economies, 19 were vulnerable and the remaining nine were non-vulnerable.[184] In almost 50 per cent of cases, there was a significant effect of fiscal consolation on banking sector stability. This significant effect was positive for all vulnerable economies.[185] However, there was mixed evidence of this significant effect if the country was categorised as non-vulnerable in our fiscal vulnerability analysis.[186] Table G1 (Appendix G) indicates that there was a significant positive effect of fiscal consolidation on capital adequacy ratios for six vulnerable economies (Australia, Ireland, Japan, Portugal, Spain and the US).[187] We observed a few fiscal consolidation episodes

[183] Out of 47 economies, we carried 28 economies in the country-specific analysis because of the lack of observations on the capital adequacy ratios. We attempted to gain the maximum data on capital adequacy ratios using Bloomberg (Bloomberg, 2016). However, we managed to gain the capital adequacy ratios of only one bank in 19 cases. Most of the data on capital adequacy ratios included the period of 25 years (1990 to 2014). Therefore, we dropped the countries with a number of observations lower than 25 to call it a panel of at least two banks. As a result, we dropped 19 economies from the country-specific analysis: Argentina, Austria, Belgium, Bulgaria, Chile, China, Colombia, Costa Rica, the Dominican Republic, Finland, Ghana, Haiti, Iceland, Pakistan, Panama, Peru, the Philippines, Romania and South Africa. We included the remaining 28 economies in the country-specific analysis: Australia, Brazil, Canada, Denmark, France, Germany, Greece, Hong Kong, Hungary, Indonesia, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, New Zealand, Norway, Portugal, South Korea, the Russian Federation, Spain, Sweden, Switzerland, Thailand, the UK, the US and Venezuela.

[184] This classification of economies was based on our fiscal vulnerability analysis. In the country-specific analysis, the 19 vulnerable economies were Australia, Canada, Denmark, France, Greece, Germany, Hungary, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Portugal, Spain, Sweden, Switzerland, the UK and the US. In the country-specific analysis, the nine non-vulnerable economies were Brazil, Hong Kong, Indonesia, New Zealand, Norway, South Korea, the Russian Federation, Thailand and Venezuela.

[185] These economies included Australia, Ireland, Japan, Portugal, Spain, the US and Venezuela.

[186] These vulnerable and non-vulnerable cases are discussed below.

[187] For the case of Australia, our results (see Table F1, Appendix F) indicated that fiscal consolidation policy improved the capital adequacy ratios of the Australian banking sector, which is consistent with the existing literature (Ardagna, 2009; Cimadomo et al., 2014). Our base specification included lagged dependent variables because of the adoptive expectation of investors. In this case, the standard fixed effects were subject to Nickell biases, as reported in Cimadomo et al. (2014); therefore, the Arellano–Bond estimates were used for the analysis. The overall finding for the case of Australia was based on the results from the Tier-2 capital ratio, which is a comprehensive measure because it also includes preferred stock, subordinated debt and general loan-loss reserves (Bank for International Settlement, 2017). This will increase the banking stability of the Australian economy, which is required in the current scenario. This aspect aligns with the Australian corporate media over the last two years (Christopher, 2016; James, 2015; Mike, 2016; Sue, 2015). Similarly, Australian regulators are reappraising their views on the acceptable level and forms of the capital (Gorajek & Turner, 2010). For robustness purposes, we estimated the effect of CAPB on the banking stability in a separate panel data analysis using Equation 5.7.1 (Section 5.7, Chapter 5), with a change in CAPB used as the fiscal consolidation. The coefficients from both measures (γ_3 = 0.23 and γ_4 = 0.15) were positive; however, the results against Tier-1 (γ_3 = 0.23) were statistically significant at 10 per cent. The estimate for the case of Tier-2 (γ_4 = 0.15) was also positive. In general, these results are consistent, since there was a significant effect of fiscal consolidation on the Tier-1 ratio. This ratio improved by 0.23 because of a one per cent change in CAPB. These results indicate that fiscal consolidation improves the capital adequacy ratio through changes in the risk-weighted assets. The APRA is closely observing capital adequacy ratios in Australia. These risk-based capital ratios capture different risk profiles of banks and reflect the stability of the sector. Following the guidelines given in the Basel Accords, different loans carry different amounts of risk, which is logical because government securities are less risky than other corporate loans (Bank for International Settlement, 2015). In this framework, the higher value of risk-weighted capital ratios indicates a higher level of banking stability. Both ratios are commonly taken as the most important indicator of banking stability because the higher ratio indicates higher protection against adverse

in the vulnerable economies. For example, there were two episodes each for Australia, Japan and the US.[188] However, the effect of these fiscal consolidation episodes was significant, which aligns with the existing literature (Agnello et al., 2015a, 2015b; Arezki et al., 2011). We also observed that degree of vulnerability was higher in these three economies.[189] We then analysed the remaining three cases of Ireland, Portugal and Spain. For the case of Ireland, our fiscal vulnerability analysis suggested that its degree of vulnerability was higher. Further, the timing of episodes for the case of Ireland was immediately after the short episodes identified in stability analysis.[190] Our fiscal vulnerability analysis (Section 6.2) identified 2010 to 2016 as the short episodes where public debt was expected to reduce the primary balance. Our fiscal consolidation analysis indicated that 2006, 2007, 2011 and 2016 were the years of fiscal consolidation episodes (Table F2, Appendix F). These results of our disaggregated analysis reveal that the timing of fiscal consolidation was expected to have a significant effect on the capital adequacy ratios of Ireland.

Next, we extended this comparison for the case of Portugal. The fiscal consolidation episodes of Portugal included 2006, 2007 and 2011 (Table F2, Appendix F). Our fiscal vulnerability analysis (Section 6.2) identified 2005 to 2007 as the short episode where public debt was expected to reduce the primary balance. These results indicated that the episodes of fiscal consolidation occurred immediately after the periods identified in the stability analysis. Therefore, the timing of fiscal consolidation was expected to have a significant effect because investors of all securities react more to fiscal consolidation episodes during vulnerable periods. For the case of Spain, we observed a higher degree of vulnerability in our fiscal vulnerability analysis (Figure E1, Appendix E). Similarly, our fiscal vulnerability analysis (Section 6.2) identified the periods of 1981, 1983 and 2014 to 2015 as short episodes of vulnerability. Our fiscal consolidation analysis indicated that 1994, 2007, 2010 and 2013 were the years of fiscal

shocks to banking assets. For instance, Estrella, Park, and Peristiani (2000) reported that the risk-weighted capital ratio outperforms the simple balance sheet ratios because these risk-weighted capital ratios are strong predictors of banking failure. Further, our results reveal that the size of the effect of fiscal consolidation varied slightly between the two measures of banking sector stability. However, the coefficient was positive in both cases. Following the strict definition of fiscal consolidation episodes (Alesina & Ardagna, 2010; Alesina & Perotti, 1995; Ardagna, 2009; Barrios et al., 2010; Mirdala, 2013), our estimates indicate that the capital adequacy ratio (Tier-2) improved by 0.96 because of fiscal consolidation episodes. For the case of the US, the results of the narrow and broader approach of fiscal consolidation indicated a positive effect ($\gamma_{s2} = 0.06$, $p < 0.05$; $\delta_{s2} = 0.16$, $p < 0.05$) for the case of Tier-2.

[188] The fiscal consolidation episodes in Australia, Japan and the US occurred in 1993 and 2007, 2001 and 2010, and 2010 and 2015, respectively.

[189] See Column 2 of Table 6.1 (Chapter 6) for the degree of vulnerability of these economies.

[190] Here, we analysed the episodes of fiscal consolidation to observe their timing. However, we did not compare the periods of fiscal vulnerability identified through screening processes with all episodes of fiscal consolidation.

consolidation episodes (Table F2, Appendix F). Both a higher degree of vulnerability and fiscal consolidations during vulnerable periods motivate investors to move towards government securities because these securities are considered safer during periods of fiscal consolidation. Among all the other vulnerable economies (Table G1, Appendix G), we observed a highly significant effect of fiscal consolidation on banking stability for the case of Japan (γ_{s1} = 0.09, p > 0.01).[191] Apart from the six economies of Australia, Ireland, Japan, Portugal, Spain and the US, we observed a positive effect of fiscal consolidation for the cases of Canada, Denmark, Hungary, Israel, Italy, Mexico, Sweden, Switzerland and the UK.[192]

The results of the control variables provided some useful information regarding the banking sectors of vulnerable economies. For instance, looking at the control variables of the US, we observed some significant effects in total assets (δ_{s1} = -0.18, p > 0.10), return on assets (δ_{s2} = 0.58, p > 0.01), output gap (δ_{s3} = -0.20, p > 0.01) and interest rates (δ_{s5} = -0.32, p > 0.01).[193] Among all these controls, return on assets provided useful information regarding the changes made to the portfolio selection. These results only provided information on the shift from one class of securities to the other class of securities. These results did not provide any evidence on the associated risks, which was provided by the positive significant results of the fiscal consolidation episodes.[194]

For the case of Australia, the disaggregated estimates of size also indicated that large banks tend to have a higher capital ratio, which is consistent with the existing literature (see Cimadomo et al., 2014). Based on the profitability of banks, the disaggregated results indicated that less profitable banks tend to have higher capital, which is also consistent with the existing evidence. Banks with lower profitability are more concerned about their capital because they are the first targets of rating agencies if something negative occurs. For instance, Frost (2017) reported that S&P lowered the rating for the Australian Mutual Provident Society (Australian Securities Exchange [ASX]: AMP), Bank of Queensland (ASX: BOQ) and Bendigo Bank (ASX: BEN). In such situations, banks with large profitability are the last institutions to be downgraded by rating agencies. Therefore, banks with lower profitability were expected to have higher capital. Regarding the macroeconomic controls, there was no statistically significant effect of these controls on the capital adequacy ratio of Australian banks. Among

[191] For the case of Tier-2.
[192] For the case of Hungary, Sweden, Switzerland and the UK, this positive effect only occurred for Tier-2, not for Tier-1.
[193] These are the results for Tier-1.
[194] This is because return on assets uses average assets, not risk-weighted assets.

these variables, the effect of public debt on GDP was positive, yet not statistically significant in any of the measures.

For the case of Greece, total assets (δ_{s1} = 1.64, $p < 0.05$) and return on assets (δ_{s2} = 0.47, $p < 0.10$) were positive and significant for the case of Tier-1. Based on these disaggregated results, the total assets might comprise a significant portion of the financial assets, and a significant amount of return might go towards retained earnings, which increased the Tier-1 capital. Further, these results indicated the specific behaviour of equity and retained earnings. We observed the positive effect of fiscal consolidation on banking stability in 15 economies in the panel of vulnerable economies.[195] Overall, the results align with the existing literature.[196] Among all of the vulnerable and non-vulnerable economies, we found negative significant results for the case of Germany and New Zealand. We discussed these results under the panel of non-vulnerable economies.

Finally, we extended the country-specific analysis of banking stability to the countries identified as non-vulnerable in our fiscal vulnerability analysis. These results are provided in Table G1 (Appendix G). Columns 3 and 4 present the results of Equation 5.7.1 (Section 5.7, Chapter 5), with Tier-1 and Tier-2 used as the banking stability variables (dependent variables) against fiscal consolidation.[197] This analysis was based on the panel regression by taking two dimensions, including different banks, over the period 1990 to 2017. For the non-vulnerable economies, we observed mixed evidence regarding the significant effect of fiscal consolidation on banking sector stability. There was a significant negative effect of fiscal consolidation on banking stability for the case of New Zealand (γ_{s1} = -1.32, $p < 0.05$; y_{s2} = -1.25, $p < 0.10$) and Germany (γ_{s1} = -0.28, $p < 0.01$; γ_{s2} = -0.20, $p < 0.05$). Conversely, there was a significant positive effect of fiscal consolidation on banking sector stability for the case of Brazil (γ_{s2} = 0.62, $p < 0.05$), Indonesia (γ_{s1} = 1.27, $p < 0.10$; y_{s2} = 1.25, $p < 0.10$), South Korea (γ_{s1} = 0.13, $p < 0.05$; y_{s2} = 0.25, $p < 0.05$), the Russian Federation (γ_{s1} = 0.88, $p < 0.01$) and Venezuela (γ_{s1} = 0.42, $p < 0.01$).[198]

[195] These countries included Australia, Canada, Denmark, Hungary, Ireland, Israel, Italy, Japan, Mexico, Portugal, Spain, Sweden, Switzerland, the UK and the US.
[196] See Agnello et al. (2015a), Arezki et al. (2011), Cimadomo et al. (2014), Demirgüç-Kunt and Detragiache (1998) and Drazen and Grilli (1993).
[197] As with the vulnerable economies analysis, a fiscal consolidation episode is defined as a period in which the CAPB improves by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year (narrow approach).
[198] These are the results for Tier-1 and Tier-2, respectively.

First, we examined the possible reasons for the results for New Zealand and Germany. We found eight fiscal consolidation episodes for the case of New Zealand and Germany.[199] We classified these economies as non-vulnerable in our fiscal vulnerability analysis.[200] Further, Moody's sovereign credit rating assigned AAA to these economies, which is also consistent with our fiscal vulnerability analysis.[201] Germany balanced its budget at the general government level from 2011. In 2014, Wolfgang Schauble, the German Finance Minister, highlighted the balanced budget at federal level since 1969. Fiscal consolidation immediately after the debt crisis was surprising for other European countries because most countries were struggling with deficits and debt levels. Breuer (2015) indicated the factors behind fiscal consolidation in Germany. These factors included lower interest rates, lower property income paid by the German general government, and reduction in monetary social transfers. Therefore, the investors of these economies were not very concerned with fiscal consolidation efforts by their respective governments. Further, these factors were expected to decline the supply of new government securities substantially. For the case of New Zealand, holding government securities by foreign investors may be a reason for higher risk-weighted assets. Therefore, the supply effect prevails, which decreases the amount of government securities in the investment portfolio of institutional investors. This deteriorates the capital adequacy ratio.

For the case of Brazil, Indonesia, South Korea and the Russian Federation, we found only 12 fiscal consolidation episodes and observed positive significant effects of these episodes on banking stability.[202] We classified these economies as non-vulnerable in our fiscal vulnerability analysis (Section 6.2). However, the financial investors of these economies were very concerned with government securities. This could be due to the capital requirement enforced by the regulatory services authorities. For example, we already observed that financial investors of Brazil invested US$1.375 billion in subordinated 10-year bonds of *Itau Unibanco's*

[199] Our fiscal consolidation analysis indicated that 1990 and 2012 were periods of fiscal consolidation for the case of New Zealand, while 1989, 1994, 1996, 2000, 2007 and 2011 were periods of fiscal consolidation for the case of Germany (Table F2, Appendix F).
[200] We categorised New Zealand as non-vulnerable in our fourth step because of its higher net financial worth. The fiscal framework of New Zealand has been purely based on accrual budgeting since the fiscal year 1993 to 1994, which was prepared under generally accepted accounting principles. In this framework, net worth is one of the key fiscal aggregates calculated from the consolidated financial statements for the central government (Marti, 2006).
[201] This sovereign credit rating is as of December 2011.
[202] Our fiscal consolidation analysis indicated that 1990 was a period of fiscal consolidation for the case of Indonesia, while 2000 and 2010 were periods of fiscal consolidation for the case of South Korea. Further, Brazil's periods occurred in 1990, 1994 and 1999. However, the Russian Federation had half of these fiscal consolidation episodes among these six economies, in 1999, 2000, 2005, 2008, 2010 and 2011 (Table F2, Appendix F).

hefty in 2012. During this period, financial institutions considered Tier-2 less expensive and preferred to issue this class of equity capital. This financing was invested significantly in the bonds by Bradesco, Banco do Brasil and Itau.[203] This justifies the positive influence of fiscal consolidation on the banking stability of these economies.

Further, Moody's sovereign credit outlook assigned a positive outlook to these economies.[204] Holding of foreign sovereign debt by domestic banks is another possible reason for lower risk-weighted assets, which improves the capital adequacy ratios. This effect should be obvious, since we used unconsolidated Bankscope data for the case of New Zealand, Germany, Brazil, Indonesia, South Korea and the Russian Federation. The Bankscope database provides consolidated and unconsolidated balance sheet data for all individual banks. Most of the analyses used consolidated balance sheet data. However, we used unconsolidated data to differentiate the domestic effect of fiscal consolidation in New Zealand, Germany, Brazil, Indonesia, South Korea and the Russian Federation. We observed the maximum number of fiscal consolidation episodes in Venezuela among all the selected economies. Interestingly, we identified Venezuela as a vulnerable economy using the fourth step of the fiscal vulnerability selection procedure (Figure 5.2, Chapter 5) because of lower financial net worth. This fact also aligns with the recent debt crises in Venezuela.[205] One of the possible explanations for the significant influence of fiscal consolidation on banking stability is that investors are aware of the weak position of the country's balance sheet, and are reluctant to buy government securities in the absence of fiscal consolidation. Resultantly, investors reacted more to fiscal consolidation efforts by the government.

In the remaining almost 50 per cent of cases, there was an insignificant influence of fiscal consolidation on banking sector stability.[206] The possible reasons for this insignificant effect can be categorised as follows: (i) no fiscal consolidation episode at all or less than one fiscal consolidation episode,[207] (ii) fiscal consolidation efforts occur during a non-vulnerable

[203] See Kilby (2012) for further details on the behaviour of Brazilian lenders towards Tier-2 capital.
[204] This sovereign credit rating is as of December 2011.
[205] Despite this vulnerability because of lower financial net worth, overall, we categorised Venezuela as non-vulnerable to maintain consistency with our fiscal vulnerability selection criteria (Figure 5.2, Chapter 5) for all 53 economies.
[206] This also applies to the insignificant results we observed in our aggregate data analysis (Section 8.2).
[207] For instance, our fiscal consolidation analysis indicated no fiscal consolidation episode for the case of Canada and only one fiscal consolidation episode each for Denmark (2010), France (2011) and Mexico (1995). The fiscal consolidation episodes in Denmark and France could be a reaction to the ongoing Euro debt crises.

period,[208] (iii) the presence of the threat of sovereign credit rating downgrades and the widening of spreads for sovereign bonds and credit default swaps[209] and (iv) holdings of government securities by domestic banks.[210]

8.4 Implications of Aggregated and Disaggregated Analysis

We compared the results of the aggregated and disaggregated analysis of 35 economies. In this section, we present the similarities and differences between the aggregated and disaggregated analyses. We dropped 18 economies in this comparison mainly because of the unavailability of disaggregated data from the Bankscope database.[211] Table G1 (Appendix G) reveals consistent results for the case of 19 economies.[212] These economies included 11 vulnerable and eight non-vulnerable economies. When considering the possible reasons for these consistencies, we began with the vulnerable economies. The aggregated and disaggregated analyses indicated a positive statistically significant influence of fiscal consolidation on banking stability for the case of three vulnerable economies—Iceland, Ireland and the US. These results are consistent with the existing literature (Agnello et al., 2015a, 2015b; Arezki et al., 2011). We observed that degree of vulnerability was higher in these four economies (see Column 2 of Table 6.1, Chapter 6), which is expected to deteriorate liquidity in the banking sector (Brutti, 2011). Under these fiscal conditions, austerity plans are associated with endorsing financial reforms (Agnello et al., 2015b). Therefore, investors react promptly and shift their portfolios towards government securities. Further, we also observed that fiscal consolidation occurred immediately after the short-term episodes of fiscal vulnerability in Ireland.[213] These results also indicate that demand effect prevails for the case of these four economies. Penetta et al. (2011) called this an 'asset

[208] For instance, Hong Kong, the Netherlands, Norway and Switzerland. These economies were not vulnerable to debt crises. Therefore, investors would not react to the fiscal consolidation efforts of the government.
[209] For instance, the investors expected sovereign credit rating downgrades for the case of Greece, Spain and Brazil in 2010 during the ongoing debt crisis. Therefore, this effect was insignificant in this case.
[210] We were unable to analyse the complete banking portfolios of some economies because of unavailability of data. However, it is expected that the banks of six economies did not hold a significant portion of government securities. These six economies were Hungary, Israel, Italy, Sweden, Thailand and the UK.
[211] These 18 economies were Belgium, Colombia, Costa Rica, the Dominican Republic, Finland, Ghana, Honduras, India, Mexico, New Zealand, Nicaragua, Panama, Paraguay, Peru, Poland, Romania, Turkey and Uruguay.
[212] These 18 economies were Argentina, Bulgaria, Canada, Chile, Haiti, Iceland, Ireland, Israel, Italy, the Netherlands, Norway, Pakistan, South Africa, Spain, Sweden, Switzerland, Thailand and the US. These economies were both vulnerable and non-vulnerable. The consistency was determined based on the statistical significance of the results. For instance, the results were considered consistent if γ was positive and statistically significant in both the aggregated and disaggregated analysis.
[213] See the discussion on Ireland in Section 8.3.

channel', where the holdings of sovereign debt securities have a direct effect on the financial position of the banking sector.

Conversely, the aggregated and disaggregated analyses indicated a statistically insignificant effect of fiscal consolidation for the case of eight vulnerable economies—Canada, Denmark, Greece, Israel, Italy, Pakistan, Sweden and Switzerland. One possible reason for this result is sovereign rating downgrading during vulnerable periods. Along these lines, Arezki et al. (2011) reported that the sign and magnitude of the spillover effect of sovereign downgrades depends on the rating agency and type of announcement. Therefore, it is possible that institutional investors rely more on sovereign downgrades than positive signals from debt restructuring by the government, and prefer to strict with non-government securities.

Turning towards the non-vulnerable economies, we observed that both analyses indicated an insignificant effect of fiscal consolidation in seven non-vulnerable economies—Argentina, Bulgaria, Chile, China, Haiti, South Africa and Thailand. One possible reason for this result is that the banks of these economies hold significantly fewer government securities in their portfolio. The investors of these economies seem to be interested in investing their money elsewhere. In these circumstances, the government faces difficulty in issuing new bonds to gain new debts. For instance, Cuddington (1986) reported the case of Argentina when it faced such an experience alongside capital flight. We also observed that the aggregated and disaggregated analyses indicated a negative significant effect of fiscal consolidation on banking stability for Norway, which was also categorised as non-vulnerable in our fiscal vulnerability analysis (Section 6.2). In this case, the supply effect prevailed, and investors did not shift their portfolio towards government bonds. This deteriorated the capital adequacy ratios of the banking sector, which we observed in both the aggregated and disaggregated analyses.

However, we observed that the results were inconsistent in 16 of 53 economies.[214] These 16 economies included 10 vulnerable and six non-vulnerable economies. Starting with the vulnerable economies, we observed that the disaggregated analysis indicated a positive and statistically significant effect for the case of six economies—Australia, Austria, Hungary, Japan, Portugal and Spain. The fiscal vulnerability analysis revealed that the degree of vulnerability was higher in all six economies (see Column 2 of Table 6.1, Chapter 6). Under these fiscal conditions, the risk-weighted assets of the banking sector worsen in response to

[214] These 16 economies included Australia, Austria, Brazil, France, Germany, Hungary, Indonesia, Japan, the Netherlands, the Philippines, Portugal, the Russian Federation, South Korea, Spain, the UK and Venezuela.

austerity plans (Agnello et al., 2015b; Brutti, 2011; Penetta et al., 2011). The results of the disaggregated analysis are consistent with this strand of the literature. However, the aggregated analysis revealed a negative and statistically significant effect for the case of the above four vulnerable economies.[215] We observed that TGE dataset did not consider different classes of capital for the composition of the capital adequacy ratios. Therefore, one possible reason for this result might be country-specific accounting standards.[216]

Moving to consider the six non-vulnerable economies, the disaggregated analysis revealed a positive statistically significant effect for five countries—Brazil, Indonesia, the Russian Federation, South Korea and Venezuela. However, the aggregated analysis revealed an insignificant effect of fiscal consolidation on the banking stability of these economies. The early consolidated financial positions revealed less holding of financial assets by the banking sectors of Brazil and the Russian Federation. Therefore, the net financial worth of these economies was less than -10.[217] These conditions could motivate institutional investors to enhance the size of their balance sheet. For instance, Brazilian lenders invested US$1.375 billion in subordinated 10-year bonds of *Itau Unibanco's hefty* in 2012. At the same time, financial institutions prefer to issue Tier-2 because they consider them less expensive. This financing was invested significantly in the bonds by Bradesco, Banco do Brasil and Itau.[218] Therefore, the disaggregated results revealed a positive significant effect on banking stability. For the case of Indonesia, we observed that their financial net worth was the highest among these non-vulnerable economies because OJK—the Financial Services Authority of Indonesia—set minimum requirements for capital adequacy ratios.[219] Therefore, the disaggregated results supported these regulatory changes in these economies.[220] In summary,

[215] These economies included Australia, Austria, Hungary and Portugal. The aggregated analysis revealed an insignificant effect for the case of Japan and Spain.
[216] For instance, see *AASB 101 Presentation of Financial Statements* and *AASB 132 Financial Instruments: Presentation*.
[217] See Sections 5.5.2 (Chapter 5), and Section 6.3 (Chapter 6) for discussion of the benchmark of -10 for financial net worth.
[218] See Kilby (2012) for further details on the behaviour of Brazilian lenders towards Tier-2 capital.
[219] See Sipahutar and Suhartono (2018) for further details on the capital adequacy ratios and capital requirements in Indonesia.
[220] At the end, we compared the disaggregated analysis with all three measures of financial sector stability, including z-score and stock market capitalisation. We mainly observed inconsistencies between the results of capital adequacy ratios. However, we observed inconsistent results because of stock market capitalisation for the case of China and Greece. We also observed inconsistency because of the z-score for the case of Denmark and Germany. We noted that TGE database aggregated values were calculated by adding the bank-by-bank unconsolidated financial statements data of Bankscope. These aggregated values were then used to calculate the banking system capital adequacy ratios and z-score. For this purpose, TGE uses the standard definition of capital adequacy ratios. See Section 3.3 (Chapter 3) for further details on the standard definitions of capital adequacy ratios. Similarly, the z-score is calculated using return on assets, equity and total assets of banks. However, TGE does not provide details of the banks used in the aggregation process. Therefore, we were unable

the findings of the country-specific analysis (aggregated and disaggregated) suggested that the degree of vulnerability and timing of fiscal consolidation are important in the role of fiscal consolidation for banking sector stability in vulnerable economies. In general, this analysis indicated that fiscal consolidation is important for banking sector stability, regardless of the initial fiscal stance of a country.

8.5 Concluding Remarks

This chapter has provided further insight on the role of fiscal consolidation in financial sector stability through country-specific analysis because financial variables behave differently in different economies. The aggregated analysis revealed that the standard capital adequacy ratios improved significantly in the vulnerable economies, compared with the non-vulnerable economies. However, we observed that the capital adequacy ratios deteriorated in five vulnerable economies—Australia, Austria, Hungary, Portugal and the UK. These inconsistent results might be because of investments in foreign securities, the prevailing supply effect and the aggregation procedure by TGE database team. We further extended our analysis to the bank-wise disaggregated data extracted from the Bankscope database. The disaggregated analysis of non-vulnerable economies revealed that two countries (Indonesia and South Korea) indicated a 1.27 and 0.13 percentage point improvement in financial stability (Tier-I). Another two economies—New Zealand and Germany—indicated a decline of 1.32 and 0.28 percentage points in the capital adequacy ratio (Tier-I), respectively, because of their stance on fiscal consolidation. It is interesting to note that, in New Zealand and Germany, excessive fiscal consolidation might be occurring, which may further force the financial sector to opt for more risky assets in their portfolio of investment. As a result of the comprehensive range of data, we relied on the disaggregated analysis. These findings indicated that fiscal surplus may not warrant financial stability. Consequently, we may extract from the above results that fiscal consolidation—particularly in economies vulnerable to fiscal crisis—helps create financial stability.

to further investigate the reasons for inconsistencies. However, we preferred the results of the disaggregate analysis because we used bank-wise data with a greater number of observations—ranging up to 3,943 for the case of the US (Tier-1).

CHAPTER 9. Conclusions, Policy Implications, Limitations and Scope for Future Research

9.1 Introduction

This thesis has explained how fiscal consolidation helps avoid fiscal vulnerability and reinforces banking stability through mitigating sovereign risks. This chapter is organised as follows. Section 9.2 provides the summary and concluding remarks of this analysis. More specifically, this section summarises each of the eight chapters of this study. Section 9.3 elaborates on the contributions, distinctions and policy implications of this study for the public and the corporate sector. Section 9.4 discusses the limitations of this study, while Section 9.5 presents future avenues for extending this research.

9.2 Summary and Concluding Remarks

Chapter 1 of this thesis elaborated the main theme of the thesis, along with the way in which all parts of this thesis are connected. Chapter 2 presented a wide range of literature on this field and identified the gaps in the existing literature. This literature review focused on two key areas—fiscal vulnerability and its linkage with banking stability. We classified the available literature on fiscal vulnerability into four classes with different alternative techniques. The next section of Chapter 2 provided the existing literature examining the way sovereign risk is transmitted into the banking sector. There is a substantial lack of theoretical and empirical literature on the role of fiscal consolidation in banking stability. This study filled this gap by suggesting that fiscal consolidation transmits into the capital adequacy ratios of the banking sector through two key channels: (i) government defaults are costly because they destroy bank balance sheets and (ii) higher bank funding costs have increased investors' concerns about sovereign risks. In this interaction, fiscal consolidation plays a significant role by mitigating sovereign risk and increasing capital adequacy ratios. This research further extended the

literature by providing empirical evidence on 53 economies. The existing literature has indicated that the initial fiscal condition of an economy is important in the role of fiscal consolidation, where this role is expected to be substantial. The final analysis of this thesis filled this gap by providing empirical evidence on this topic.

Chapter 3 presented the framework of analysis, which identified the appropriate channels though which fiscal consolidation is transmitted into the banking sector balance sheets. This chapter also presented the debt analysis of an economy through the evolution process of public debt. An economy never retires and essentially lives forever; thus, an economy does not need to pay off its debts entirely. In this framework, fiscal sustainably differentiates an economy from an individual or household. We presented the component-wise analysis of fiscal sustainability in this chapter. Among the different conditions of the fiscal balance, budget deficit is more relevant to debt analysis, where budget deficit can be financed through issuing new debts, monetising or using a mix of both options. The first option is the most commonly used measure of financing budget deficit; however, it depends on investors' confidence, which deteriorates in the case of persistent fiscal vulnerability. In this situation, the general public and potential buyers stop buying government securities. Interestingly, banks are the key holders of government securities, especially in emerging economies, such as India.

These conditions force institutional investors to rebalance their portfolio by shifting from government securities to private securities. Theoretically, banks make changes to their portfolio because of investors' perceptions of sovereign risk. Banks also make changes to their investment portfolio because of the probability of default in the interbank lending market. Based on the regulatory framework (Basel Accords), this increases the weighted average assets of banks and subsequently deteriorates their capital adequacy ratios—the key measure of banking stability. As such, fiscal consolidation mitigates sovereign risk and transmits into bank balance sheets, thereby resulting in higher financial stability. This chapter provided a complete framework of analysis based on the concerned financial regulations.

Chapter 4 presented the data collection process, data sources and their related issues, as we collected fiscal, financial and banking variable from several databases. For the empirical investigations, we used country-wise annual data for fiscal vulnerability analysis from 1960 to 2017. We mainly relied on the database created by Mauro et al. (2013) for these fiscal variables. For the next part of our analysis, we used country-wise (aggregated) annual data from TGE and bank-wise (disaggregated) annual data from the Bankscope database. More directly, we

collected aggregated data on banking system regulatory capital to risk-weighted assets, z-score and stock market capitalisation from TGE database ranging from 1960 to 2017. For the disaggregated financial stability analysis, we collected bank-wise annual data on total assets, return on total assets, Tier-1 and Tier-2 from the Bankscope database, ranging from 1990 to 2016. Normally, the consolidated balance sheet data are used for financial market analysis, which creates difficulty analysing the domestic effects of fiscal consolidation. Therefore, we decided to use consolidated bank balance sheet data for the financial stability analysis.

Chapter 5 presented the empirical strategy by initially proposing a fiscal vulnerability selection procedure (Figure 5.2, Chapter 5) to overcome some quantitative issues in conventional techniques of fiscal vulnerability. Finally, we used this proposed fiscal vulnerability selection approach to identify the economies vulnerable to debt crisis. At the start of the fiscal vulnerability analysis, we suspected structured breaks in the data for most of our selected 53 economies. We first applied a breakpoint unit root test to identify the break year. We then applied the Bai (Bai, 1997) and Bai–Perron (Bai & Perron, 1998) approach of multiple-breakpoint test on Equation 5.2.1 (Section 5.2, Chapter 5). After this identification process, we used appropriate dummies for the significant breaks. This process (first step of our fiscal vulnerability selection procedure) provided a single debt coefficient, which could be misleading when the sample for the period of vulnerability was pooled with the non-vulnerability period. We overcame this problem by extending our estimation to subsamples of at least 20 observations through forward, backward and moving screening processes. These screening processes partially eliminated this problem; therefore, we extended the analysis to the threshold regression.

Using the identified vulnerable economies from these three steps (Bohn [1998], stability analysis and threshold regression), we further determined that, if the net financial worth of the identified economies (in the VaR and CVaR framework) was less than -10, the economy should be identified as vulnerable. This gave us the fiscal vulnerability selection procedure. The next part provided the fiscal consolidation measurement strategy, followed by the panel regression model to analyse the effect of fiscal consolidation on banking stability. For the country-specific financial stability investigation, we conducted aggregated and disaggregated analyses. We included the lagged dependent variable because of the presence of adoptive expectations. During disaggregated analysis, the standard fixed-effects panel regression can be subject to Nickell bias. Therefore, it is recommended to apply the GMM estimation procedure proposed by Arellano and Bond (1991). We observed higher variation in the number

of banks (*N*) and number of years (*T*) in our large sample. We applied GMM estimation when *N* was greater than *T*. However, the dynamic panel bias became insignificant if *T* was greater than *N* then we applied standard fixed effect. We followed this estimation procedure in the country-wise analysis of banking stability.

Chapter 6 discussed the results of the fiscal vulnerability analysis, where we classified the sample of these economies into vulnerable and non-vulnerable using our fiscal vulnerability selection procedure. In this multi-approach method, we extended our analysis from the conventional debt approach to the investment approach. In this manner, we selected the countries commonly identified by both approaches as vulnerable to debt crisis. Initially, Bohn's (1998) method identified 30 of 53 economies as vulnerable (the first step of our fiscal vulnerability selection procedure). However, these results could be misleading when the sample for the period of vulnerability was pooled with the non-vulnerability sample, as one sample would nullify the effects of the other. Therefore, we extended these estimates to the subsample through forward, backward and moving screening processes, and the results revealed nine additional economies as vulnerable to debt crisis (the second step of our fiscal vulnerability procedure).

It could be argued that these screening processes may not completely avoid the identification problem, since some vulnerable periods can be nullified by non-vulnerable periods within the subsample. To overcome this issue, we extended our analysis to a country-specific threshold regression, which could endogenously determine the period during which a country is vulnerable to crisis. Further, the threshold regression identified one additional economy (11 total economies) where the vulnerable period was nullified by the non-vulnerable period within the sample. The threshold approach also helped us achieve our second objective of identifying the country-specific threshold of public debt. In total, we identified 40 of 53 economies as vulnerable to debt crisis, with a specific critical level of public debt to GDP ranging from a minimum of 21.16 per cent (France) to a maximum of 84.06 per cent (Belgium). These results are in contrast with the existing literature, including Reinhart and Rogoff (2010). To incorporate investment aspects of public debt, we analysed the financial net worth (VaR and CVaR) of these 40 vulnerable economies. We finally matched the results of debt and investment analysis to determine the fiscal health of these economies. Finally, we classified a total of 26 economies as vulnerable economies. This procedure offered a rigorous analysis and may be considered far superior to the existing procedures, which are subject to heavy criticism involving methodological issues or suggesting a single cut off of public debt to GDP as a

criterion of vulnerability to fiscal crisis. Finally, we compared these results with the results of alternative measures and with data from different rating agencies, including S&P, Moody's and Fitch Group.

In Chapter 7, we analysed fiscal consolidation and its role in the banking stability of the 53 economies. In the fiscal consolidation analysis, we conducted a rigorous reconciliation of narrative techniques and quantitative approaches using CAPB. We calculated fiscal consolidation episodes where CAPB improved by at least 1.5 per cent of GDP in a year, or at least one per cent of GDP per year in a period of two consecutive years (Ardagna, 2009). Using this definition, we calculated 202 fiscal consolidation episodes from 1960 to 2015 in our selected countries. We used these fiscal consolidation episodes in the panel analysis of banking stability. We applied Arellano–Bond dynamic panel data estimation, Roodman collapse and straightforward fixed effects to analyse the influence of fiscal consolidation episodes in the banking stability of three panels: (i) all economies, (ii) vulnerable economies and (iii) non-vulnerable economies. The results of this analysis indicated that standard capital adequacy ratios, such as the Tier-1 ratio, improved by 0.36 percentage points in the panel of all economies. However, the final objective of our study was to estimate the effect of fiscal consolidation on the banking sector separately for the groups of vulnerable and non-vulnerable economies. Therefore, we categorised these economies into two panels (vulnerable and non-vulnerable) and extended our analysis to these two panels separately. The results suggested that the standard capital adequacy ratio (Tier-1) improved by 0.58 percentage points in response to fiscal consolidation episodes in vulnerable economies. These results for the panel of non-vulnerable economies were not statistically significant. These findings suggest that fiscal consolidation creates banking stability, particularly in vulnerable economies.

Chapter 8 presented a country-specific analysis on the role of fiscal consolidation in the financial stability of 53 economies. This analysis was further bifurcated into aggregated and disaggregated analysis. This analysis provided more insights to the topic, since financial, fiscal and banking variables behave differently in different economies. The overall results of this analysis were consistent with the panel results; however, we observed some contradictions. For example, the aggregated analysis revealed that fiscal consolidation deteriorated financial stability in five vulnerable economies. This could be due to the lack of investor interest in domestic securities and the prevailing supply effect. The aggregation procedure for capital adequacy ratio may also be a reason for this inconsistency. We also observed some irregularities in the disaggregated analysis. For instance, the disaggregated country-specific

analysis of non-vulnerable economies revealed that Tier-1 (for FC-1) of Indonesia and South Korea improved by 1.27 and 0.13 percentage points, respectively. However, Tier-1 (FC-I) of New Zealand and Germany deteriorated by 1.32 and 0.28 percentage points, respectively. Excessive fiscal consolidation in New Zealand and Germany may further force the financial sector to opt for more risky assets in their portfolio of investment. These findings reveal that fiscal surplus may not warrant financial stability. Therefore, we may infer from the above findings that fiscal consolidation helps create financial stability, particularly in vulnerable economies.

9.3 Contributions, Distinctions and Policy Implications of the Study

This study has covered various important aspects of public economics and the banking sector. Therefore, a couple of important findings in these areas may be attributed to this study. One of the key findings is that the existing literature lacks consensus on the direction of the relationship between twin crises (sovereign defaults and financial crises). This thesis attempted to explore this missing link by considering the role of fiscal consolidation in banking stability through the channel of sovereign risk. The first part of this study investigated fiscal vulnerability to crisis through the perspective of fiscal consolidation by suggesting a fiscal vulnerability selection procedure. Along these lines, we overcame the issues of the technicalities involved to correctly estimate the parameter of fiscal vulnerability to crisis. Moreover, we incorporated the missing aspect of fiscal consolidation as a policy response to fiscal vulnerability.

More directly, the first part of this study extended contributions to the existing fiscal literature in five main ways, as follows. First, it proposed a fiscal vulnerability selection procedure (Figure 5.2, Chapter 5) by incorporating the investment component of public debt that can be applied to a large sample of developing, emerging and developed economies. Second, it calculated a threshold level of debt as a proportion of GDP, beyond which a country may fall into fiscal crisis. Third, it calculated the threshold level based on the special case of the regime-switching model, used for the first time in the literature on this topic. Fourth, it reconciled the results of the debt approach with the investment approach to confirm the results of the debt approach to estimate vulnerability to fiscal crisis. Fifth, it determined that the alternative approaches (fiscal vulnerability index and financial net worth/balance sheet) cannot be applied as standalone techniques in a fiscal vulnerability analysis. Thus, this study has an obvious advantage over other studies, since the existing studies focused on a single approach to investigate fiscal vulnerability.

The next part of this study provided a transmission mechanism through which fiscal vulnerability is transmitted into the banking sector by deteriorating banking stability. More specifically, persistent fiscal vulnerability increases sovereign risk, and the general public—especially expected investors of government securities—lose confidence. In these situations, fiscal consolidation rebuilds this market confidence, and institutional investors finally include government securities in their investment portfolios to achieve the required adequacy ratio for banking stability. This gives a key distinction to this study over the existing literature, since the existing literature only discusses the transmission mechanism between sovereign risk and increasing banking costs. By applying this theoretical framework to two different panels of 53 economies, this study further contributes to the empirical literature. We successfully estimated and found that fiscal consolidation performs an important role in banking sector stability, particularly during a fiscal crisis. Another distinction of this study is the fact that the Bankscope database has never been used on a large scale to explain banking sector stability in association with the changing stance of fiscal policy.

The above observations reflect deeper implications for public policy makers and financial market practitioners. Considering the short-term pain and long-term gain view of budget consolidation, policy makers of vulnerable economies (especially the 26 economies identified as vulnerable in our analysis) should change their fiscal stance to mitigate their respective sovereign risks. Further, it is suggested that financial market practitioners should closely observe the changes in fiscal policy stance, and rebalance their investment portfolios accordingly. In this manner, they are expected to increase their profitability through gaining maximum return from the loans extended to firms and consumers, and on investment securities. Following our guidelines, these institutional investors can increase their capital adequacy ratio and subsequent banking stability if they rebalance their investment portfolio in response to changes in the fiscal policy stance by their respective governments. This is not suggested for all economies, since the role of fiscal consolidation depends on the initial fiscal stance of an economy.

9.4 Limitations of the Study

Despite these contributions and distinctions, we observed a few limitations of this study, mainly relating to the data, both sector specific and country specific. We attempted to incorporate the qualitative aspect of fiscal stance in the measurement of fiscal consolidation episodes. For this purpose, we required the following data sources for all 53 economies: (i) convergence and

stability programs submitted by the authorities to the European Commission, (ii) IMF reports and OECD reports for the OECD economies, (iii) budgets and budget speeches and (iv) central bank reports. These data were not available in the databases for all the selected developed, emerging and developing economies. Therefore, we restricted our fiscal consolidation measurement analysis to quantitative approaches only. Further, we observed that the data on capital adequacy ratios for some banks were not available in the Bankscope database. Even for Romania, Colombia and Costa Rica, the data for only one bank was available. From a sector perspective, this study was only limited to the banking sector. We only included stock market capitalisation in the aggregated analysis. Further, we restricted this study to the Basel Accords framework, and did not incorporate the country-specific capital adequacy requirements for all 53 economies.

9.5 Scope for Future Research

The first logical step forward to extend this study is to incorporate external vulnerability for the country-specific cases. This research can also be extended by incorporating alternative measures of public debt, including net financial liabilities and net public debt, in the fiscal vulnerability analysis for all 53 economies. One of the key limitations of this research was the unavailability of public sector balance sheet data. However, data on government balance sheets are available for all OECD (2018) economies from 1990 onwards, which enabled us to calculate the net financial liabilities and net debt for these economies. The banking stability analysis can be extended by analysing the compositional effect. Alternative measures of banking stability could be used, including NPL score, probability of default score, and the price of credit default swaps. However, previous research indicated that capital ratios are good predictors of banking failures. This research can be extended by incorporating other components of financial markets. In this manner, future research can be extended by incorporating the stock market index in our framework of analysis. For this empirical investigation, standard event study methodology can be applied to determine the effect of fiscal consolidation episodes on the stock markets of vulnerable and non-vulnerable economies. Further, this event study analysis can be extended to our vulnerability classification for all 53 economies.

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Appendix A (Chapter 1)

Table A1: Stylized Facts: Sovereign Default Episodes, Banking Crises and Fiscal Consolidation Episodes

		Banking Crisis			
Country	Sovereign Default	Started or ongoing in any of three years prior?	Started concurrently or subsequently?	Large Fiscal Consolidation Episodes	Small Fiscal Consolidation Episodes
(1)	(2)	(3)	(4)	(5)	(6)
Albania	1991 to 1995	No	Yes (1992)		1996, 1998-99, 2003, 2005.
Algeria	1991 to 1996	Yes (1990)	No		1995-96, 1999-2000, 2003, 2005.
Angola	1985 to 2004	No	Yes (1991)		1999-2000, 2004-06, 2010-11.
Antigua	1996 to 2004	No	No		2003-05, 2007, 2010-12, 2013.
Argentina	1982 to 1993, 2001 to 2004	Yes (1981), No	No, Yes (2001)		1993
Australia				1984-88 1994-98	n/a
Bolivia	1980 to 1984, 1986 to 1997	No, No	No, Yes (1986)		1990-91, 1993, 2002.
Bosnia and Herzegovina	1992 to 1997	No	Yes (1992)		n/a
Brazil	1983 to 1994	No	Yes (1994)		1991, 1994-95, 1997, 1999.
Bulgaria	1990 to 1994	No	Yes (1996)		1991, 1994, 1997-99, 2002, 2004-05, 2012-13.
Burkina Faso	1983 to 1996	No	Yes (1988)		n/a
Cameroon	1985 to 2003	No	Yes (1987)		1992, 1995, 1998.
Canada				1993-97	
Cape Verde	1981 to 1996	No	Yes (1993)		n/a
Central African, Rep	1981, 1983 to 2004	Yes (1980-81), Yes	No, No		n/a
Chile	1983 to 1990	Yes (1981)	No		0

continued…

Table A1 (…continued): Stylized Facts: Sovereign Default Episodes, Banking Crises and Fiscal Consolidation Episodes

Country	Sovereign Default	Banking Crisis		Large Fiscal Consolidation Episodes	Small Fiscal Consolidation Episodes
		Started or ongoing in any of three years prior?	Started concurrently or subsequently?		
(1)	(2)	(3)	(4)	(5)	(6)
Congo	1983 to 2004	No	Yes (1992)		2000, 2003-05.
Congo, Dem. Rep.	1980 to 2004	No	Yes (1980)		2000
Costa Rica	1981, 1983 to 1989	No, No	No, Yes (1994)		1992, 1995, 2003, 2006, 2007.
Cote d'Ivoire	1983 to 1998, 2000 to 2004	No, No	Yes (1988), No		n/a
Cuba	1982 to 2004	No	No		n/a
Denmark				1983-86	1990, 1996-97.
Dominica	2003 to 2004	No	No		2002-03, 2005-06, 2013.
Dominican Republic	1982 to 1994	No	No		1990, 1992, 1995, 2001.
Ecuador	1982 to 1995, 1999 to 2000	Yes (1980), Yes (1998)	No, No		n/a
Ethiopia	1991 to 1999	No	Yes (1994)		1991-93, 1995-96, 2000, 2003-04, 2007, 2011-12.
Finland				1993-2000	1990, 1995-98.
Gabon	1986 to 1994, 1999 to 2004	No, Yes (1997)	Yes (1995), No		n/a
Gambia	1986 to 1990	Yes (1985)	No		1992, 2004, 2006-07, 2010.
Ghana	1987	Yes (1986)	No		1991, 1993-94, 2011-12.
Greece				1990-94	n/a
Guatemala	1989	No	Yes (1990)		1991, 2004, 2013.
Guinea	1986 to 1988, 1991 to 1998	Yes (1985), No	No, Yes (1993)		n/a

continued…

Table A1 (…continued): Stylized Facts: Sovereign Default Episodes, Banking Crises and Fiscal Consolidation Episodes

Country	Sovereign Default	Banking Crisis		Large Fiscal Consolidation Episodes	Small Fiscal Consolidation Episodes
		Started or ongoing in any of three years prior?	Started concurrently or subsequently?		
(1)	(2)	(3)	(4)	(5)	(6)
Guinea Bissau	1983 to 1996	No	Yes (1995)		n/a
Guyana	1982 to 2004	No	No		n/a
Haiti	1982 to 1994	No	No		n/a
Honduras	1981 to 2004	No	No		n/a
Indonesia	1998 to 2000, 2002	Yes (1997), Yes (2001)	No, No		1993-94, 2000, 2002, 2010.
Iran	1981 to 1995	No	No		1995, 1999-2000, 2004-05, 2007.
Iraq	1987 to 2004	No	No		n/a
Ireland				1982-88	n/a
Italy				1990-95	1994-95, 1997-99.
Jamaica	1981 to 1985, 1987 to 1993	No, No	No, Yes (1994)		1997, 2000, 2003, 2005, 2010, 2012-13.
Japan				1979-87	1991-1994.
Jordan	1989 to 1993	No	Yes (1989)		1991-92, 1999, 2003, 2006, 2008, 2010, 2013.
Kenya	1994 to 2004	Yes (1993)	No		1992-93, 1996, 2000, 2005, 2011, 2013.
Korea, Dem. Rep.	1980 to 2004	No	No		2000
Liberia	1987 to 2004	No	Yes (1991)		2005-06, 2013.
Macedonia	1992 to 1997	No	Yes (1993)		2005
Madagascar	1981 to 2002	No	Yes (1988)		1995-96.
Malawi	1982, 1988	No, No	No, No		2010, 2013.
Mauritania	1992 to 1996	Yes (1991)	No		n/a

continued…

Table A1 (…continued): Stylized Facts: Sovereign Default Episodes, Banking Crises and Fiscal Consolidation Episodes

Country	Sovereign Default	Banking Crisis: Started or ongoing in any of three years prior?	Banking Crisis: Started concurrently or subsequently?	Large Fiscal Consolidation Episodes	Small Fiscal Consolidation Episodes
(1)	(2)	(3)	(4)	(5)	(6)
Mexico	1982 to 1990	Yes (1981)	No		1991-92.
Moldova	1998, 2002	No, No	No, No		1996, 1998, 2000, 2001, 2003, 2005, 2010, 2013.
Morocco	1983, 1986 to 1989	Yes (1980), No	No, No		1992, 1996, 2000.
Mozambique	1980, 1983 to 2002	No, No	No, Yes (1987)		2013
Myanmar	1997 to 2004	Yes (1996)	No		1992, 1996-97, 2000.
Nicaragua	1980 to 2004	No	Yes (late 1980s)		1993, 1995, 2002, 2006, 2011.
Niger	1983 to 1991	No	Yes (1983)		n/a
Nigeria	1982 to 1992, 2002	No, No	Yes (1991), No		2013
Pakistan	1998 to 1999	No	No		1994, 1998, 2000, 2009, 2013.
Panama	1983 to 1996	No	Yes (1988)		1993, 1995.
Paraguay	1986 to 1992, 2003 to 2004	No, Yes (2001)	Yes (1995), No		2001, 2003-04, 2008, 2010, 2013.
Peru	1984 to 1997	Yes (1983)	No		1994, 1996, 2006, 2010.
Philippines	1983 to 1992	Yes (1981)	No		2005-06, 2011, 2013.
Poland	1981 to 1994	No	No		1994
Romania	1981 to 1983, 1986	No, No	No, Yes (1990s)		1993, 1995.
Russia	1991 to 2000	No	No		1995-96, 1999, 2000, 2001.
SaoTomeand Principe	1987 to 1994	Yes (1980s)	No		n/a

continued…

Table A1 (…continued): Stylized Facts: Sovereign Default Episodes, Banking Crises and Fiscal Consolidation Episodes

		Banking Crisis			
Country	Sovereign Default	Started or ongoing in any of three years prior?	Started concurrently or subsequently?	Large Fiscal Consolidation Episodes	Small Fiscal Consolidation Episodes
(1)	(2)	(3)	(4)	(5)	(6)
Senegal	1981 to 1985, 1990, 1992 to 1996	No, Yes (1989), Yes (1991)	Yes (1988), No, No		2002
Serbia and Montenegro	1992 to 2004	No	No		2013
Seychelles	2000 to 2002	No	No		1998-2000, 2005, 2008, 2011.
Sierra Leone	1983 to 1984, 1986 to 1995	No, No	No, Yes (1990)		1998-2000, 2002, 2004, 2009, 2011.
Slovenia	1992 to 1996	No	Yes (1992)		1995-96, 2003, 2012-13.
South Africa	1985 to 1987, 1989, 1993	No, No, No	No, Yes (1989), No		1996, 1999, 2003.
Sudan	1980 to 2004	No	No		0
Sweden				1981-87 1994-97	1994-97, 1999.
Tanzania	1984 to 2004	No	Yes (late 1980s)		2011, 2013.
Togo	1980, 1982 to 1984, 1988, 1991 to 1997	No, No, No, No	No, No, No, Yes (1993)		n/a
Trinidad and Tobago	1988 to 1989	Yes (1987)	No		0
Turkey	1982	No	Yes (1982)		1994, 1997, 2002.
Uganda	1980 to 1993	No	Yes (1994)		2004-08, 2012-13.
Ukraine	1998 to 2000	No	Yes (1998)		2000, 2002, 2006, 2011, 2013.

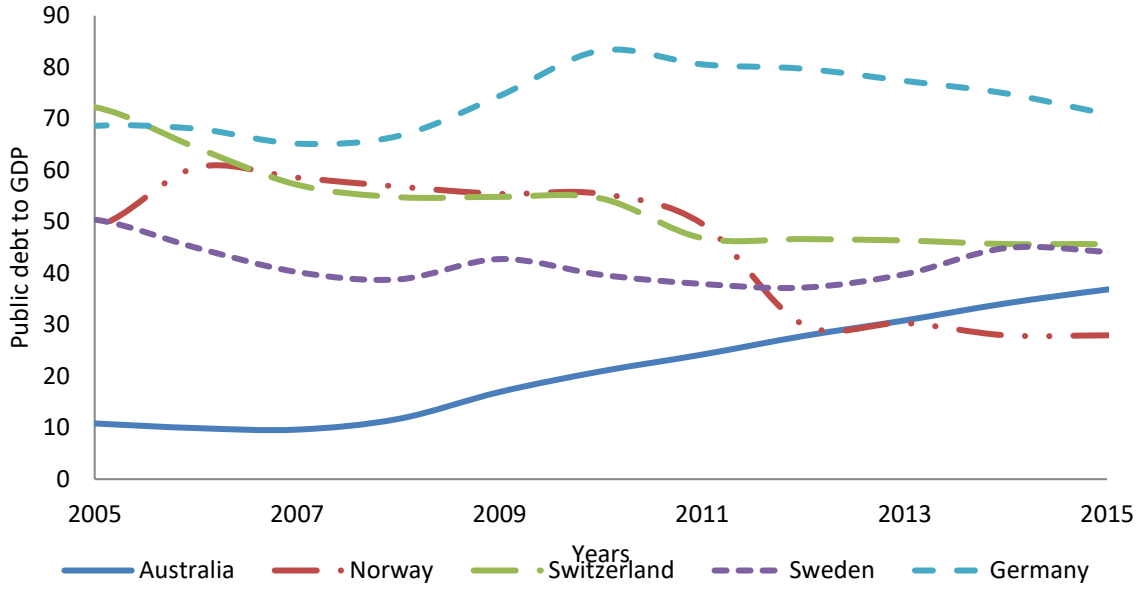
continued…

Table A1 (…continued): Stylized Facts: Sovereign Default Episodes, Banking Crises and Fiscal Consolidation Episodes

Country	Sovereign Default	Banking Crisis: Started or ongoing in any of three years prior?	Banking Crisis: Started concurrently or subsequently?	Large Fiscal Consolidation Episodes	Small Fiscal Consolidation Episodes
(1)	(2)	(3)	(4)	(5)	(6)
United Kingdom				1994-98	
United States				1993-98	
Uruguay	1983 to 1985, 1987	Yes (1981), Yes (1984)	No, No		1990, 1995-96, 2000, 2004, 2013.
Venezuela	1983 to 1988, 1990, 1995 to 1997	Yes (early 1980s), No, Yes (1994)	No, Yes (1993), No		1990, 1996, 1999, 2004-05.
Vietnam	1985 to 1998	No	Yes (1997)		n/a
Yemen	1985 to 2001	No	Yes (1996)		1991, 1995-96, 2000.
Yugoslavia	1983 to 1992	No	No		n/a
Zambia	1983 to 1994	No	Yes (1995)		1992, 1994, 1996, 1998-99, 2001, 2003, 2006, 2008, 2009, 2011.
Zimbabwe	1980, 2000 to 2004	No, Yes (late 1990s)	No, No		2010
Total	110	30	44	13	

Note: The detail on sovereign defaults (column 2) and banking crises (column 3 and 4) is extracted from Gennaioli et al. (2014). Small fiscal consolidation (column 6) episode is defined as a period where change in cyclical adjusted primary balance (CAPB) is greater than 1 per cent in a year. Large fiscal consolidation episodes (column 5) are extracted from Blochliger, Song, and Sutherland (2012). This sample period contains 110 default episodes (total of column 2) in 81 countries. Out of the 110 default episodes during 1980 to 2005, 74 (total of column 3 and 4) were accompanied by a banking crisis. In 30 cases (total of column 3), banking crises were ongoing or had started in 3 years prior to sovereign default. While in 44 (total of column 4) of these cases, banking crises occurred in the same year or in a later year.

Figure A1: Public Debt to GDP of the Selected Economies



Source: Data from 1980 to 2011 is extracted from historical public finance databases and is further updated from Fiscal Monitor April 2016.

Appendix B (Chapter 3)

Figure B1: Basel III Phase-in Arrangements (Basel Committee on Banking Supervision)

Figure E3.

Basel III phase-in arrangements
(All dates are as of 1 January)

Basel Committee on Banking Supervision
BANK FOR INTERNATIONAL SETTLEMENTS

	Phases	2013	2014	2015	2016	2017	2018	2019
Capital	Leverage Ratio		Parallel run 1 Jan 2013 – 1 Jan 2017 Disclosure starts 1 Jan 2015				Migration to Pillar 1	
	Minimum Common Equity Capital Ratio	3.5%	4.0%	4.5%				**4.5%**
	Capital Conservation Buffer				0.625%	1.25%	1.875%	**2.5%**
	Minimum common equity plus capital conservation buffer	3.5%	4.0%	4.5%	5.125%	5.75%	6.375%	**7.0%**
	Phase-in of deductions from CET1*		20%	40%	60%	80%	100%	**100%**
	Minimum Tier 1 Capital	4.5%	5.5%	6.0%				**6.0%**
	Minimum Total Capital		8.0%					**8.0%**
	Minimum Total Capital plus conservation buffer		8.0%		8.625%	9.25%	9.875%	**10.5%**
	Capital instruments that no longer qualify as non-core Tier 1 capital or Tier 2 capital		Phased out over 10 year horizon beginning 2013					
Liquidity	Liquidity coverage ratio – minimum requirement			60%	70%	80%	90%	**100%**
	Net stable funding ratio						Introduce minimum standard	

* Including amounts exceeding the limit for deferred tax assets (DTAs), mortgage servicing rights (MSRs) and financials.
– – transition periods

Source: Extracted from http://bis.org/bcbs/basel3.htm

Appendix C (Chapter 4)

Table C1: Financial Assets and Liabilities used in Calculation of Net Financial Worth

Indicator Name
Budgetary Central Government, Assets and Liabilities, Assets, Domestic, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Assets, Foreign, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Assets, Net Acquisition of Financial Assets Other than Cash, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Financial Assets, Financial Derivatives, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Financial Assets, Insurance Technical Reserves, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Financial Assets, Loans, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Financial Assets, Securities Other than Shares, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Financial Assets, Shares and Other Equity, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Classification of the stocks of assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Currency and Deposits, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Domestic, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Financial Derivatives, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Foreign, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Insurance Technical Reserves, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Loans, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Securities Other than Shares, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency
Budgetary Central Government, Assets and Liabilities, Liabilities, Shares and Other Equity, Classification of transactions in assets and liabilities, 2001 Manual, Cash, National Currency

Source: Author's calculation of net financial worth for the selected countries is based on these indicators as given in IMF data set. Indicator code are as used in IMF data set.

Table C2. The Banks used in the Analysis

Country	Bank	Bank Type
Argentina	Banco de la Nacion Argentina	Commercial Bank
	Banco Santander Rio S.A.	Commercial Bank
	Banco Macro SA	Commercial Bank
	BBVA Banco Frances SA	Commercial Bank
Australia	Macquarie Bank Limited	Investment Banks
	Westpac Banking Corporation	Commercial Bank
	UFJ Australia Limited	Investment Banks
	Investec Holdings Pty Limited	Investment Banks
	Suncorp-Metway Ltd	Commercial Bank
	HSBC Bank Australia Limited	Investment Banks
	SG Australia Limited	Commercial Bank
	Bank of Queensland Limited	Commercial Bank
	Investec Australia Limited	Investment Banks
	Credit Agricole CIB Australia Limited	Commercial Bank
Austria	Raiffeisenverband Salzburg eGen	Cooperative Banks
	Meinl Bank AG	Commercial Bank
	Kaerntner Sparkasse	Savings Bank
	Dornbirner Sparkasse Bank AG	Savings Bank
	Bank Gutmann AG	Private Banking & Asset Mgt Companies
	Raiffeisenbank Reutte rGmbH	Cooperative Banks
	Sparkasse Eferding-Peuerbach-Waiznkirchen	Savings Bank
	Autobank AG	Commercial Bank
Belgium	Investar-Investeringsmaatschappij Argenta	Investment & Trust Corporations
	Europabank NV	Commercial Bank
Brazil	Banco BMG SA	Commercial Bank
	Banco Votorantim SA	Commercial Bank
	Banco Industrial do Brasil S.A.	Commercial Bank
	Unibanco-Uniao de Bancos Brasileiros	Commercial Bank
	Banco BBM SA	Investment Banks
	Banco Alfa de Investimento S.A.	Investment Banks
	Banco Industrial e Comercial S.A. - BICBANCO	Commercial Bank
	Banco Mercantil do Brasil S.A.	Commercial Bank
	Banco do Estado do Espirito Santo S.A. - BANESTES	Commercial Bank
	Banco ABC - Brasil SA	Commercial Bank
	Banco Sudameris Brazil SA	Commercial Bank
	Conglomerado Financeiro Alfa (Combined)	Bank Holding & Holding Companies
	Banco Fibra S.A.	Commercial Bank
	Banco Indusval SA	Commercial Bank
	Banco Sofisa S.A.	Commercial Bank
Bulgaria	Unionbank EAD	Commercial Bank
	DSK Bank Plc	Savings Bank
	First Investment Bank AD	Commercial Bank
Canada	Export Development Canada	Specialized Governmental Credit Institution
	HSBC Bank Canada	Commercial Bank
	Caisse Centrale Desjardins	Cooperative Banks
	Laurentian Bank of Canada	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
Canada	Alberta Treasury Branches	Specialized Governmental Credit Institution
	Citibank Canada	Commercial Bank
	BNP Paribas (Canada)	Commercial Bank
	BPO Properties Ltd	Investment Banks
	Société Générale (Canada)	Commercial Bank
	JP Morgan Bank of Canada	Commercial Bank
	Citizens Bank of Canada	Commercial Bank
	JP Morgan Canada	Investment Banks
	ABN AMRO Bank NV	Commercial Bank
Chile	Banco de Credito e Inversiones - BCI	Commercial Bank
	Banco BICE	Commercial Bank
China	Agricultural Bank of China Limited	Commercial Bank
	Xiamen International Bank	Commercial Bank
Colombia	BBVA Colombia SA	Commercial Bank
Costa Rica	Banco Nacional de Costa Rica	Commercial Bank
Greece	ABH Financial Limited	Commercial Bank
	Cyprus Popular Bank Public Co Ltd	Commercial Bank
	Bank of Cyprus Public Company Limited-Bank of Cyprus Group	Investment Banks
	Cyprus Development Bank Public Company Ltd	Specialized Governmental Credit Institution
	Hellenic Bank Public Company Limited	Commercial Bank
	Alpha Bank Cyprus Limited	Commercial Bank
	National Bank of Greece (Cyprus) Ltd.	Commercial Bank
	Turkish Bank Ltd.	Commercial Bank
Denmark	Spar Nord Bank	Commercial Bank
	Selskabet af 1. september	Commercial Bank
	Vestjysk Bank A/S	Commercial Bank
	Arbejdernes Landsbank A/S	Commercial Bank
	Bankaktieselskabet Alm. Brand Bank	Commercial Bank
	Fjordbank Mors A/S	Savings Bank
	Selskabet af 1. september 2008 A/S	Commercial Bank
	Sparekassen Thy	Savings Bank
	Middelfart Sparekasse	Savings Bank
	DiBa Bank A/S	Commercial Bank
Dominican Republic	Grupo BHD, S.A.	Bank Holding & Holding Companies
Finland	Alandsbanken Abp-Bank of Aland Plc	Commercial Bank
France	Entenial	Commercial Bank
	Legal & General Bank (Fran	Private Banking & Asset Mgt Companies
	Crédit du Nord	Commercial Bank
	Banque Palatine	Commercial Bank
	Crédit Foncier de France	Real Estate & Mortgage Bank
	Crédit Industriel d'Alsace et de Lorraine - Banque CIAL	Commercial Bank
	BLOM Bank France SA	Commercial Bank
	BNP Paribas	Commercial Bank
	Banque Populaire De l'Ouest	Cooperative Banks
	Credit Agricole Corporate and Investment	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
France	Bank-Credit Agricole CIB	
	BPIFrance Financement	Commercial Bank
	Casden Banque Populaire	Cooperative Banks
	Banque CIN-Crédit Industriel de Normandie	Commercial Bank
	Le Crédit Lyonnais (LCL)	Commercial Bank
	Crédit Mutuel Océan	Cooperative Banks
	Banque CIC Nord Ouest	Commercial Bank
	Franfinance	Finance Companies (Credit Card, Factoring & Leasing)
	BNP Paribas Fortis	Commercial Bank
	ODDO et Compagnie	Investment Banks
	Edmond de Rothschild (France)	Commercial Bank
	Banque OBC - Odier Bungener Courvoisier	Private Banking & Asset Mgt Companies
	Union de Banques Arabes et Françaises UBAF	Commercial Bank
	Euronext Paris SA	Clearing Institutions & Custody
	SwissLife banque Privée	Private Banking & Asset Mgt Companies
	Monte Paschi Banque S.A.	Commercial Bank
	FC France	Finance Companies (Credit Card, Factoring & Leasing)
	Banque Privée Anjou	Private Banking & Asset Mgt Companies
	Banque Transatlantique SA	Private Banking & Asset Mgt Companies
	Compagnie Financière Lazard Frères	Investment Banks
	Union Financière de France Banque	Group Finance Companies
	Legal & General Bank (France)	Private Banking & Asset Mgt Companies
	KBL Richelieu Banque Privée	Commercial Bank
Germany	Bankhaus Lampe KG	Commercial Bank
	Commerzbank AG	Commercial Bank
	MKB Mittelrheinische Bank GmbH	Investment Banks
	LRP Landesbank Rheinland-Pfalz	Specialized Governmental Credit Institution
	WGZ-Bank AG Westdeutsche Genossenschafts-Zentralbank	Cooperative Banks
	Bayerische Landesbank	Specialized Governmental Credit Institution
	IKB Deutsche Industriebank AG	Investment Banks
	HSBC Trinkaus & Burkhardt AG	Private Banking & Asset Mgt Companies
	Sparda-Bank Baden-Württemberg eG	Cooperative Banks
	B. Metzler seel. Sohn & Co. Kommanditgesellschaft auf Aktien-Metzler Bank	Commercial Bank
	GE Money Bank GmbH	Commercial Bank
	Hauck & Aufhaeuser Privatbankiers KGaA	Commercial Bank
	Edekabank Aktiengesellschaft	Commercial Bank
	Bankhaus Bauer AG	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
Germany	Grenke Bank Ag	Private Banking & Asset Mgt Companies
	NordFinanz Bank AG	Commercial Bank
Ghana	Ecobank Ghana Limited	Investment Banks
	Universal Merchant Bank	Commercial Bank
Haiti	Société Générale Haitienne de Banque SA – SOGEBANK	Commercial Bank
Haiti	Unibank SA	Commercial Bank
	Capital Bank	Commercial Bank
Hong Kong	Dah Sing Bank, Ltd	Commercial Bank
	Nanyang Commercial Bank Ltd	Commercial Bank
	Industrial and Commercial Bank of China (Asia) Limited - ICBC (Asia)	Commercial Bank
	Hang Seng Bank Ltd.	Commercial Bank
	Bank of East Asia Ltd	Commercial Bank
	DBS Bank (Hong Kong) Limited	Commercial Bank
	Chekiang First Bank Ltd	Commercial Bank
	CITIC International Financial Holdings Limited	Bank Holding & Holding Companies
	China CITIC Bank International Limited	Commercial Bank
	Shanghai Commercial Bank Ltd	Commercial Bank
	Wing Lung Bank Ltd	Commercial Bank
	Chong Hing Bank Limited	Commercial Bank
	Fubon Bank (Hong Kong) Limited	Commercial Bank
	Chiyu Banking Corporation Ltd.	Commercial Bank
	Public Bank (Hong Kong) Limited	Commercial Bank
Hungary	OTP Bank Plc	Commercial Bank
	K&H Bank Zrt	Commercial Bank
	UniCredit Bank Hungary Zrt	Commercial Bank
	MKB Bank Zrt	Commercial Bank
	CIB Bank Ltd-CIB Bank Zrt	Commercial Bank
	Inter-Europa Bank Zrt	Commercial Bank
	KDB Bank Europe Ltd	Commercial Bank
Iceland	Arion Bank	Commercial Bank
	Sparisjodabanki Islands hf	Commercial Bank
Indonesia	Bank Permata Tbk	Commercial Bank
	Bank Rakyat Indonesia (Persero) Tbk	Commercial Bank
	Bank Central Asia	Commercial Bank
	Bank Internasional Indonesia Tb	Others (still to be classified as per Bankscope classification)
	PT Bank CIMB Niaga Tbk	Commercial Bank
	Bank Internasional Indonesia Tbk	Commercial Bank
	Bank Lippo Tbk.	Commercial Bank
	Bank Commonwealth	Commercial Bank
	Danareksa (Persero)	Investment Banks
Ireland	Irish Bank Resolution Corporation Limited	Commercial Bank
	Scotiabank (Ireland) Limited	Securities Firm
	Bank of Ireland-Governor and Company of the Bank of Ireland	Commercial Bank
	Commerz Europe (Ireland)	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
Israel	UBank Ltd	Commercial Bank
	Mizrahi Tefahot Bank Ltd.	Commercial Bank
	Bank Hapoalim BM	Commercial Bank
	Union Bank of Israel Ltd	Commercial Bank
	Mercantile Discount Bank Ltd.	Commercial Bank
	Bank of Jerusalem	Commercial Bank
Italy	Banca Popolare di Milano SCaRL	Cooperative Banks
	Banca Monte dei Paschi di Siena SpA-Gruppo Monte dei Paschi di Siena	Commercial Bank
Italy	Finanziaria Internationale Holdings SpA	Bank Holding & Holding Companies
Japan	The Shikoku Bank Ltd	Commercial Bank
	Hitachi Capital Corporation	Finance Companies (Credit Card, Factoring & Leasing)
	The Awa Bank	Commercial Bank
	The Bank of Saga, Ltd	Commercial Bank
	IwaiCosmo Securities Co Ltd	Investment bank
	The Shinwa Bank Ltd	Commercial Bank
	Kansai Urban Banking Corpo	Commercial Bank
	Chiba Kogyo Bank	Commercial Bank
	Yamaguchi Bank	Commercial Bank
	The Kinki Osaka Bank Ltd	Commercial Bank
	Hiroshima Bank Ltd	Commercial Bank
	Joyo Bank Ltd.	Commercial Bank
	The Suruga Bank, Ltd	Commercial Bank
	Minami-Nippon Bank, Ltd.	Commercial Bank
	The Daishi Bank Ltd	Commercial Bank
	The Kagoshima Bank Ltd	Commercial Bank
	The Hokkoku Bank Ltd	Commercial Bank
	Shizuoka Bank	Commercial Bank
	Bank of Fukuoka Ltd.	Commercial Bank
	Shinsei Bank Limited	Commercial Bank
	The 77 Bank	Commercial Bank
	The Nishi-Nippon City Bank Ltd	Commercial Bank
	Bank of Kyoto	Commercial Bank
	North Pacific Bank	Commercial Bank
	Hachijuni Bank	Commercial Bank
	The Gunma Bank Ltd	Commercial Bank
	The Chugoku Bank, Ltd	Commercial Bank
	Aichi Bank	Commercial Bank
	The Eighteenth Bank	Commercial Bank
	Shinkin Central Bank	Cooperative Banks
	Chiba Bank Ltd.	Commercial Bank
	Hyakugo Bank Ltd.	Commercial Bank
	Ogaki Kyoritsu Bank	Commercial Bank
	Aozora Bank Ltd	Investment Banks
	The Shiga Bank, Ltd	Commercial Bank
	Hokkaido Bank	Commercial Bank
	The Higo Bank	Commercial Bank
	Hyakujushi Bank Ltd.	Commercial Bank
	San-In Godo Bank, Ltd	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
Japan	Kansai Urban Banking Corporation	Commercial Bank
	The Keiyo Bank, Ltd	Commercial Bank
	Musashino Bank	Commercial Bank
	Kiyo Bank	Commercial Bank
	The Nanto Bank Ltd	Commercial Bank
	Chukyo Bank Ltd	Commercial Bank
	UFJ Bank Ltd	Commercial Bank
	Rokinren Bank	Cooperative Bank
	Miyazaki Bank	Commercial Bank
	Akita Bank Ltd	Commercial Bank
	Tochigi Bank, Ltd.	Commercial Bank
	The Aomori Bank Ltd	Commercial Bank
	The Tokyo Tomin Bank, Ltd	Commercial Bank
	Tokyo Star Bank Ltd.	Commercial Bank
	The Hokuetsu Bank Ltd	Commercial Bank
	The Ehime Bank, Ltd	Commercial Bank
	Saikyo Bank	Commercial Bank
	First Bank of Toyama, Ltd.	Commercial Bank
	Mizuho Investors Securities Co Ltd	Investment Banks
	Nagano Bank Ltd.	Commercial Bank
	Tomato Bank, Ltd	Commercial Bank
	SMBC Consumer Finance Co Ltd	Finance Companies (Credit Card, Factoring & Leasing)
	Bank of Kochi, Ltd	Commercial Bank
	Aplus Financial Co., Ltd	Finance Companies (Credit Card, Factoring & Leasing)
	The Tajima Bank Ltd	Commercial Bank
	Fukushima Bank	Commercial Bank
	Chikuho Bank	Commercial Bank
	The Okinawa Kaiho Bank Ltd	Commercial Bank
	Okasan Securities Group Inc	Bank Holding & Holding Companies
	The Fukuho Bank, Ltd	Commercial Bank
	Kanagawa Bank, Ltd.	Commercial Bank
Mexico	HSBC Mexico, SA	Commercial Bank
	Banco Nacional de Mexico, SA - BANAMEX	Commercial Bank
	Grupo Financiero BANORTE	Bank Holding & Holding Companies
	Banco Regional de Monterrey S.A. - BANREGIO	Commercial Bank
	Grupo Financiero HSBC SA de CV	Bank Holding & Holding Companies
	Nacional Financiera S.N.C.	Specialized Governmental Credit Institution
	Banco Interacciones, SA de CV	Commercial Bank
	Banco Nacional de Comercio Exterior SNC - BANCOMEXT	Specialized Governmental Credit Institution
	Banco Inbursa SA	Commercial Bank
	Banco Nacional de Obras y Servicios Publicos, SNC - BANOBRAS	Specialized Governmental Credit Institution
	Banco del Bajio	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
Mexico	Afirme Grupo Financiero SA	Bank Holding & Holding Companies
	Banco Ve por Mas, SA	Commercial Bank
Netherlands	Cooperatieve Centrale Raif	Cooperative Banks
	DVB Bank NV	Real Estate & Mortgage Bank
	CenE Bankiers	Commercial Bank
	KBC Bank Nederland NV	Commercial Bank
	Bank Mendes Gans NV	Commercial Bank
	NIBC Bank NV	Commercial Bank
	Kas Bank NV	Securities Firm
	AEGON Bank NV	Commercial Bank
	Bank of Tokyo - Mitsubishi UFJ (Holland) NV	Commercial Bank
	GE Artesia Bank	Commercial Bank
	Staalbankiers NV	Private Banking & Asset Mgt Companies
	CITCO Bank Nederland NV	Clearing Institutions & Custody
	Demir-Halk Bank (Nederland) NV-DHB Bank	Commercial Bank
	Dexia Bank Nederland NV	Commercial Bank
New Zealand	ANZ Bank, New Zealand	Commercial Bank
	National Bank of New Zealand Ltd.	Commercial Bank
	ASB Bank	Commercial Bank
	Rabobank Nederland New Zealand Banking Group	Bank Holding & Holding Companies
Norway	Sparebank 1 Nord-Norge	Savings Bank
	Nordea Bank Norge ASA	Commercial Bank
	SpareBank 1 SMN	Savings Bank
	Pareto A/S	Bank Holding & Holding Companies
	SpareBank 1 SR-Bank	Savings Bank
	BNbank ASA	Real Estate & Mortgage Bank
Pakistan	Muslim Commercial Banks	Commercial Bank
	Habib Bank Limited	Commercial Bank
	Bank of Punjab	Commercial Bank
Panama	Banco General SA	Real Estate & Mortgage Bank
	Banco Latinoamericano de Comercio Exterior S.A.	Finance Companies (Credit Card, Factoring & Leasing)
Peru	Scotiabank Peru SAA	Commercial Bank
Philippines	Metropolitan Bank & Trust Company	Commercial Bank
	Bank of The Philippine Islands	Commercial Bank
	Rizal Commercial Banking Corp.	Commercial Bank
	United Coconut Planters Bank - UCPB	Commercial Bank
Portugal	Caixa - Banco de Investime	Commercial Bank
	Caixa - Banco de Investimento SA	Commercial Bank
South Korea	Kyongnam Bank	Commercial Bank
	Korea Exchange Bank	Commercial Bank
	Citibank Korea Inc.	Commercial Bank
	Daegu Bank Ltd.	Commercial Bank
	National Federation of Fisheries Cooperatives-Suhyup Bank	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
South Korea	KB Kookmin Bank	Commercial Bank
	Industrial Bank of Korea	Commercial Bank
Romania	BRD-Groupe Societe Generale SA	Commercial Bank
Russian Federation	VTB Bank, an Open Joint-Stock Company (JSC)	Commercial Bank
	AK Bars Bank	Commercial Bank
	ZAO Citibank	Commercial Bank
	Banca Intesa ZAO	Micro-Financing Institutions
	Investbank PJSC	Investment Banks
South Africa	Industrial Development Corporation of South Africa	Bank Holding & Holding Companies
South Africa	Standard Bank Group Limited	Bank Holding & Holding Companies
	Ithala Development Finance Corporation Limited	Finance Companies (Credit Card, Factoring & Leasing)
Spain	Banco Espanol de Crédito SA, BANESTO	Commercial Bank
	Banco Popular Espanol SA	Cooperative Banks
	Caja de Ahorros de Cataluña-Caixa d'Estalvis de Catalunya	Savings Bank
	Bankinter SA	Commercial Bank
	Caixa de Aforros de Vigo, Ourense e Pontevedra-Caixanova	Savings Bank
	Banco Pastor SA	Commercial Bank
	Caja de Ahorros y Monte de piedad de Córdoba - Caja Sur	Savings Bank
	Deutsche Bank SAE	Commercial Bank
	Scotiabank Trinidad & Tobago Limited	Commercial Bank
	Republic Bank Limited	Commercial Bank
	Banco Guipuzcoano SA	Others (still to be classified as per Bankscope classification)
	Banca March SA	Commercial Bank
	First Citizens Bank Limited	Commercial Bank
	Banco Urquijo SA	Private Banking & Asset Mgt Companies
Sweden	Skandinaviska Enskilda Ban	Commercial Bank
	GE Money Bank AB	Commercial Bank
	Landshypotek Bank AB	Real Estate & Mortgage Bank
	Nordea Bank Sweden AB (publ)	Commercial Bank
	Alandsbanken Asset Management AB	Commercial Bank
Switzerland	Falcon Private Bank Ltd	Private Banking & Asset Mgt Companies
	Banque Pasche SA	Private Banking & Asset Mgt Companies
	Hinduja Bank (Switzerland) Ltd	Commercial Bank
	Banque Cantonale de Genève	Specialized Governmental Credit Institution
	Valiant Holding	Bank Holding & Holding Companies
	Banque Cantonale Vaudoise	Specialized Governmental Credit Institution

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
Switzerland	PKB Privatbank AG	Private Banking & Asset Mgt Companies
	BSI AG-BSI SA	Private Banking & Asset Mgt Companies
	BNP Paribas (Suisse) SA	Investment Banks
	Bank J. Safra Sarasin AG	Private Banking & Asset Mgt Companies
	BNP Paribas Private Bank (Switzerland) SA	Commercial Bank
	Coutts & Co Ltd	Private Banking & Asset Mgt Companies
	Union Bancaire Privée - UBP	Private Banking & Asset Mgt Companies
	Habib Bank AG Zurich	Commercial Bank
	Société Générale Private Banking (Suisse) SA	Private Banking & Asset Mgt Companies
	Corner Banca S.A.	Commercial Bank
	Clariden Leu AG	Private Banking & Asset Mgt Companies
	Rothschild Bank AG	Private Banking & Asset Mgt Companies
	Financière Syz & Co	Private Banking & Asset Mgt Companies
	CBH Compagnie Bancaire Helvétque SA-Banque SCS Alliance SA	Commercial Bank
	Bank EEK	Commercial Bank
	Banque Safdie SA	Private Banking & Asset Mgt Companies
	Finter Bank Zuerich AG	Private Banking & Asset Mgt Companies
	Morval Vonwiller Holding S.A.	Bank Holding & Holding Companies
	Bellevue Group AG	Bank Holding & Holding Companies
	Banque de Patrimoines Privés Genève BPG SA	Commercial Bank
	Mercantil Bank (Schweiz) AG	Commercial Bank
	La compagnie Benjamin de Rothschild SA	Group Finance Companies
	Banca Arner S.A.	Commercial Bank
Thailand	Bangkok Bank Public Company Limited	Commercial Bank
	Siam Commercial Bank Public Company Limited	Commercial Bank
	Kasikornbank Public Company Limited	Commercial Bank
	CIMB Thai Bank Public Company Limited	Commercial Bank
	Kiatnakin Bank Public Company Limited	Commercial Bank
United Kingdom	First Farmers and Merchants Corporation	Bank Holding & Holding Companies
	Yorkshire Building Society	Real Estate & Mortgage Bank
	C. Hoare & Co	Commercial Bank
	Barclays Plc	Bank Holding & Holding Companies

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
United Kingdom	Schroders Plc	Bank Holding & Holding Companies
	MBNA Limited	Commercial Bank
	Close Brothers Group Plc	Investment Banks
	London Scottish Bank Plc	Commercial Bank
	Darlington Building Society	Real Estate & Mortgage Bank
	Scottish Building Society	Real Estate & Mortgage Bank
	3i Group plc	Investment & Trust Corporations
	Finsbury Pavement Limited	Commercial Bank
	Barnsley Building Society	Real Estate & Mortgage Bank
	Britannia Building Society	Real Estate & Mortgage Bank
	National Counties Building Society	Real Estate & Mortgage Bank
	Market Harborough Building Society	Real Estate & Mortgage Bank
	Coutts & Co	Private Banking & Asset Mgt Companies
	Investec Bank Plc	Commercial Bank
	Skipton Building Society	Real Estate & Mortgage Bank
	HSBC Bank plc	Commercial Bank
	Yorkshire Bank Plc	Commercial Bank
	Monmouthshire Building Society	Real Estate & Mortgage Bank
	Royal Bank of Canada (Channel Islands) Limited	Commercial Bank
	Leeds Building Society	Real Estate & Mortgage Bank
	Bank of America Merrill Lynch International Limited	Securities Firm
	West Bromwich Building Society	Real Estate & Mortgage Bank
	Danske Bank	Commercial Bank
	Close Brothers Limited	Investment Banks
	N M Rothschild & Sons Limited	Commercial Bank
	Principality Building Society	Real Estate & Mortgage Bank
	Dunfermline Building Society	Real Estate & Mortgage Bank
	Newcastle Building Society	Real Estate & Mortgage Bank
	Northern Trust (Guernsey) Limited	Private Banking & Asset Mgt Companies
	Norwich & Peterborough Building Society	Real Estate & Mortgage Bank
	Kaupthing Singer & Friedlander Ltd	Commercial Bank
	Stroud & Swindon Building Society	Real Estate & Mortgage Bank
	British Arab Commercial Bank Plc	Commercial Bank
	Gulf International Bank (UK) Ltd	Investment Banks
	Scarborough Building Society	Real Estate & Mortgage Bank
	Ahli United Bank (UK) Plc	Commercial Bank
	Cumberland Building Society	Others (still to be classified as per Bankscope classification)
	Bank Leumi (UK) Plc	Commercial Bank
	Adam & Company Group plc	Bank Holding & Holding Companies
	Rothschild Bank International Limited	Private Banking & Asset Mgt Companies
	Saffron Building Society	Real Estate & Mortgage Bank
	Cambridge Building Society	Real Estate & Mortgage Bank
	Butterfield Bank (Guernsey) Limited	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
United Kingdom	Leek United Building Society	Real Estate & Mortgage Bank
	Newbury Building Society	Real Estate & Mortgage Bank
	Ipswich Building Society	Real Estate & Mortgage Bank
	Manchester Building Society	Real Estate & Mortgage Bank
	Ansbacher & Co Limited	Private Banking & Asset Mgt Companies
	Leopold Joseph Holdings Plc	Bank Holding & Holding Companies
	Celtic Bank Limited	Commercial Bank
	Heritable Bank Plc	Commercial Bank
	Weatherbys Bank Limited	Commercial Bank
	Bath Investment & Building Society BIBS	Real Estate & Mortgage Bank
	Leopold Joseph (Guernsey) Limited	Commercial Bank
	R Raphael & Sons Plc	Commercial Bank
	BSI Generali Bank (CI) Limited (Old)	Private Banking & Asset Mgt Companies
	Riggs Bank Europe Limited	Commercial Bank
	Robert W Baird Group Ltd	Bank Holding & Holding Companies
	Dalbeattie Finance Company Limited	Finance Companies (Credit Card, Factoring & Leasing)
	Sumitomo Mitsui Trust (UK) Limited	Investment & Trust Corporations
USA	Hancock Holding Company	Bank Holding & Holding Companies
	Colombo Bank	Savings Bank
	Union National Financial Corporation	Bank Holding & Holding Companies
	Cathay General Bancorp Inc	Bank Holding & Holding Companies
	Bermuda Commercial Bank Lt	Commercial Bank
	Credomatic International C	Bank Holding & Holding Companies
	Palestine Investment Bank	Investment Banks
	First Citizens BancShares	Bank Holding & Holding Companies
	Meridian Bank, National As	Commercial Bank
	Banco Agricola	Commercial Bank
	Pinnacle Bancorp, Inc	Bank Holding & Holding Companies
	Park National Corporation	Bank Holding & Holding Companies
	Arrow Financial Corp.	Bank Holding & Holding Companies
	HSBC USA Inc.	Others (still to be classified as per Bankscope classification)
	United Bankshares, Inc.	Bank Holding & Holding Companies
	Southern Michigan Bancorp, Inc	Bank Holding & Holding Companies
	Tri City Bankshares Corporation	Bank Holding & Holding Companies

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	Frontier Financial Corporation	Bank Holding & Holding Companies
	Wells Fargo Advisors LLC	Investment Banks
	First Keystone Corporation	Bank Holding & Holding Companies
	Northern Trust Corporation	Bank Holding & Holding Companies
	Bank of Hawaii Corporation	Bank Holding & Holding Companies
	FNBH Bancorp, Inc	Bank Holding & Holding Companies
	UBS Financial Services Inc	Private Banking & Asset Mgt Companies
	First Financial Bancorp	Private Banking & Asset Mgt Companies
	BMO Financial Corp	Private Banking & Asset Mgt Companies
	Bank of America Corporation	Private Banking & Asset Mgt Companies
	Comerica Incorporated	Bank Holding & Holding Companies
	Wintrust Financial Corporation	Bank Holding & Holding Companies
	Morgan Stanley	Bank Holding & Holding Companies
	Community West Bancshares	Bank Holding & Holding Companies
	Bremer Financial Corporation	Bank Holding & Holding Companies
	Prosperity Bancshares, Inc	Bank Holding & Holding Companies
	Mid Penn Bancorp, Inc	Bank Holding & Holding Companies
	Intrust Financial Corporation	Bank Holding & Holding Companies
	Citizens & Northern Corporation	Bank Holding & Holding Companies
	Bear Stearns Companies LLC	Investment Banks
	Fifth Third Bancorp	Bank Holding & Holding Companies
	Legg Mason Inc	Private Banking & Asset Mgt Companies
	Freddie Mac	Real Estate & Mortgage Bank
	State Street Corporation	Bank Holding & Holding Companies
	Merchants Bancshares Inc.	Bank Holding & Holding Companies
	Fidelity Southern Corporation	Bank Holding & Holding Companies

continued…

Table C2 (... continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	Bank of Tokyo - Mitsubishi UFJ Trust	Commercial Bank
	SunTrust Banks, Inc.	Bank Holding & Holding Companies
	Bank of New York Company, Inc. (The)	Bank Holding & Holding Companies
	Northern Trust Company (The)	Private Banking & Asset Mgt Companies
	AgriBank, FCB & Seventh District Associations (Combined)	Finance Companies (Credit Card, Factoring & Leasing)
	Cobank, ACB	Cooperative Banks
	KeyCorp	Bank Holding & Holding Companies
	M&T Bank Corporation	Bank Holding & Holding Companies
	International Finance Corporation - IFC	Multi-Lateral Government Banks
	BancWest Corporation	Bank Holding & Holding Companies
	BBVA Compass Bancshares Inc	Bank Holding & Holding Companies
	Deutsche Bank Trust Corporation	Investment & Trust Corporations
	LNB Bancorp, Inc	Bank Holding & Holding Companies
	Associated Banc-Corp.	Bank Holding & Holding Companies
	TransAtlantic Bank	Commercial Bank
	TCF Financial Corporation	Bank Holding & Holding Companies
	AmSouth Bancorporation	Bank Holding & Holding Companies
	American State Financial Corp	Bank Holding & Holding Companies
	Citizens National Bancorp, Inc	Bank Holding & Holding Companies
	William Blair & Company LLC	Investment Banks
	Zions Bancorporation	Bank Holding & Holding Companies
	Hills Bancorporation	Bank Holding & Holding Companies
	MUFG Americas Holdings Corporation	Bank Holding & Holding Companies
	Great Southern Bancorp, Inc	Bank Holding & Holding Companies
	United Community Bank	Commercial Bank
	First BanCorp	Bank Holding & Holding Companies
	HSBC Finance Corporation	Finance Companies (Credit Card, Factoring & Leasing)
	People's United Bank	Commercial Bank
	HMN Financial Inc	Bank Holding & Holding Companies
	Wachovia Bank of Delaware NA	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	New York Community Bancorp, Inc	Bank Holding & Holding Companies
	E*Trade Bank	Savings Bank
	Mellon Financial Corporation	Bank Holding & Holding Companies
	Charles Schwab & Co. Inc	Investment Banks
	Jefferies Group LLC	Investment Banks
	Hudson City Bancorp Inc	Bank Holding & Holding Companies
	Boston Private Financial Holdings Inc	Bank Holding & Holding Companies
	Tompkins Financial Corp	Bank Holding & Holding Companies
	Centrue Financial Corporation	Bank Holding & Holding Companies
	Ohio Valley Banc Corp	Bank Holding & Holding Companies
	Taylor Capital Group, Inc	Bank Holding & Holding Companies
	United Community Banks, Inc	Commercial Bank
	SNBNY Holdings Limited	Bank Holding & Holding Companies
	Integra Bank Corporation	Bank Holding & Holding Companies
	Wells Fargo & Company	Bank Holding & Holding Companies
	Firstbank Holding Company of Colorado	Bank Holding & Holding Companies
	Whitney Holding Corporation	Bank Holding & Holding Companies
	Iberiabank Corporation	Bank Holding & Holding Companies
	PNC Financial Services Group Inc	Bank Holding & Holding Companies
	NBT Bancorp, Inc.	Bank Holding & Holding Companies
	First National Corporation	Bank Holding & Holding Companies
	Southwest Bancorp, Inc	Bank Holding & Holding Companies
	Midwest Banc Holdings, Inc	Bank Holding & Holding Companies
	BOK Financial Corporation	Bank Holding & Holding Companies
	SVB Financial Group	Bank Holding & Holding Companies
	Synovus Financial Corp	Bank Holding & Holding Companies
	Colonial BancGroup, Inc	Bank Holding & Holding Companies

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	East West Bancorp, Inc	Bank Holding & Holding Companies
	Cullen/Frost Bankers, Inc	Bank Holding & Holding Companies
	Frost Bank	Commercial Bank
	FirstMerit Corporation	Bank Holding & Holding Companies
	First Horizon National Corporation	Bank Holding & Holding Companies
	Raymond James Financial Inc	Investment Banks
	Commerce Bancshares, Inc.	Bank Holding & Holding Companies
	Goldman Sachs Group, Inc	Bank Holding & Holding Companies
	Piper Jaffray & Co	Investment Banks
	Sterling Bancshares, Inc	Bank Holding & Holding Companies
	First National of Nebraska, Inc.	Bank Holding & Holding Companies
	Sandy Spring Bancorp, Inc.	Bank Holding & Holding Companies
	Penns Woods Bancorp, Inc	Bank Holding & Holding Companies
	Sun Bancorp, Inc	Bank Holding & Holding Companies
	Fulton Financial Corporation	Bank Holding & Holding Companies
	UMB Financial Corporation	Bank Holding & Holding Companies
	Apple Bank for Savings	Commercial Bank
	MBNA Corporation	Bank Holding & Holding Companies
	DNB Financial Corporation	Bank Holding & Holding Companies
	Bank of Kentucky Financial Corporation	Bank Holding & Holding Companies
	M&I Bank, FSB	Savings Bank
	Susquehanna Bancshares, Inc.	Bank Holding & Holding Companies
	TCF National Bank	Savings Bank
	BNY Mellon, National Association	Commercial Bank
	FBOP Corporation	Bank Holding & Holding Companies
	American Express Bank Ltd.	Commercial Bank
	Valley National Bancorp	Bank Holding & Holding Companies
	Chevy Chase Bank, FSB	Savings Bank
	Astoria Financial Corporation	Bank Holding & Holding Companies
	Investors Bancorp, MHC	Bank Holding & Holding Companies

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	Milford Bank (The)	Commercial Bank
	Hato Rey Oriental CTR BR	Commercial Bank
	MidSouth Bancorp, Inc	Bank Holding & Holding Companies
	Pacific Capital Bancorp	Bank Holding & Holding Companies
	Bank Leumi Le-Israel Corporation	Bank Holding & Holding Companies
	Citigroup Inc	Bank Holding & Holding Companies
	Arvest Bank Group, Inc.	Bank Holding & Holding Companies
	First of Long Island Corporation (The)	Bank Holding & Holding Companies
	Westernbank Puerto Rico	Commercial Bank
	South Financial Group, Inc	Bank Holding & Holding Companies
	Trustmark Corporation	Bank Holding & Holding Companies
	Wilmington Trust Corporation	Commercial Bank
	MB Financial Inc	Commercial Bank
	Citizens Republic Bancorp, Inc	Bank Holding & Holding Companies
	Old National Bancorp	Bank Holding & Holding Companies
	Central Bancompany	Bank Holding & Holding Companies
	Stifel Financial Corp	Bank Holding & Holding Companies
	Eastern Bank Corporation	Bank Holding & Holding Companies
	National Penn Bancshares, Inc.	Bank Holding & Holding Companies
	Doral Financial Corporation	Bank Holding & Holding Companies
	Corus Bankshares, Inc	Bank Holding & Holding Companies
	PlainsCapital Bank	Commercial Bank
	First Citizens Bancorporation Inc.	Bank Holding & Holding Companies
	First Midwest Bancorp, Inc	Bank Holding & Holding Companies
	OFG Bancorp	Bank Holding & Holding Companies
	First Interstate Bancsystem, Inc	Bank Holding & Holding Companies
	Community Bank System, Inc.	Bank Holding & Holding Companies
	Santander BanCorp	Bank Holding & Holding Companies
	CIBC World Markets Corp	Investment Banks

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	CVB Financial Corp	Bank Holding & Holding Companies
	Provident Bankshares Corporation	Bank Holding & Holding Companies
	First Commonwealth Financial Corp.	Bank Holding & Holding Companies
	Chemical Financial Corporation	Bank Holding & Holding Companies
	WesBanco, Inc.	Bank Holding & Holding Companies
	R-G Premier Bank of Puerto Rico	Real Estate & Mortgage Bank
	BancFirst Corporation	Bank Holding & Holding Companies
	First Banks, Incorporated	Bank Holding & Holding Companies
	Renasant Corporation	Bank Holding & Holding Companies
	First Merchants Corporation	Bank Holding & Holding Companies
	First Financial Bankshares, Inc	Bank Holding & Holding Companies
	Mizuho Bank (USA)	Commercial Bank
	Harleysville National Corporation	Commercial Bank
	T. Rowe Price Group, Inc	Private Banking & Asset Mgt Companies
	Irwin Financial Corporation	Bank Holding & Holding Companies
	City National Bank of Florida	Commercial Bank
	Westamerica Bancorporation	Bank Holding & Holding Companies
	Central Pacific Financial Corp.	Bank Holding & Holding Companies
	1st Source Corporation	Bank Holding & Holding Companies
	Columbia Bank (MHC)	Savings Bank
	W.T.B. Financial Corporation	Bank Holding & Holding Companies
	Banner Corporation	Bank Holding & Holding Companies
	Simmons First National Corporation	Bank Holding & Holding Companies
	SWS Group Inc	Investment Banks
	Johnson Bank	Commercial Bank
	Amarillo National Bancorp, Inc.	Bank Holding & Holding Companies
	AMCORE Financial, Inc.	Bank Holding & Holding Companies
	Community Trust Bancorp, Inc	Bank Holding & Holding Companies
	First Busey Corporation	Bank Holding & Holding Companies

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	BTC Financial Corporation	Bank Holding & Holding Companies
	Southside Bancshares, Inc	Bank Holding & Holding Companies
	First American Bank Corporation	Bank Holding & Holding Companies
	Republic Bancorp Inc.	Bank Holding & Holding Companies
	City Holding Company	Bank Holding & Holding Companies
	Lakeland Bancorp, Inc	Bank Holding & Holding Companies
	Ocean Bankshares, Inc	Bank Holding & Holding Companies
	Valley View Bancshares, Inc	Bank Holding & Holding Companies
	Hudson Valley Holding Corp	Others (still to be classified as per Bankscope classification)
	Financial Institutions, Inc	Others (still to be classified as per Bankscope classification)
	Broadway Bancshares, Inc.	Bank Holding & Holding Companies
	CoBiz Financial Inc	Bank Holding & Holding Companies
	Sterling Bancorp	Bank Holding & Holding Companies
	SunTrust Robinson Humphrey, Inc	Investment Banks
	Smithtown Bancorp, Inc	Bank Holding & Holding Companies
	First Community Bancshares, Inc	Bank Holding & Holding Companies
	Capital City Bank Group, Inc.	Bank Holding & Holding Companies
	Cambridge Financial Group, Inc	Bank Holding & Holding Companies
	West Coast Bancorp	Bank Holding & Holding Companies
	American Chartered Bank	Commercial Bank
	Green Bankshares, Inc.	Bank Holding & Holding Companies
	Southern Bancshares (North Carolina), Inc	Bank Holding & Holding Companies
	Seacoast Banking Corporation of Florida	Bank Holding & Holding Companies
	OceanFirst Financial Corp	Bank Holding & Holding Companies
	1867 Western Financial Corporation	Bank Holding & Holding Companies
	Independent Bank Corporation	Bank Holding & Holding Companies

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	Univest Corporation of Pennsylvania	Bank Holding & Holding Companies
	Morgan Keegan & Company Inc.	Investment Banks
	German American Bancorp	Bank Holding & Holding Companies
	Dickinson Financial Corporation	Bank Holding & Holding Companies
	First Regional Bancorp	Bank Holding & Holding Companies
	West Suburban Bancorp, Inc	Bank Holding & Holding Companies
	Old Second Bancorp, Inc	Bank Holding & Holding Companies
	First Commercial Bank	Commercial Bank
	NewBridge Bancorp	Bank Holding & Holding Companies
	Canandaigua National Corporation	Bank Holding & Holding Companies
	ESB Financial Corporation	Bank Holding & Holding Companies
	National Mercantile Bancorp	Bank Holding & Holding Companies
	Bridge Bancorp, Inc	Bank Holding & Holding Companies
	The Bank of Kentucky, Inc	Commercial Bank
	Enterprise Bancorp Inc	Bank Holding & Holding Companies
	Lauritzen Corporation	Bank Holding & Holding Companies
	National Consumer Cooperative Bank	Commercial Bank
	Farmers Capital Bank Corporation	Bank Holding & Holding Companies
	Meta Financial Group, Inc	Bank Holding & Holding Companies
	Wilson Bank Holding Company	Bank Holding & Holding Companies
	Star Financial Group, Inc.	Bank Holding & Holding Companies
	ConnectOne Bancorp Inc	Bank Holding & Holding Companies
	AmericanWest Bancorporation	Bank Holding & Holding Companies
	Cadence Financial Corporation	Bank Holding & Holding Companies
	Intervest Bancshares Corporation	Bank Holding & Holding Companies
	Emprise Financial Corporation	Bank Holding & Holding Companies
	Marquette National Corporation	Bank Holding & Holding Companies
	WNB Bancshares, Inc	Bank Holding & Holding Companies

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	Isabella Bank Corporation	Bank Holding & Holding Companies
	Heritage Commerce Corp	Bank Holding & Holding Companies
	Firstbank Corporation	Bank Holding & Holding Companies
	Chemung Financial Corporation	Bank Holding & Holding Companies
	First Bancorp, Inc (The)	Bank Holding & Holding Companies
	First United Corporation	Bank Holding & Holding Companies
	Far East National Bank	Commercial Bank
	C&F Financial Corporation	Bank Holding & Holding Companies
	Peoples Bancorp	Bank Holding & Holding Companies
	Henderson Citizens Bancshares	Bank Holding & Holding Companies
	Bank of Tampa (The)	Commercial Bank
	Ames National Corporation	Bank Holding & Holding Companies
	Orrstown Financial Services, Inc	Bank Holding & Holding Companies
	Marquette Financial Companies	Bank Holding & Holding Companies
	Colony Bankcorp, Inc	Bank Holding & Holding Companies
	Hawthorn Bancshares Inc	Bank Holding & Holding Companies
	Farmers National Banc Corp	Bank Holding & Holding Companies
	Provident Financial Holdings, Inc	Bank Holding & Holding Companies
	Palmetto Bancshares, Inc	Bank Holding & Holding Companies
	Bank First National Corp	Bank Holding & Holding Companies
	AmeriServ Financial, Inc	Bank Holding & Holding Companies
	ACNB Corporation	Bank Holding & Holding Companies
	Capital Trust Holdings Inc	Bank Holding & Holding Companies
	Baylake Corporation	Bank Holding & Holding Companies
	PAB Bankshares, Inc	Bank Holding & Holding Companies
	Bank of Commerce Holdings	Bank Holding & Holding Companies
	Unity Bancorp, Inc	Bank Holding & Holding Companies

continued…

Table C2 (... continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	Northway Financial, Inc	Bank Holding & Holding Companies
	Old Point Financial Corporation	Bank Holding & Holding Companies
	TF Financial Corporation	Bank Holding & Holding Companies
	O.A.K. Financial Corporation	Bank Holding & Holding Companies
	Croghan Bancshares, Inc	Bank Holding & Holding Companies
	Falcon International Bank	Commercial Bank
	Kentucky Bancshares, Inc	Bank Holding & Holding Companies
	Community Bancshares, Inc	Bank Holding & Holding Companies
	Citizens 1st Bank	Commercial Bank
	Lincoln Bancorp	Bank Holding & Holding Companies
	Norwood Financial Corp	Bank Holding & Holding Companies
	First Pulaski National Corporation	Bank Holding & Holding Companies
	Meridian Bank, National Association	Commercial Bank
	NB&T Financial Group, Inc	Bank Holding & Holding Companies
	SB Financial Group, Inc	Bank Holding & Holding Companies
	Highlands Bankshares, Inc	Bank Holding & Holding Companies
	Union Bankshares, Inc	Bank Holding & Holding Companies
	Albank Corporation	Bank Holding & Holding Companies
	Citizens Incorporated	Bank Holding & Holding Companies
	DCB Financial Corporation	Bank Holding & Holding Companies
	Latin American Agribusiness Development Corporation SA	Investment & Trust Corporations
	CIB Marine Bancshares, Inc	Bank Holding & Holding Companies
	Deutsche Bank Trust Company Delaware	Commercial Bank
	Delta National Bank and Trust Company	Commercial Bank
	Iowa First Bancshares Corp	Bank Holding & Holding Companies
	Denmark Bancshares, Inc	Bank Holding & Holding Companies
	Bankers' Bank	Commercial Bank
	Habersham Bancorp	Bank Holding & Holding Companies
	International Finance Bank	Commercial Bank

continued…

Table C2 (… continued): The Banks used in the Analysis

Country	Bank	Bank Type
USA	Citizens Security Bank (Guam), Inc.	Commercial Bank
	Fentura Financial, Inc	Bank Holding & Holding Companies
	American Savings Bank, FSB	Savings Bank
	Gateways Bank, Federal Savings Bank	Savings Bank
	BankPacific Ltd	Savings Bank
	Gleacher & Company Inc	Investment Banks
	Siebert Financial Corp	Securities Firm
Venezuela	Mercantil Servicios Financieros, C.A.	Bank Holding & Holding Companies
	Banco de Venezuela, S.A.C.A.	Commercial Bank

Note. Column 2 indicates the number of banks included in the Bankscope dataset and we include these banks in the disaggregated analysis. These were the maximum number of banks in Bankscope database on 14 October 2014 for which the capital adequacy ratios were available. We use these capital adequacy ratios from the capitalization section of Summary Analytics. Column 3 provides the total number of banks in the economy. This data is extracted from the central banks of the countries where this detail is available. For some economies, we use other country specific resources. For instance, we use https://thebanks.eu/banks-by-country/Norway for the case of Norway.

Table C3. Definition of Variables Used in the Study

Variable	*Definition*
Dependent Variables	
Primary balance to GDP (*S*)	We calculated the primary balance by deducting government expenditure (without the amount of interest paid on public debt) from government revenue. Both government revenue and government primary expenditure are a per cent of real GDP.
Capital adequacy ratios (*W*), including Tier-1 and Tier-2	Tier-1 is defined as the Tier-1 capital divided by the risk-weighted assets. Similarly, Tier-2 is defined as the Tier-2 capital divided by the risk-weighted assets. Tier-1 capital includes equity and retained earnings. Tier-2 capital includes equity, retained earnings, preferred stock and subordinated bonds. Risk-weighted assets are calculated by multiplying bank assets with their respective risk weights allocated by the Basel Accords. These bank assets include: (i) loans extended to firms, (ii) loans extended to consumers (such as mortgages), (iii) investment securities and (iv) government securities.
Independent Variables	
Fiscal consolidation (*FC*)	A fiscal consolidation episode is defined as a period in which the cyclically CAPB improves by at least 1.5 per cent of GDP in a year, or by at least one per cent of GDP per year in a period of two consecutive years.
Public debt per cent of GDP (*D*)	General government gross public debt per cent of GDP. We follow the concept of gross debt given in Chapter 7, Section F on Memorandum Items, and Subsection 1 on Debt of the IMF GFS. Paragraph 7.142 of the IMF GFS defines debt as all liabilities that require payments by debtors to creditors at a date or dates in the future. These payments include interest and/or the principal. Therefore, all liabilities in the GFS are debt, except the shares, other equity and financial derivatives.
GVAR	GVAR indicates the temporary government expenditure. We calculated this by using Equation 4.6.1.1.
YVAR	YVAR is a business cycle indicator. We calculated this by using Equation 4.6.1.2.
Total assets	Total assets include loans, other earning assets and non-earning assets. The complete details on total assets, as calculated in the Bankscope database, are provided in Table 4.1.
Return on assets	Return on the average assets of the individual bank.
Output gap	The output gap refers to the difference between the actual and potential GDP as a per cent of potential GDP.
Long-term interest rates	Long-term interest rates on the general government debt.

Table C4: Number of Banks in Bankscope Database

Country	No_of_Banks_BS	Total_No_of_Banks
(1)	(2)	(3)
Argentina	4	16
Australia	10	59
Austria	8	60
Belgium	2	22
Brazil	15	30
Bulgaria	3	26
Canada	13	82
Chile	2	12
China	2	37
Colombia	1	14
Costa Rica	1	15
Greece	8	38
Denmark	10	116
The Dominican Republic	1	5
Finland	1	14
France	32	638
Germany	16	84
Ghana	2	39
Haiti	3	6
Hong Kong	15	190
Hungary	7	30
Iceland	2	5
Indonesia	9	120
Ireland	4	19
Israel	6	20
Italy	3	580
Japan	70	198
Mexico	13	48
The Netherlands	14	50
New Zealand	4	26
Norway	6	168
Pakistan	2	34
Panama	2	70
Peru	1	14
The Philippines	4	36
Portugal	2	31
South Korea	7	148
Romania	1	41
Russia	5	575
South Africa	3	43
Spain	14	48
Sweden	5	117
Switzerland	29	253
Thailand	5	36
The UK	64	345

continued…

Table C4 (…continued): Number of Banks in Bankscope Database

Country	No_of_Banks_BS	Total_No_of_Banks
(1)	(2)	(3)
The US	305	6,799
Venezuela	2	25

Note: Column 2 indicates the number of banks included in the Bankscope dataset, and we included these banks in the disaggregated analysis. These were the maximum number of banks in the Bankscope database on 14 October 2014 for which the capital adequacy ratios were available. We used these capital adequacy ratios from the capitalisation section of Summary Analytics. Column 3 provides the total number of banks in the economy. These data were extracted from the central banks of the countries where this detail was available. For some economies, we used other country-specific resources. For example, for the case of Norway, we used https://thebanks.eu/banks-by-country/Norway.

Appendix D (Chapter 5)

Investment Aspect of Public Debt

Consistent with governmental accounting concepts, Seiferling (2013) reported that the general government debt in fiscal statistics includes public investment aspects, which are elaborated in a simple model below.

Under accrual accounting, the operating balance is represented as follows:

$$NOB_t = TCR_t - TCE_t \quad \text{(D1}$$

where NOB_t is the net operating balance at time t; TCR_t is the total current revenues, including expected earnings from the future fund; and TCE_t is the total current expenses (the real operating expenses).[221] Thus, the net lending or surplus of any institutional unit at time t will be (δ_t) as follows[222]:

$$\delta_t = NOB_t - \widetilde{NFA_t} \quad \text{(D2}$$

where $\widetilde{NFA_t}$ represents the net acquisition of non-financial assets of any institutional unit, which is used in the calculation of surplus or deficits. The net result of Equation D2 can be either of surplus or deficits, which can be used as follows:

$$\delta < 0 = (-FA)\ or\ (+L)^{223} \quad \text{(D3}$$

$$\delta > 0 = (+FA)\ or\ (-L)^{224} \quad \text{(D4}$$

Then, the net result of the net acquisition of financial assets and net incurrence of liabilities can be represented as follows:

$$\delta_t = \overbrace{\widetilde{\sum_{i=1}^{8} st_{it}^{FA}}}^{Net\ acquisition\ of\ financial\ assets} - \underbrace{\sum_{i=1}^{8} \widetilde{st}_{it}^{L}}_{Net\ incurrance\ of\ liabilities} \quad \text{(D5}$$

[221] Expected earnings of future funds are included when considering the case of the Australian general government. See Budget Strategy and Outlook, 2011–12, *Budget Paper No. 1*, Statement 3, Table 4 (Australian Government, 2012) for further details.
[222] Here, the institutional unit is the general government of Australia, since it can be the entire public sector or the state, central or local government. For further details, see Chapter 2 of the GFS Manual 2001 (IMF, 2001).
[223] In the case of deficits, the deficit amount is financed through the incurrence of liabilities or the sale of financial assets.
[224] In the case of surplus, the amount is invested either to pay off the liabilities or invest in financial assets.

where:

$\widetilde{st}_1^f$ = currency and deposits (*f* = *FA* or *f* = *L*)

$\widetilde{st}_2^f$ = securities other than shares (*f* = *FA* or *f* = *L*)

$\widetilde{st}_3^f$ = loans (*f* = *FA* or *f* = *L*)

$\widetilde{st}_4^f$ = shares and other equity (*f* = *FA* or *f* = *L*)

$\widetilde{st}_5^f$ = insurance technical reserves (*f* = *FA* or *f* = *L*)

$\widetilde{st}_6^f$ = other accounts receivable (*f* = *FA*)/other accounts payable (*f* = *L*)

$\widetilde{st}_7^f$ = unfunded superannuation liability (*f* = *L*)

$\widetilde{st}_8^f$ = other employee entitlements and provisions (*f* = *L*).

The common mistake in the existing literature is the missing aspect of flow items. For instance, the generic definition of gross public debt is the sum of surplus/deficits over an entire period. By incorporating flow items, the stock (*st*) of any instrument, *i*, at any time, *t*, can be rewritten as follows (Seiferling, 2013):

$$\overbrace{st_{it}^f}^{stocks} = \overbrace{st_{it-1}^f}^{Stocks\ in\ (t-1)} + \overbrace{\underbrace{\widetilde{st}_{it}^f}_{transactions} + \Delta re - valu_{st_{it}^f} + \Delta vol_{st_{it}^f}}^{flows} \quad \text{(D6}$$

where st_{it-1}^f represents the openings balance of the stock of instrument *i*, and $\widetilde{st}_{it}^f$ represents all transactions relating to this instrument during time *t*. *SNA 2008* (United Nations Statistics Division, 2018) considers $\Delta re - valu_{st_{it}^f}$ and $\Delta vol_{st_{it}^f}$ two key components of the flows. Although these components are not part of the transactions, both components can change the value of assets, liability and net worth. The first component, $\Delta re - valu_{st_{it}^f}$, includes revaluation of asset or liability (*f* = *NFA*, *FA* or *L*) and capital gain or losses on this instrument *i* at any point *t*. For instance, the changes in the monetary value of any asset or liability can change these values because of exchange rate changes or the structure of prices in the economy. These changes are classified as revaluation change.[225] The second component, $\Delta vol_{st_{it}^f}$,

[225] For further details, see *GFSM 2001* (IMF, 2001).

involves changes in the volume of an asset and liability (*f = NFA, FA* or *L)* for instrument *i* at time *t*. Following the IMF (2013), this component is not a result of the revaluation and transactions. Some examples of this component are financial or banking crises, natural disasters, written-off unilateral debts, and restructuring and reclassification of institutional units.

Based on Equations D1 to D6, it is obvious that the deficit measures do not incorporate the last two components of Equation D6. Therefore, the deficits are significantly large during periods of financial or banking crisis, natural disasters or large fluctuation in exchange rates. These significant deficits have real effects on debt and the government balance sheet. Consequently, the key difference between deficits and debt is *stock transactions residual*.

Based on Equation D6, the total stock of assets and liabilities is the sum of the eight items mentioned under Equation D5, and can be expressed as follows:

$$f_t = \sum_{i=1}^{8} st_{it}^{f} = \sum_{i=1}^{8} \left(st_{it-1}^{f} + \widetilde{st}_{it}^{f} + \Delta re - valu_{st_{it}^{f}} + \Delta vol_{st_{it}^{f}} \right);\ (f \equiv \{FA, NFA, L\}) \quad \text{(D7}$$

Equation D7 presents a snapshot of the accumulation of all assets and liabilities of an institutional unit (the general government in this case) at a specific point in time, normally at the end of the year. This includes (st_{it-1}^{f}) stock from the previous period, along with the flows of an institutional unit ($\widetilde{st}_{it}^{f} + +\Delta re - valu_{st_{it}^{f}} + \Delta vol_{st_{it}^{f}}$). Based on Equation D7, the net worth or financial position of any government at time *t* is the total stock of all assets (financial and non-financial) minus the total stock of the liabilities, and can be written as:

$$Net\ Worth_t = FA_t + NFA_t - L_t \quad \text{(D8}$$

Considering only financial assets, net financial worth can be written as:

$$Net\ Financial\ Worth_t = FA_t - L_t \quad \text{(D9}$$

Figure D1: Value at Risk (VAR), Conditional Value and Risk (CVaR) Framework for Financial Net Worth Approach

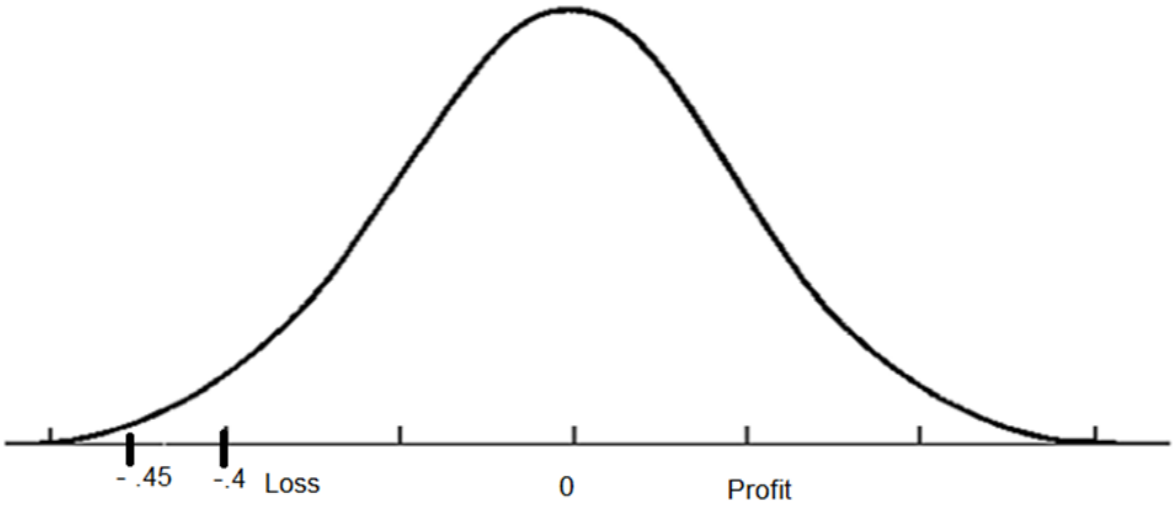


Figure 2. In VaR and CVaR framework for public debt overhang and financial net worth approaches, 10% VaR and 10% CVaR indicate the maximum loss on this portfolio that can be – 0.40 and – 0.45 respectively, where conditional VaR is the average amount of loss in worst 10% of the cases.

Source: Author's own extraction

Appendix E (Chapter 6)

Table E1: Unit Root Tests

Country	Augmented Dickey–Fuller test statistics							
	Null hypothesis: Series is non-stationary							
	Level				1st Difference			
	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Argentina	-1.32	-1.92	-4.52***	-2.72	-4.28***	-4.35***		-7.18***
Australia	-3.01***	-2.03	-6.83***	-6.67***		-3.68***		
Austria	-4.36***	-1.92	-7.08***	-7.78***		-5.18***		
Belgium	-1.92*	0.13	-5.46***	-5.76***	-9.83***	-3.67***		
Brazil	-1.91*	-3.39*	-4.78***	-3.39***	-9.08***	-5.70***		
Bulgaria	-3.35*	-2.99	-3.24***	-3.41*	-4.81***	-13.29***		-5.89***
Canada	-1.49	-2.33	-5.98***	-8.07***	-6.25***	-4.28***		
Chile	-2.90***	-2.50	-5.69***	-8.21***		-4.23***		
China	-3.53**	3.43	-0.08	-3.68***		-9.30***	-3.85***	
Colombia	-2.92***	-2.86	-4.10***	-6.39***		-3.73***		
Costa Rica	-4.52***	-0.82	-6.10***	-5.51***		-5.97***		
Denmark	-3.15**	-0.60	-7.36***	-7.32***	-5.99***	-3.49***		
Dominican Republic	-3.35***	-2.15	-8.81***	-7.79***		-9.19***		
Finland	-1.94**	-3.02	-7.72***	-7.44***	-6.53***	-4.67***		
France	-2.98***	-2.70	-5.59***	-6.09***		-5.34***		
Germany	-3.98***	-2.79	-5.08***	-5.90***		-4.22***		
Ghana	-3.96***	-2.68	-5.45***	-5.25***		-5.56***		
Greece	-2.39**	-1.37	-7.74***	-6.82***	-8.18***	-6.97***		
Haiti	-2.03**	-2.33	-4.36***	-3.08	-5.11***	-6.18***		-5.82***
Honduras	-2.52**	-0.34	-6.66***	-8.41***	-7.63***	-7.26***		
Hong Kong	-3.75**	-2.28	-4.53***	-6.60***	-4.53***	-2.52**		
Hungary	-3.52***	-2.59	-5.20***	-5.34***		-4.17***		

continued…

Table E1 (…continued): Unit Root Tests

	Augmented Dickey–Fuller test statistics							
	Null hypothesis: Series is non-stationary							
	Level				1st Difference			
Country	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Iceland	-5.07***	-4.14***	-8.01***	-9.45***				
India	-3.41**	-2.05	-6.99***	-6.48***	-6.25***	-7.45***		
Indonesia	-1.14	-3.00**	-6.01***	-8.55***	-8.52***	-4.74***		
Ireland	-2.83***	-2.77*	-6.38***	-6.49***		-3.50***		
Israel	-2.14**	-9.90***	-6.14***	-4.30***	-6.79***			
Italy	-1.61*	-1.99	-7.88***	-6.63***	-8.30***	-4.34***		
Japan	-1.43	0.72	-5.23***	-5.95***	-6.47***	-4.45***		
Mexico	-1.73*	-1.80	-5.84***	-6.95***	-7.16***	-6.81***		
Netherlands	-3.57***	-1.97	-7.26***	-4.05***		-3.99***		
New Zealand	-2.57**	-2.54	-7.73***	-10.08***	-5.37***	-3.38***		
Nicaragua	-7.68***	-2.94*	-8.15***	-107.27***		-6.15***		
Norway	-1.12	-2.03	-5.79***	-5.46***	-6.91***	-6.78***		
Pakistan	-1.98**	-2.39	-5.23***	-7.82***	-8.19***	-6.86***		
Panama	-4.32***	-0.43	-6.02***	-4.92***		-4.24***		
Paraguay	-3.59***	-0.82	-6.48***	-6.78***		-4.82***		
Peru	-2.95***	-2.79	-8.41***	-5.59***		-7.42***		
Philippines	-3.18**	-0.55	-5.64***	-7.17***	-5.05***	-5.12***		
Polnad	-2.78*	-0.76	-2.56**	-1.99**	-4.60***	-5.61***	-4.70***	-4.76***
Portugal	-3.00***	-2.74	-3.46***	-7.18***		-3.59***		
Romania	-2.35**	0.46	-4.23***	-2.69***	-8.105***	-3.59***		
Russian Federation*	-1.76*	-3.55***	2.20	-2.86	-3.76***		-1.84*	-3.19***
South Africa	-2.73***	-2.63*	-7.20***	-7.38***		-7.05***		
South Korea	-2.95***	-2.07	-4.93***	-5.75***		-4.42***		
Spain	-2.91***	-2.65	-7.33***	-7.39***		-3.46***		

continued…

Table E1 (…continued): Unit Root Tests

	Augmented Dickey–Fuller test statistics							
	Null hypothesis: Series is non-stationary							
	Level				1st Difference			
Country	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sweden	-3.19***	-0.42	-8.55***	-7.82***		-5.83***		
Switzerland	-2.71***	0.03	-5.47***	-4.41***		-6.51***		
Thailand	-3.83***	-3.46*	-2.10**	-1.54		-5.14***	-7.83***	-12.66***
Turkey	-2.77***	-2.05	-5.64***	-7.69***		-6.74***		
United Kingdom	-3.34***	-0.87	-7.09***	-6.50***		-3.18***		
Uruguay	-4.73***	-2.67*	-6.97***	-9.69***		-4.72***		
USA	-3.73**	-2.63	-4.04	-0.16	-5.88***	-3.06**	-10.69***	-6.43***
Venezuela	-0.12	-0.92	-6.57***	-6.21***	-8.86***	-7.80***		

continued…

Table E1 (…continued): Unit Root Tests

Country	Phillips–Perron test statistics							
	Null hypothesis: Series is non-stationary							
	Level				1st Difference			
	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Argentina	-1.37	-1.98	-4.49***	-5.57***	-4.32***	-4.46***		
Australia	-2.45**	-0.86	-6.81***	-6.64***		-3.68***		
Austria	-4.11***	2.08	-7.08***	-7.77***		-5.15***		
Belgium	-1.78*	0.21	-5.43***	-5.59***	-9.83***	-3.71***		
Brazil	-1.90*	-2.50	-4.80***	-3.40***	-9.05***	-5.70***		
Bulgaria	-3.38*	-2.98	-3.28***	-3.41*	-4.81***	-10.49***		-6.23***
Canada	-1.49	0.28	-5.87***	-8.05***	-6.27***	-4.30***		
Chile	-2.58**	-1.09	-5.66***	-8.61***		-4.29***		
China	-2.10	-1.63	-0.53	-2.35**	-4.68***	-9.28***	-3.91***	
Colombia	-3.07***	0.85	-3.85***	-6.61***		-3.85***		
Costa Rica	-2.93***	-0.89	-6.09***	-5.55***		-5.93***		
Denmark	-1.71*	-0.42	-7.36***	-7.32***	-5.84***	-3.55***		
Dominican Republic	-3.35***	-2.24	-8.81***	-7.79***		-8.93***		
Finland	-2.10**	-2.21	-7.72***	-7.44***	-6.57***	-3.42***		
France	-2.98***	-2.75	-5.60***	-6.12***		-5.28***		
Germany	-3.98***	1.27	-5.05***	-5.90***		-4.24***		
Ghana	-3.98***	-1.63	-5.45***	-4.84***		-5.53***		
Greece	-2.31**	-1.58	-7.74***	-6.810***	-8.29***	-7.04***		
Haiti	-1.99**	-1.20	-3.54***	-1.92*	-7.93***	-4.87***		-5.69***
Honduras	-2.52**	-0.41	-6.66***	-8.47***	-7.63***	-7.29***		
Hong Kong	-3.85**	-2.69	-4.58***	-6.72***	-10.27***	-2.52**		
Hungary	-3.52***	-0.58	-5.15***	-5.27***		-3.96***		
Iceland	-5.04***	-0.70	-8.01***	-9.45***		-4.66***		
India	-2.61*	-2.05	-6.99***	-6.48***	-6.15***	-7.45***		

continued…

Table E1 (…continued): Unit Root Tests

	Phillips–Perron test statistics							
	Null hypothesis: Series is non-stationary							
	Level				1st Difference			
Country	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Indonesia	-2.60**	-1.10	-6.02***	-7.73***	-9.59***	-3.92***		
Ireland	-2.93***	-0.58	-6.38***	-6.51***		-3.51***		
Israel	-2.27**	-7.91***	-6.17***	-4.30***	-6.79***			
Italy	-1.52	-0.56	-8.01***	-6.63***	-8.44***	-4.35***		
Japan	-1.71*	-2.08	-6.87***	-7.28***	-6.48***	-4.34***		
Mexico	-1.74*	-1.81	-5.80***	-6.95***	-7.16***	-6.79***		
Netherlands	-3.57***	-0.58	-7.26***	-7.26***		-3.99***		
New Zealand	-2.05**	-2.55	-7.58***	-9.75***	-5.38***	-5.77***		
Nicaragua	-6.91***	-0.51	-13.07***	-107.27***		-6.15***		
Norway	-1.14	-2.23	-5.62***	-5.18***	-6.97***	-6.78***		
Pakistan	-1.96**	-2.38	-3.50***	-8.19***	-8.19***	-6.85***		
Panama	-5.15***	-0.45	-6.02***	-4.92***		-4.26***		
Paraguay	-3.57***	-1.01	-6.48***	-6.78***		-4.89***		
Peru	-2.98***	-1.97	-8.37***	-5.59***		-7.07***		
Philippines	-3.24**	-0.26	-5.64***	-7.28***	-8.77***	-4.97***		
Polnad	-4.05***	-0.18	-2.64**	-2.09**		-5.54***	-5.85***	-4.74***
Portugal	-2.79***	2.25	-2.06**	-7.22***		-3.61***	-10.79***	
Romania	-3.46***	0.69	-4.23***	-2.74***		-3.61***		
Russian Federation*	-3.26	-3.17***	6.87	0.25	-4.52***		-1.083142	-3.19***
South Africa	-2.57**	-2.43	-7.20***	-7.38***	-10.07***	-7.04***		
South Korea	-2.05**	-1.78	-7.99***	-5.81***	-12.31***	-4.39***		
Spain	-2.50**	-2.03	-7.34***	-7.39***	-6.19***	-3.51***		
Sweden	-2.52**	-0.43	-8.56***	-7.83***	-5.00***	-5.82***		
Switzerland	-3.00***	-0.03	-5.47***	-4.42***		-6.51***		

continued…

Table E1 (…continued): Unit Root Tests

	Phillips–Perron test statistics							
	Null hypothesis: Series is non-stationary							
	Level				1st Difference			
Country	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Thailand	-3.87***	-0.40	-6.28***	-15.31***		-5.10***		
Turkey	-2.71***	-2.28	-5.67***	-7.69***		-6.75***		
United Kingdom	-2.80***	-1.09	-7.09***	-6.44***		-3.17***		
Uruguay	-4.71***	-0.61	-6.97***	-9.81***		-4.69***		
USA	-2.38**	-1.55	-4.19***	0.46	-5.88***	-3.16**		-6.66***
Venezuela	-2.72	-0.86	-6.54***	-6.18***	-9.31***	-7.80***		

continued…

Table E1 (…continued): Unit Root Tests

Country	Kwiatkowski–Phillips–Schmidt–Shin test statistic							
	Null hypothesis: Series is stationary							
	Level				1st Difference			
	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Argentina	0.18	0.08	0.22	0.06				
Australia	0.10	0.11	0.07	0.08				
Austria	0.18	0.13*	0.07	0.10		0.10		
Belgium	0.34	0.16**	0.06	0.23		0.13		
Brazil	0.12	0.05	0.39	0.10				
Bulgaria	0.08	0.17**	0.15	0.10		0.29		
Canada	0.12	0.09	0.07	0.12				
Chile	0.18	0.17	0.26	0.08				
China	0.29	0.16**	0.13*	0.09		0.29	0.27	
Colombia	0.08	0.17**	0.04	0.08		0.09		
Costa Rica	0.11	0.21	0.06	0.07				
Denmark	0.15	0.17**	0.11	0.13		0.16		
Dominican Republic	0.23	0.13	0.15	0.12				
Finland	0.14	0.10	0.35*	0.28			0.28	
France	0.08	0.24***	0.07	0.13		0.12		
Germany	0.12	0.11	0.09	0.11				
Ghana	0.06	0.09	0.07	0.07				
Greece	0.07	0.19**	0.38*	0.19		0.28		
Haiti	0.19	0.16	0.30	0.24				
Honduras	0.07	0.20**	0.20	0.16		0.23		
Hong Kong	0.50**	0.14*	0.05	0.05	0.46*	0.19		
Hungary	0.12	0.12*	0.29	0.28		0.11		
Iceland	0.06	0.04	0.19	0.16				
India	0.11	0.14*	0.32	0.28		0.09		

continued…

Table E1 (…continued): Unit Root Tests

	Kwiatkowski–Phillips–Schmidt–Shin test statistic							
	Null hypothesis: Series is stationary							
	Level				1st Difference			
Country	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Indonesia	0.24	0.12	0.12	0.36*				0.34
Ireland	0.10	0.10	0.27	0.27				
Israel	0.11	0.12	0.10	0.13				
Italy	0.12*	0.13*			0.13	0.09		
Japan	0.12*	0.21**	0.16	0.27	0.05	0.10		
Mexico	0.20	0.20**	0.06	0.18		0.11		
Netherlands	0.13	0.09	0.28	0.17				
New Zealand	0.09	0.09	0.23	0.32				
Nicaragua	0.14*	0.22	0.15**	0.28			0.34	
Norway	0.07	0.06	0.08	0.06				
Pakistan	0.12	0.19**	0.06	0.07		0.16		
Panama	0.10	0.23***	0.10	0.07		0.10		
Paraguay	0.05	0.17	0.24	0.05				
Peru	0.10	0.26	0.05	0.05				
Philippines	0.17**	0.19**	0.17	0.11	0.27	0.25		
Polnad	0.20	0.20	0.07	0.10				
Portugal	0.18	0.13*	0.22***	0.06		0.07	0.30	
Romania	0.10	0.09	0.28	0.21				
Russian Federation*	0.13*	0.16**	0.14*	0.11	0.26	0.06	0.34	
South Africa	0.10	0.13	0.09	0.07				
South Korea	0.26***	0.15**	0.16	0.14	0.19	0.19		
Spain	0.08	0.11	0.27	0.25				
Sweden	0.09	0.19**	0.08	0.03		0.12		
Switzerland	0.09	0.14*	0.09	0.17		0.19		

continued…

Table E1 (…continued): Unit Root Tests

	Kwiatkowski–Phillips–Schmidt–Shin test statistic							
	Null hypothesis: Series is stationary							
	Level				1st Difference			
Country	S	Dp	YVAR	GVAR	S	Dp	YVAR	GVAR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Thailand	0.08	0.06	0.07	0.45*				0.21
Turkey	0.11	0.07	0.07	0.12				
United Kingdom	0.06	0.22***	0.12	0.29		0.04		
Uruguay	0.08	0.07	0.13	0.13				
USA	0.09	0.16**	0.12*	0.32		0.06	0.29	
Venezuela	0.19**	0.17**	0.20	0.14				

*Note: *, ** and *** denote the rejection of the null hypothesis at the 10, five and one per cent levels, respectively. Column 1 of Table E1 presents the country name. Columns 2 to 5 present the test statistics of the unit root test in the level for S, Dp, YVAR and GVAR, respectively. Similarly, Columns 6 to 9 present the test statistics of the unit root test in the first difference for S, Dp, YVAR and GVAR, respectively.*

Table E2. Breakpoint Unit Root Test Results

Country	Variables	Levels				First Differences			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Argentina	s	-3.93	2011	Intercept only	Intercept only	-9.28***	1985	Intercept only	Intercept only
	Pd	-5.13**	2001	Trend and Intercept	Trend and Intercept				
	YVAR	-11.17***	1975	Intercept only	Intercept only				
	GVAR	-27.02***	1975	Intercept only	Intercept only				
Australia	s	-5.04**	2007	Intercept only	Intercept only				
	Pd	-3.45	2007	Intercept only	Intercept only	-4.60**	2007	Intercept only	Intercept only
	YVAR	-17.74***	1992	Trend and Intercept	Intercept only				
	GVAR	-9.63***	1991	Intercept only	Intercept only				
Austria	s	-5.04***	1974	Intercept only	Intercept only				
	Pd	-2.96	1989	Trend and Intercept	Trend only	-5.65***	1974	Trend and Intercept	Intercept only
	YVAR	-23.04***	1984	Intercept only	Intercept only				
	GVAR	-13.33***	1984	Intercept only	Intercept only				
Belgium	s	-2.74	2000	Trend and Intercept	Trend only	-11.86***	1981	Trend and Intercept	Intercept only
	Pd	-3.75	1991	Trend and Intercept	Trend only	-4.89**	1993	Trend and Intercept	Intercept only
	YVAR	-6.86***	2013	Intercept only	Intercept only				
	GVAR	-8.57***	2011	Intercept only	Intercept only				
Brazil	s	-3.87	1984	Trend and Intercept	Trend and Intercept	-9.55***	1994	Intercept only	Intercept only
	Pd	-2.84	1997	Intercept only	Intercept only	-7.15***	2000	Intercept only	Intercept only
	YVAR	-11.65***	2008	Trend and Intercept	Intercept only				
	GVAR	-8.36***	2009	Intercept only	Intercept only				
Bulgaria	s	-4.63*	2004	Trend and Intercept	Intercept only	-7.54***	2008	Trend and Intercept	Intercept only
	Pd	-7.47***	2007	Trend and Intercept	Intercept only				
	YVAR	-4.01	2008	Intercept only	Intercept only	-9.70***	2008	Trend and Intercept	Intercept only
	GVAR	-4.27*	2002	Trend and Intercept	Trend only	-9.71***	2009	Trend and Intercept	Trend only

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Levels				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Canada	s	-3.70	2005	Trend and Intercept	Trend only	-7.04***	2009	Intercept only	Intercept only
	Pd	-4.04	1989	Intercept only	Intercept only	-5.85***	1995	Trend and Intercept	Intercept only
	YVAR	-19.17***	1990	Trend and Intercept	Intercept only				
	GVAR	-9.03***	1995	Trend and Intercept	Intercept only				
Chile	s	-4.38*	1990	Trend and Intercept	Intercept only	-6.20***	1988	Intercept only	Intercept only
	Pd	-3.35	1984	Trend and Intercept	Trend only	-5.88***	1991	Trend and Intercept	Intercept only
	YVAR	-6.33***	2016	Trend and Intercept	Trend only				
	GVAR	-11.21***	1999	Intercept only	Intercept only				
China	s	-4.48**	2015	Trend and Intercept	Trend only				
	Pd	-4.64	2005	Trend and Intercept	Trend and Intercept	-15.36***	2010	Intercept only	Intercept only
	YVAR	-3.22	2009	Trend and Intercept	Trend only	-5.15***	2007	Intercept only	Intercept only
	GVAR	-5.33***	2009	Trend and Intercept	Trend and Intercept				
Colombia	s	-4.71**	1999	Intercept only	Intercept only				
	Pd	-4.74**	1998	Intercept only	Intercept only				
	YVAR	-9.48***	1998	Trend and Intercept	Trend and Intercept				
	GVAR	-10.39***	1998	Trend and Intercept	Trend and Intercept				
Costa Rica	s	-6.00***	1986	Trend and Intercept	Trend only				
	Pd	-16.52***	1980	Trend and Intercept	Trend and Intercept				
	YVAR	-7.56***	1980	Trend and Intercept	Trend only				
	GVAR	-5.80***	1981	Trend and Intercept	Trend only				
Denmark	s	-4.19	2005	Trend and Intercept	Trend only	-6.34***	1986	Intercept only	Intercept only
	Pd	-3.27	1991	Trend and Intercept	Trend only	-5.17**	1993	Trend and Intercept	Intercept only
	YVAR	-7.86***	1994	Trend and Intercept	Trend only				
	GVAR	-14.91***	1993	Intercept only	Intercept only				

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Domin. Rep.	s	-5.66***	1993	Trend and Intercept	Trend only				
	Pd	-4.98*	1990	Trend and Intercept	Trend and Intercept	-11.45***	1989	Trend and Intercept	Intercept only
	YVAR	-9.01***	2008	Trend and Intercept	Intercept only				
	GVAR	-11.50***	2003	Intercept only	Intercept only				
Finland	s	-3.64	2008	Intercept only	Intercept only	-7.19***	2009	Intercept only	Intercept only
	Pd	-7.85***	1991	Trend and Intercept	Trend and Intercept				
	YVAR	-56.31***	2013	Trend and Intercept	Trend and Intercept				
	GVAR	-19.99***	2012	Trend and Intercept	Trend and Intercept				
France	s	-4.80	2008	Trend and Intercept	Trend and Intercept	-9.94***	2009	Intercept only	Intercept only
	Pd	-3.43	1977	Trend and Intercept	Trend only	-6.05***	2008	Trend and Intercept	Trend and Intercept
	YVAR	-7.81***	2007	Trend and Intercept	Trend and Intercept				
	GVAR	-6.76***	1981	Intercept only	Intercept only				
Germany	s	-5.24***	1976	Trend and Intercept	Trend only				
	Pd	-4.33	2008	Trend and Intercept	Trend and Intercept	-6.05***	2007	Trend and Intercept	Trend and Intercept
	YVAR	-5.18***	1990	Trend and Intercept	Trend only				
	GVAR	-7.91***	1995	Intercept only	Intercept only				
Ghana	s	-6.52***	2003	Trend and Intercept	Trend only				
	Pd	-3.68	2000	Trend and Intercept	Intercept only	-7.95***	2000	Trend and Intercept	Trend and Intercept
	YVAR	-5.83***	2009	Intercept only	Intercept only				
	GVAR	-6.57***	2013	Trend and Intercept	Trend and Intercept				
Greece	s	-3.49	2009	Intercept only	Intercept only	-9.90***	2009	Trend and Intercept	Trend and Intercept
	Pd	-2.26	1977	Trend and Intercept	Trend only	-8.85***	2008	Trend and Intercept	Trend and Intercept
	YVAR	-8.96***	2006	Trend and Intercept	Trend and Intercept				

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	GVAR	-23.31***	2007	Trend and Intercept	Trend and Intercept				
Haiti	s	-5.46***	2010	Intercept only	Intercept only				
	Pd*	-6.85***	1986	Trend and Intercept	Trend and Intercept				
	YVAR	-6.360***	2005	Trend and Intercept	Trend only				
	GVAR	-4.16	2011	Trend and Intercept	Trend and Intercept	-8.30***	2013	Trend and Intercept	Trend only
Honduras	s	-5.57***	1988	Trend and Intercept	Intercept only				
	Pd*	-5.42**	1989	Trend and Intercept	Trend and Intercept				
	YVAR	-11.06***	1990	Intercept only	Intercept only				
	GVAR	-12.38***	1990	Intercept only	Intercept only				
Hong Kong	s	-5.93***	2016	Trend and Intercept	Trend only				
	Pd*	-7.32***	2009	Trend and Intercept	Trend and Intercept				
	YVAR	-6.37***	1999	Trend and Intercept	Trend and Intercept				
	GVAR	-7.21***	2004	Trend and Intercept	Trend and Intercept				
Hungary	s	-4.49*	2006	Trend and Intercept	Trend only	-5.49***	2006	Trend and Intercept	Intercept only
	Pd*	-6.54***	2004	Trend and Intercept	Trend only				
	YVAR	-47.79***	2008	Trend and Intercept	Trend only				
	GVAR	-8.39***	2003	Trend and Intercept	Trend only				
Iceland	s	-6.14***	2007	Trend and Intercept	Trend and Intercept				
	Pd	-5.17**	2007	Trend and Intercept	Intercept only	-10.48***	2007	Trend and Intercept	Trend and Intercept
	YVAR	-8.70***	1996	Trend and Intercept	Trend only				
	GVAR	-9.88***	1989	Trend and Intercept	Trend only				
India	s	-3.96	1986	Trend and Intercept	Trend only	-7.16***	2007	Trend and Intercept	Trend and Intercept
	Pd*	-9.74***	1992	Trend and Intercept	Intercept only				
	YVAR	-7.54***	2014	Trend and Intercept	Trend only				

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	GVAR	-6.96***	1976	Intercept only	Intercept only				
Indonesia	s*	-5.98***	2003	Trend and Intercept	Trend only				
	Pd	-12.10***	1997	Trend and Intercept	Trend and Intercept				
	YVAR	-9.57***	1998	Trend and Intercept	Trend and Intercept				
	GVAR	-10.45***	1998	Trend and Intercept	Trend and Intercept				
Ireland	s	-5.02***	2010	Intercept only	Intercept only				
	Pd	-5.10***	2011	Trend and Intercept	Trend only				
	YVAR	-247.28***	2012	Intercept only	Intercept only				
	GVAR	-34.14***	2011	Intercept only	Intercept only				
Israel	s	-6.31***	2005	Intercept only	Intercept only				
	Pd	-9.75***	2017	Trend and Intercept	Trend only				
	YVAR	-44.70***	2001	Trend and Intercept	Trend and Intercept				
	GVAR	-58.83***	2001	Intercept only	Intercept only				
Italy	s	-2.78	1999	Trend and Intercept	Trend only	-8.81***	2009	Intercept only	Intercept only
	Pd	-3.95	1990	Trend and Intercept	Trend and Intercept	-5.79***	1993	Trend and Intercept	Intercept only
	YVAR	-14.64***	2013	Intercept only	Intercept only				
	GVAR	-8.52***	1992	Intercept only	Intercept only				
Japan	s	-3.35	1983	Trend and Intercept	Intercept only	-8.18***	2009	Intercept only	Intercept only
	Pd	-2.90	1990	Trend and Intercept	Trend only	-6.30***	2007	Trend and Intercept	Trend and Intercept
	YVAR	-9.48***	2001	Trend and Intercept	Trend and Intercept				
	GVAR	-15.52***	2011	Intercept only	Intercept only				
Mexico	s	-5.47**	1982	Trend and Intercept	Trend and Intercept				
	Pd	-5.00*	1990	Trend and Intercept	Trend and Intercept	-8.23***	1986	Trend and Intercept	Intercept only
	YVAR	-11.47***	2002	Intercept only	Intercept only				

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	GVAR	-9.01***	2002	Intercept only	Intercept only				
Netherlands	s	-6.08***	2008	Trend and Intercept	Trend and Intercept				
	Pd	-5.47**	2007	Trend and Intercept	Trend and Intercept				
	YVAR	-13.61***	2013	Intercept only	Intercept only				
	GVAR	-15.11***	2013	Trend and Intercept	Intercept only				
New Zealand	s	-4.10	1992	Trend and Intercept	Intercept only	-5.84***	1983	Trend and Intercept	Intercept only
	Pd	-4.68*	1978	Trend and Intercept	Intercept only	-6.05***	1991	Trend and Intercept	Intercept only
	YVAR	-10.25***	1990	Intercept only	Intercept only				
	GVAR	-11.77***	2009	Trend and Intercept	Trend and Intercept				
Nicaragua	s	-11.23***	2001	Trend and Intercept	Intercept only				
	Pd	-5.98***	1982	Trend and Intercept	Intercept only				
	YVAR	-7.64***	2010	Intercept only	Intercept only				
	GVAR	-104.62***	2002	Trend and Intercept	Trend only				
Norway	s	-4.24	2004	Trend and Intercept	Trend and Intercept	-8.23***	2000	Intercept only	Intercept only
	Pd	-3.03	2011	Trend and Intercept	Intercept only	-7.97***	2012	Intercept only	Intercept only
	YVAR	-7.27***	1982	Intercept only	Intercept only				
	GVAR	-6.11***	2003	Intercept only	Intercept only				
Pakistan	s	-4.19	1987	Intercept only	Intercept only	-8.35***	1989	Intercept only	Intercept only
	Pd	-2.82	1990	Trend and Intercept	Trend only	-7.03***	1986	Intercept only	Intercept only
	YVAR	-5.82***	2001	Intercept only	Intercept only				
	GVAR	-9.82***	2008	Intercept only	Intercept only				
Panama	s	-6.09***	1993	Trend and Intercept	Trend and Intercept				
	Pd	-4.75**	1991	Trend and Intercept	Trend only	-5.46***	1988	Intercept only	Intercept only
	YVAR	-7.97***	1989	Intercept only	Intercept only				

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	GVAR	-6.28***	1977	Intercept only	Intercept only				
Paraguay	s	-4.71**	1984	Intercept only	Intercept only	-8.26***	2003	Intercept only	Intercept only
	Pd	-4.87**	1992	Trend and Intercept	Trend only	-6.10***	2002	Intercept only	Intercept only
	YVAR	-25.38***	2002	Intercept only	Intercept only				
	GVAR	-15.11***	1998	Intercept only	Intercept only				
Peru	s	-5.14***	2012	Trend and Intercept	Trend only				
	Pd	-3.96	2007	Intercept only	Intercept only	-8.05***	2012	Trend and Intercept	Trend only
	YVAR	-10.25***	1982	Intercept only	Intercept only				
	GVAR	-6.30***	1977	Intercept only	Intercept only				
Philippines	s	-5.78***	1997	Trend and Intercept	Trend and Intercept				
	Pd	-3.90	1982	Trend and Intercept	Intercept only	-7.09***	1986	Intercept only	Intercept only
	YVAR	-6.90***	1992	Intercept only	Intercept only				
	GVAR	-7.89***	2009	Intercept only	Intercept only				
Poland	s	-10.59***	2009	Trend and Intercept	Intercept only				
	Pd	-5.75***	2001	Trend and Intercept	Trend only				
	YVAR	-3.39	2006	Trend and Intercept	Trend only	-6.09***	2013	Intercept only	Intercept only
	GVAR	-2.25	2010	Intercept only	Intercept only	-5.20***	2009	Trend and Intercept	Trend only
Portugal	s	-4.31	1982	Trend and Intercept	Intercept only	-9.57***	2009	Intercept only	Intercept only
	Pd	-5.01**	2008	Trend and Intercept	Intercept only	-12.29***	2012	Intercept only	Intercept only
	YVAR	-7.75***	2013	Intercept only	Intercept only				
	GVAR	-12.05***	2008	Intercept only	Intercept only				
Romania	s	-6.59***	2008	Intercept only	Intercept only				
	Pd	-8.51***	2010	Trend and Intercept	Trend and Intercept				

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	YVAR	-7.47***	1999	Intercept only	Intercept only				
	GVAR	-5.65***	2009	Intercept only	Intercept only				
Russia*	s	-12.87***	2008	Trend and Intercept	Trend and Intercept				
	Pd	-7.19***	2000	Intercept only	Intercept only				
	YVAR	-2.59	2009	Trend and Intercept	Trend and Intercept	-5.96***	2015	Intercept only	Intercept only
	GVAR	-4.61**	2015	Intercept only	Intercept only	-5.06***	2015	Intercept only	Intercept only
South Africa	s	-4.92**	2007	Trend and Intercept	Intercept only	-9.49***	1974	Intercept only	Intercept only
	Pd	-3.22	1979	Trend and Intercept	Intercept only	-7.54***	1977	Intercept only	Intercept only
	YVAR	-17.83***	1986	Intercept only	Intercept only				
	GVAR	-10.25***	1986	Intercept only	Intercept only				
South Korea	s	-5.54***	1991	Trend and Intercept	Intercept only				
	Pd	-4.35	1985	Trend and Intercept	Intercept only	-4.88**	1998	Intercept only	Intercept only
	YVAR	-22.33***	2009	Intercept only	Intercept only				
	GVAR	-9.38***	2008	Trend and Intercept	Intercept only				
Spain	s	-4.38*	2007	Intercept only	Intercept only	-8.60***	2009	Intercept only	Intercept only
	Pd	-2.53	2007	Intercept only	Intercept only	-10.88***	2009	Intercept only	Intercept only
	YVAR	-25.59***	2010	Intercept only	Intercept only				
	GVAR	-72.88***	2010	Intercept only	Intercept only				
Sweden	s	-5.07*	1983	Trend and Intercept	Trend and Intercept	-5.17***	1984	Intercept only	Intercept only
	Pd	-4.09	1992	Trend and Intercept	Trend and Intercept	-7.89***	1993	Intercept only	Intercept only
	YVAR	-11.48***	2012	Intercept only	Intercept only				
	GVAR	-9.38***	1990	Intercept only	Intercept only				
Switzerland	s	-3.70	1997	Intercept only	Intercept only	-6.66***	2006	Intercept only	Intercept only
	Pd	-2.63	2003	Trend and Intercept	Trend only	-6.96***	2006	Intercept only	Intercept only

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	YVAR	-21.53***	2003	Intercept only	Intercept only				
	GVAR	-5.58**	1994	Trend and Intercept	Trend and Intercept	-9.16***	1994	Intercept only	
Thailand	s	-5.26**	1986	Trend and Intercept	Intercept only	-10.97***	1974	Intercept only	Thailand
	Pd	-4.65**	1996	Intercept only	Intercept only	-8.062***	2000	Intercept only	
	YVAR	-11.06***	2009	Intercept only	Intercept only				
	GVAR	-3.45	2003	Intercept only	Intercept only	-15.12***	2009	Intercept only	Intercept only
Turkey	s	-4.50**	1993	Intercept only	Intercept only	-9.13***	2001	Intercept only	Intercept only
	Pd	-5.40***	1998	Trend and Intercept	Intercept only				
	YVAR	-7.80***	2009	Trend and Intercept	Trend and Intercept				
	GVAR	-10.15***	1989	Intercept only	Intercept only				
United Kingdom	s	-4.63**	2007	Intercept only	Intercept only	-7.75***	2009	Intercept only	Intercept only
	Pd	-3.86	2007	Intercept only	Intercept only	-5.44**	2007	Trend and Intercept	Trend and Intercept
	YVAR	-7.09***	1992	Intercept only	Intercept only				
	GVAR	-12.44***	2008	Intercept only	Intercept only				
Uruguay	s	-7.06***	1989	Intercept only	Intercept only				
	Pd	-3.77	1981	Intercept only	Intercept only	-6.22***	2002	Intercept only	Intercept only
	YVAR	-8.78***	2003	Intercept only	Intercept only				
	GVAR	-12.27***	1989	Trend and Intercept	Intercept only				
USA	s	-5.48**	2007	Trend and Intercept	Trend and Intercept	-7.21***	2009	Intercept only	Intercept only
	Pd	-5.19***	1982	Trend and Intercept	Trend and Intercept				
	YVAR	-4.66**	2015	Intercept only	Intercept only	-11.34***	2010	Intercept only	Intercept only
	GVAR	-6.24***	2013	Intercept only	Intercept only				
Venezuela	s	-7.53***	2004	Trend and Intercept	Trend and Intercept				
	Pd	-3.21	1991	Trend and Intercept	Trend only	-9.41***	1986	Intercept only	Intercept only
	YVAR	-10.01***	1985	Intercept only	Intercept only				

continued…

Table E2 (…continued). Breakpoint Unit Root Test Results

Country	Variables	Level				First Difference			
		Innovation Outlier	Break date	Trend Specification	Break Specification	Innovation Outlier	Break date	Trend Specification	Break Specification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	GVAR	-12.39***	1985	Intercept only	Intercept only				

*Note. *, ** and *** denote the rejection of the null hypothesis at the 10, five and one per cent levels, respectively. Following Perron (1989), we considered four basic models for our data with a one-time break. The first model is in level for non-trending data. The second model is in level for trending data. The third model is in both level and trend. The fourth model is in trend. Additionally, we considered the innovational outlier version of the four models. The innovational outlier model assumes that the break occurs gradually. Columns 4 and 5 provide the one-time break date of the breakpoint unit root test in the level and first difference, respectively. Columns 5 and 6 provide the trend and break specification in the level, respectively. Similarly, Columns 9 and 10 provide the trend and break specification in the first difference, respectively.*

Table E3: Estimated Break Years Using Multiple Breakpoint Test

Sr. No.	Country	Estimated Break Years	Test Specification Method	Selected Break Criterion
(1)	(2)	(3)	(4)	(5)
1	Australia	1974, 1983, 1992, 2000, 2008	Compare information criteria for 0 to M globally determined breaks	Schwarz criterion selected breaks
2	Austria	2004	Bai-Perron tests of L+1 vs. L sequentially determined breaks	Sequential F-statistic determined breaks
3	Belgium	1972, 1984, 1992, 2001, 2009	Compare information criteria for 0 to M globally determined breaks	Schwarz criterion selected breaks
4	Brazil	2001, 2004, 2007, 2011, 2014	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks UDmax determined breaks WDmax determined breaks
5	Canada	1970, 1980, 1988, 1996, 2009	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks
6	Chile	1982, 1991, 1997, 2004, 2011	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks
7	Colombia	1983, 2000, 2009	Compare information criteria for 0 to M globally determined breaks	Schwarz criterion selected breaks
8	Coasta Rica	1980, 2005	Compare information criteria for 0 to M globally determined breaks	Schwarz criterion selected breaks
9	Denmark	1974, 1984, 1992, 2009	Compare information criteria for 0 to M globally determined breaks	Schwarz criterion selected breaks
10	Finland	1969, 1977, 1992, 2001, 2009	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks

continued…

Table E3 (…continued): Estimated Break Years Using Multiple Breakpoint Test

Sr. No.	Country	Estimated Break Years	Test Specification Method	Selected Break Criterion
(1)	(2)	(3)	(4)	(5)
11	France	1975, 2006	Bai-Perron tests of L+1 vs. L sequentially determined breaks	Sequential F-statistic determined breaks
12	Germany	1983	Bai-Perron tests of L+1 vs. L sequentially determined breaks	Sequential F-statistic determined breaks
13	Ghana	1975, 1983, 1992, 2000, 2008	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks UDmax determined breaks WDmax determined breaks
14	Greece	1991, 2002	Bai-Perron tests of L+1 vs. L sequentially determined breaks	Sequential F-statistic determined breaks
15	Honduras	1975, 1983, 1992, 2001, 2009	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks
16	Iceland	1976, 1985, 1993, 2001, 2009	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
17	India	1980, 1992, 2009	Bai-Perron tests of L+1 vs. L globally determined breaks	Significant F-statistic largest breaks
18	Indonesia	1978, 1984, 1993, 2001, 2007	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks UDmax determined breaks WDmax determined breaks
19	Ireland	1984, 1998, 2004, 2010	Bai-Perron tests of L+1 vs. L sequentially determined breaks	Sequential F-statistic determined breaks

continued…

Table E3 (…continued): Estimated Break Years Using Multiple Breakpoint Test

Sr. No.	Country	Estimated Break Years	Test Specification Method	Selected Break Criterion
(1)	(2)	(3)	(4)	(5)
20	Israel	1989, 1993, 1998, 2005, 2009	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks UDmax determined breaks WDmax determined breaks
21	Italy	1971, 1979, 1988, 1998, 2006	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
22	Japan	1970, 1979, 1988, 2000, 2008	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks
23	Mexico	1974, 1982, 1993, 2001, 2009	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks
24	Netherlands	1980, 1995, 2003	Compare information criteria for 0 to M globally determined breaks	Schwarz criterion selected breaks
25	New Zealand	1986, 1992, 1997, 2006, 2011	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks UDmax determined breaks WDmax determined breaks
26	Norway	1970, 1978, 1986, 1994, 2009	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
27	Pakistan	1973, 1980, 1989, 2003, 2010	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks WDmax determined breaks

continued…

Table E3 (…continued): Estimated Break Years Using Multiple Breakpoint Test

Sr. No.	Country	Estimated Break Years	Test Specification Method	Selected Break Criterion
(1)	(2)	(3)	(4)	(5)
28	Panama	1971, 1982, 1989, 1996, 2003	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
29	Paraguay	1978, 1984, 1990, 1996, 2002	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks
30	Philippines	1973, 1983, 1991, 2000, 2009	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks
31	Portugal	1972, 1983, 1991, 1999, 2009	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
32	South Africa	1968, 1981, 1990, 1997, 2007	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
33	South Korea	1969, 1979, 1988, 2000, 2009	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
34	Spain	1971, 1979, 1987, 1995, 2009	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
35	Sweden	1969, 1977, 1985, 1993, 2002	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
36	Switzerland	1986, 1991, 1999, 2004, 2011	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks UDmax determined breaks WDmax determined breaks
37	Thailand	1971, 1979, 1987, 1995, 2007	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
38	United Kingdom	1973, 1985, 1993, 2001, 2009	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks WDmax determined breaks
39	Uruguay	1983, 1989, 1995, 2001, 2007	Bai-Perron tests of 1 to M globally determined breaks	Sequential F-statistic determined breaks Significant F-statistic largest breaks
40	United States	1971, 1983, 1991, 2001, 2009	Bai-Perron tests of 1 to M globally determined breaks	Significant F-statistic largest breaks

Note. These estimated break years are significant at the 0.05 level. In some cases, different criteria give different break years. We report only the maximum number of breaks in those cases. However, we include dummies for all break years identified using the multiple-breakpoint test. Column 2 presents the country name and Column 3 presents the maximum number of estimated breaks. Columns 4 and 5 present the test specification method and selected breaks criterion, respectively. L and M above indicates the pre-specified number of breaks and the potential breaks respectively. UDmax indicates the equal-weighted version of the test, while WDmax applies weights to the individual statistics.

Figure E1: Stability Analysis (Forward, Backward and Moving Screening Processes)

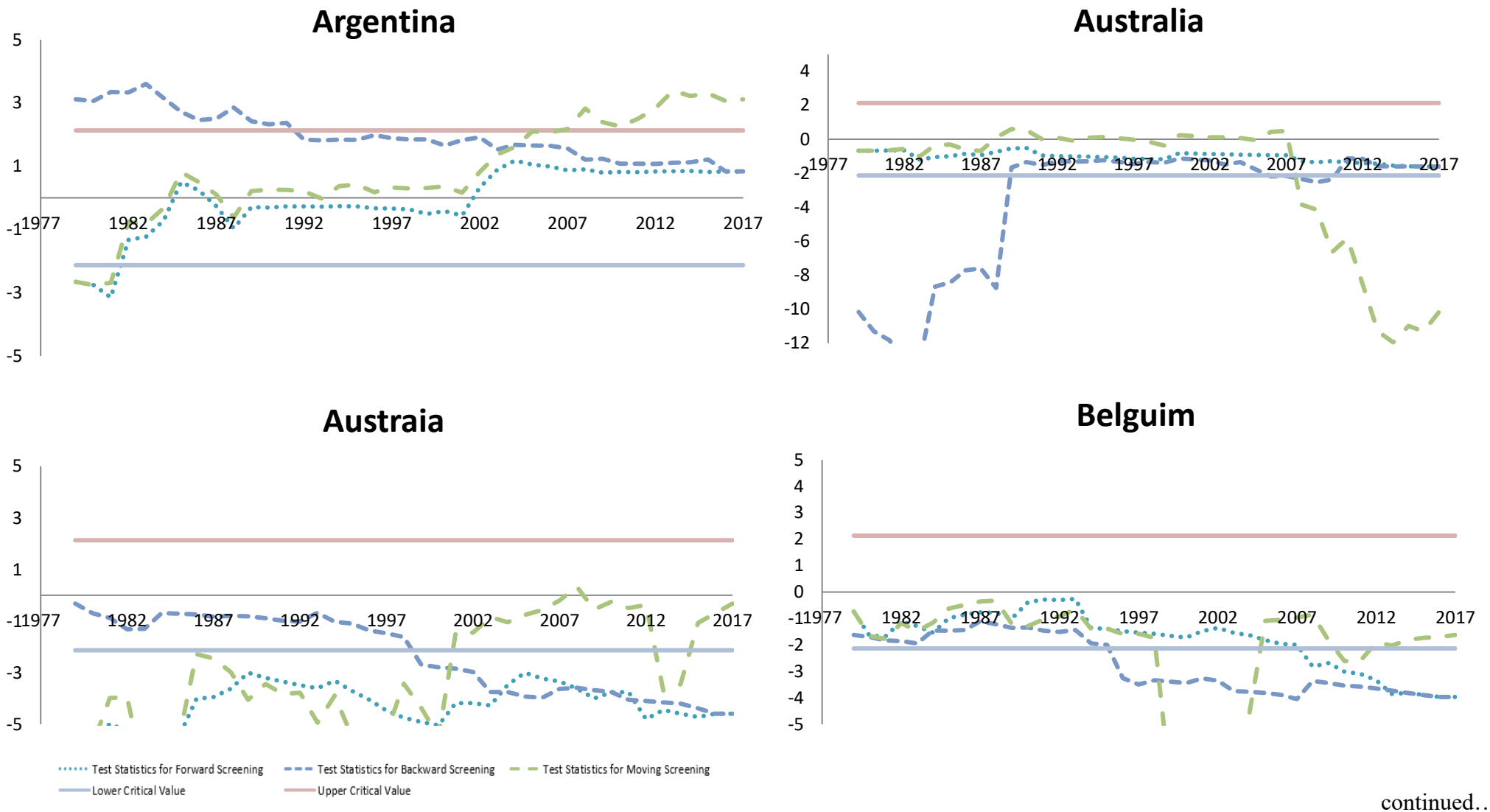


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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

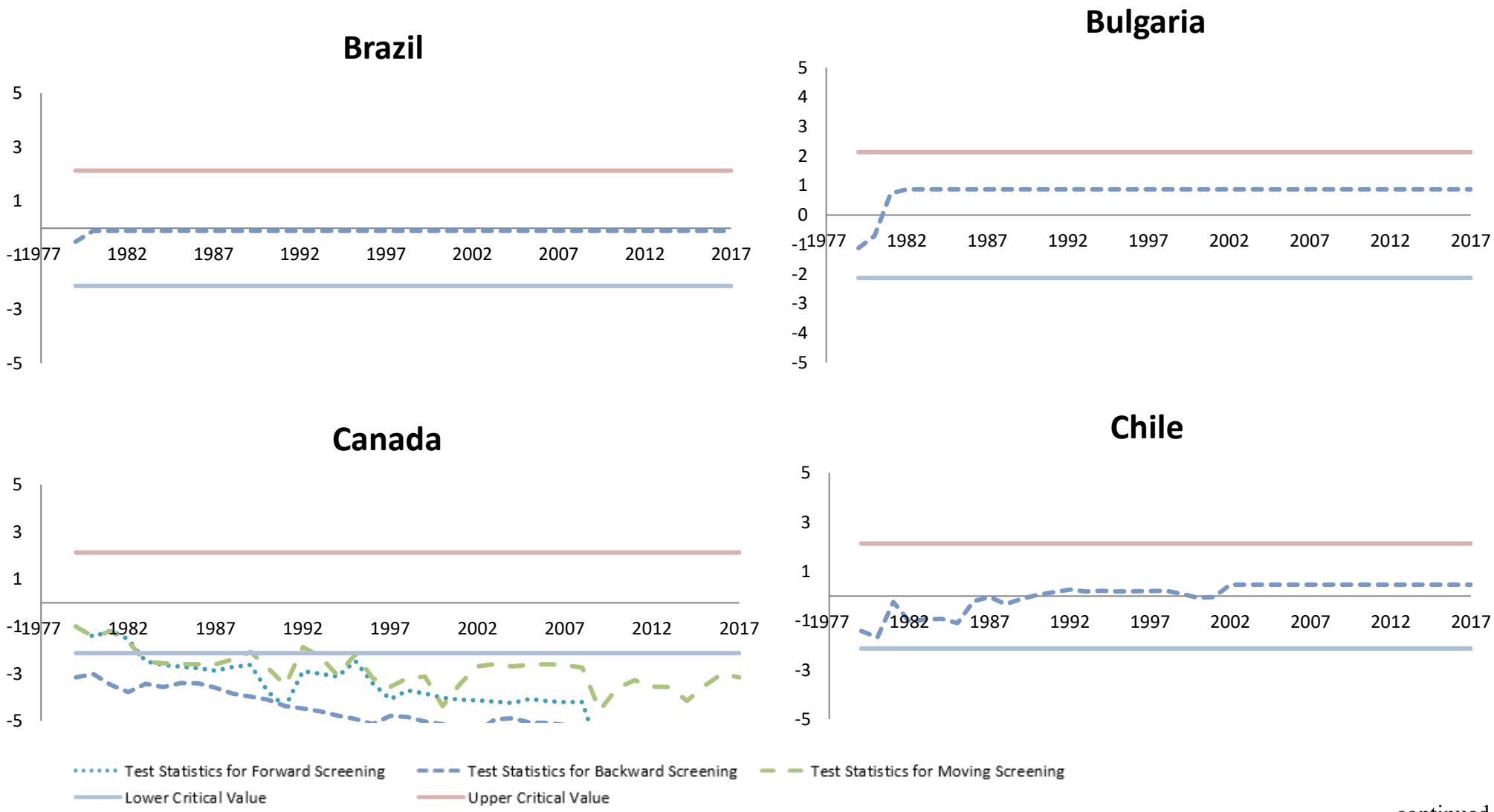

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

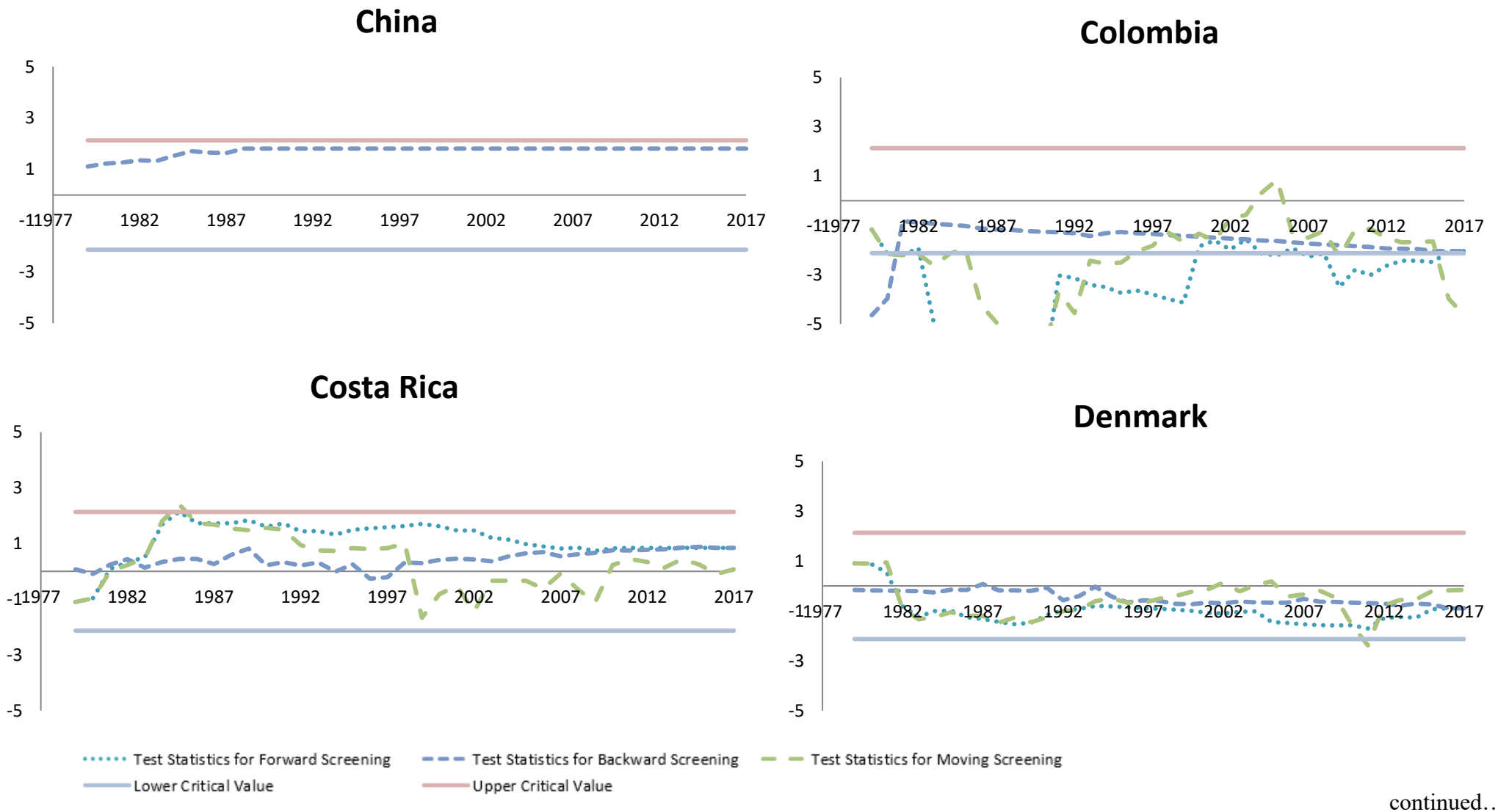

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

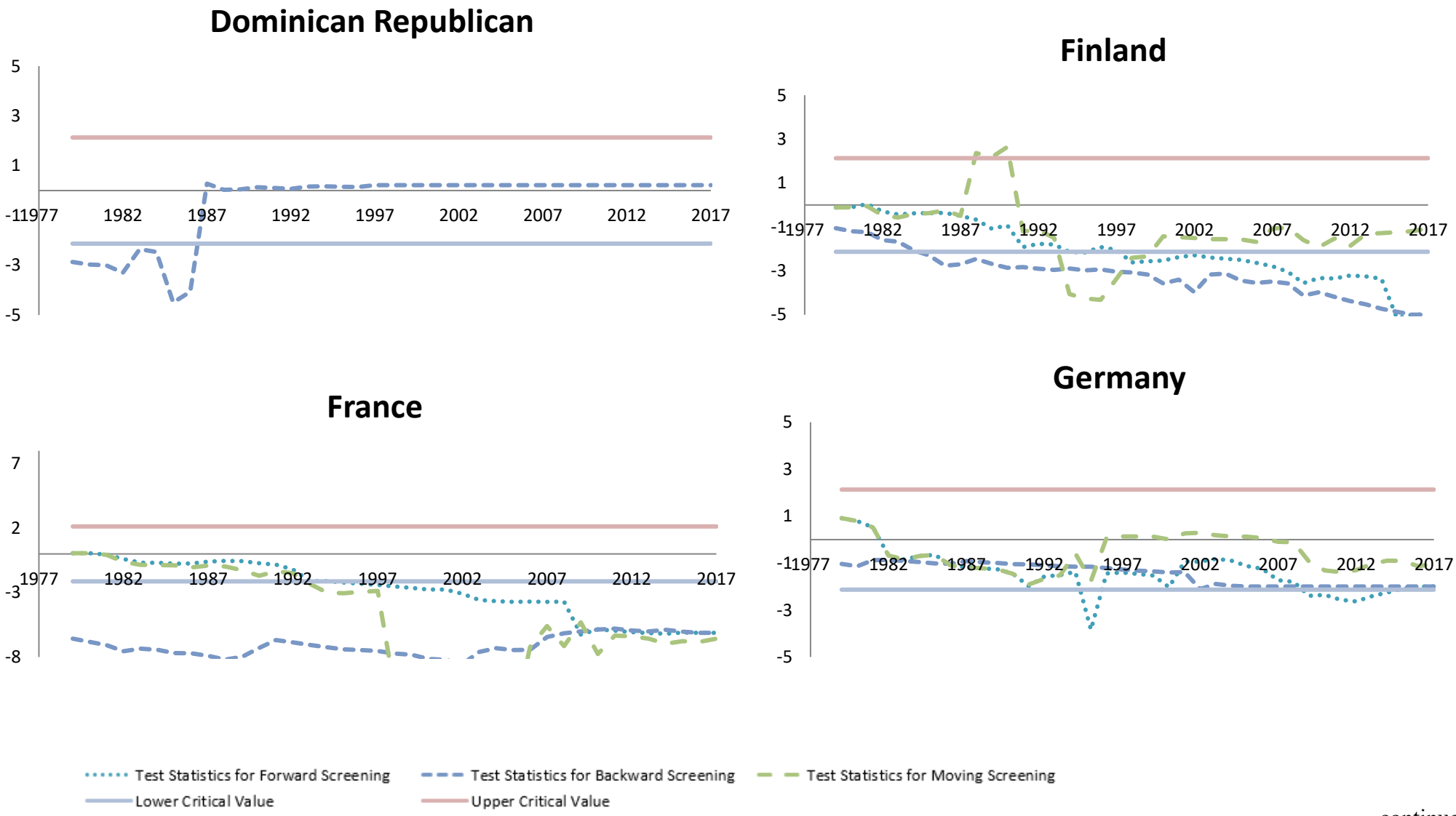

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

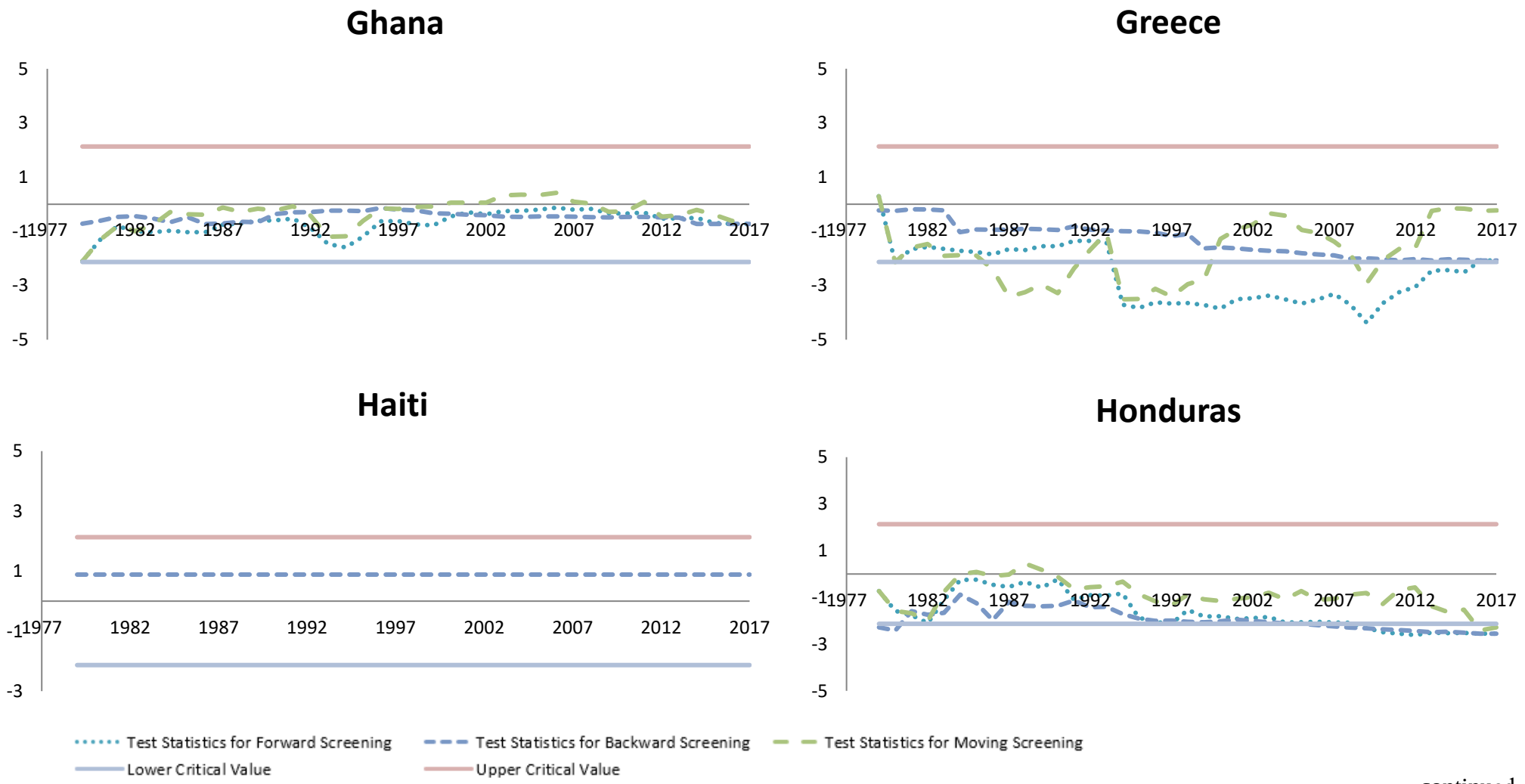

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

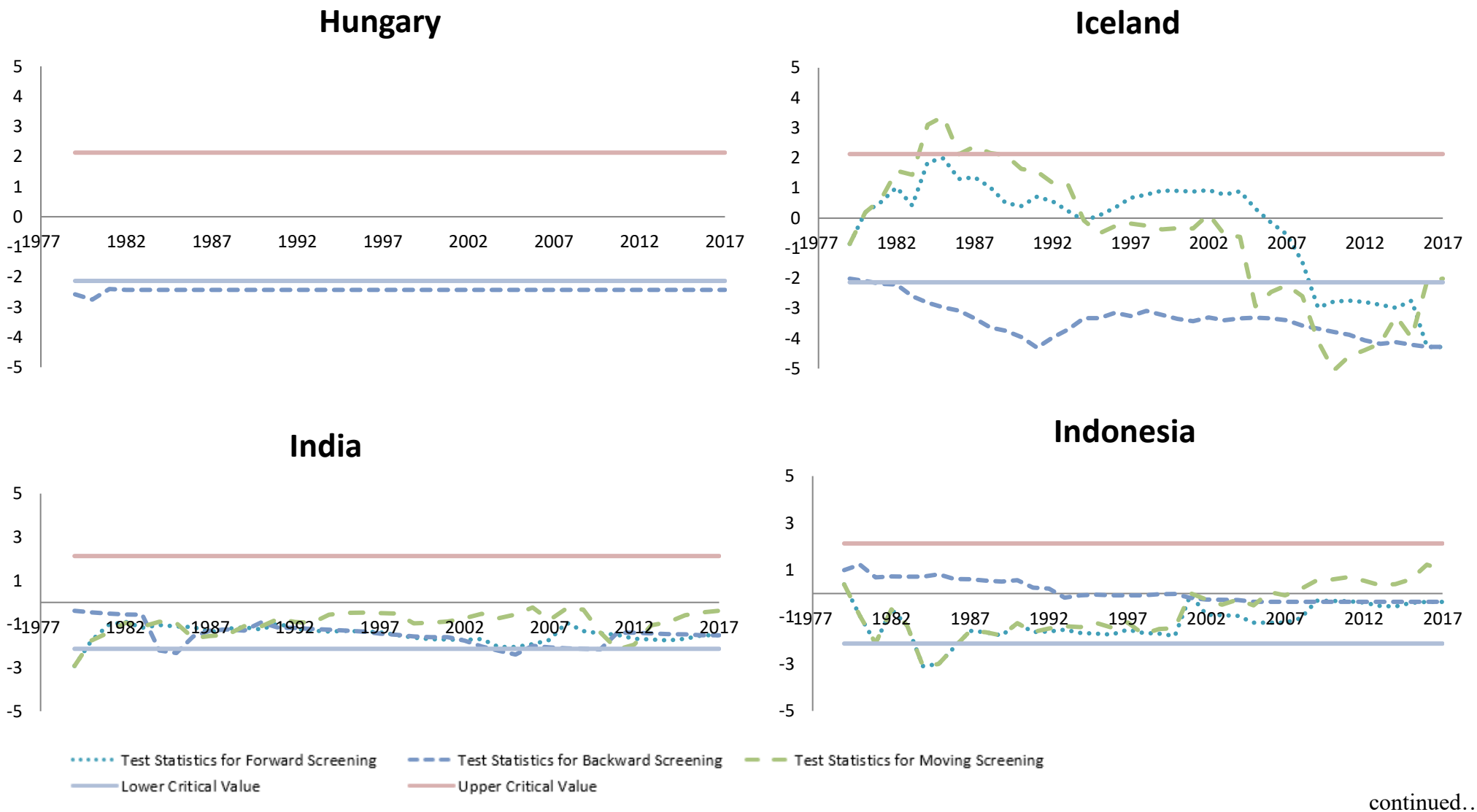

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

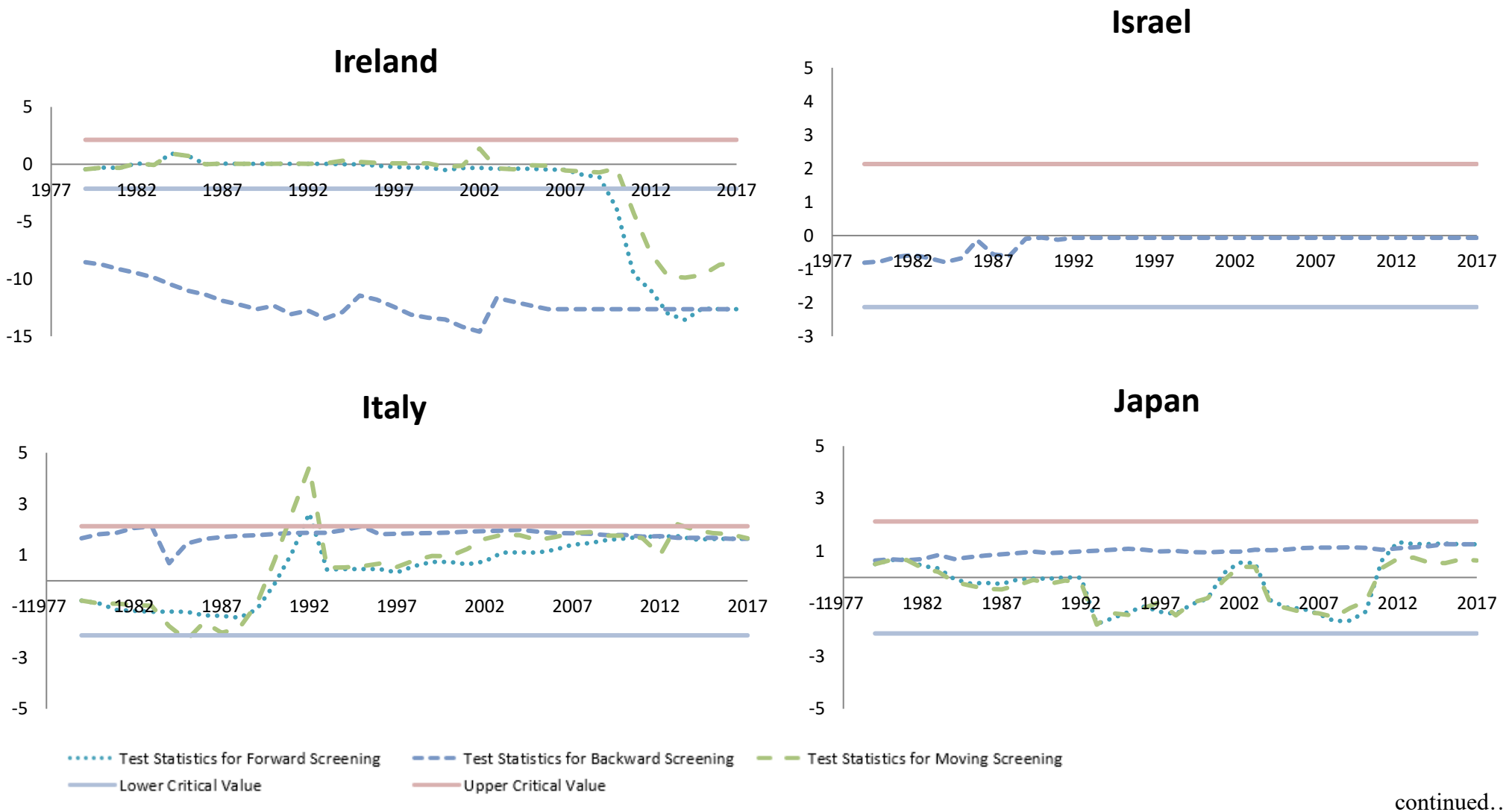

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

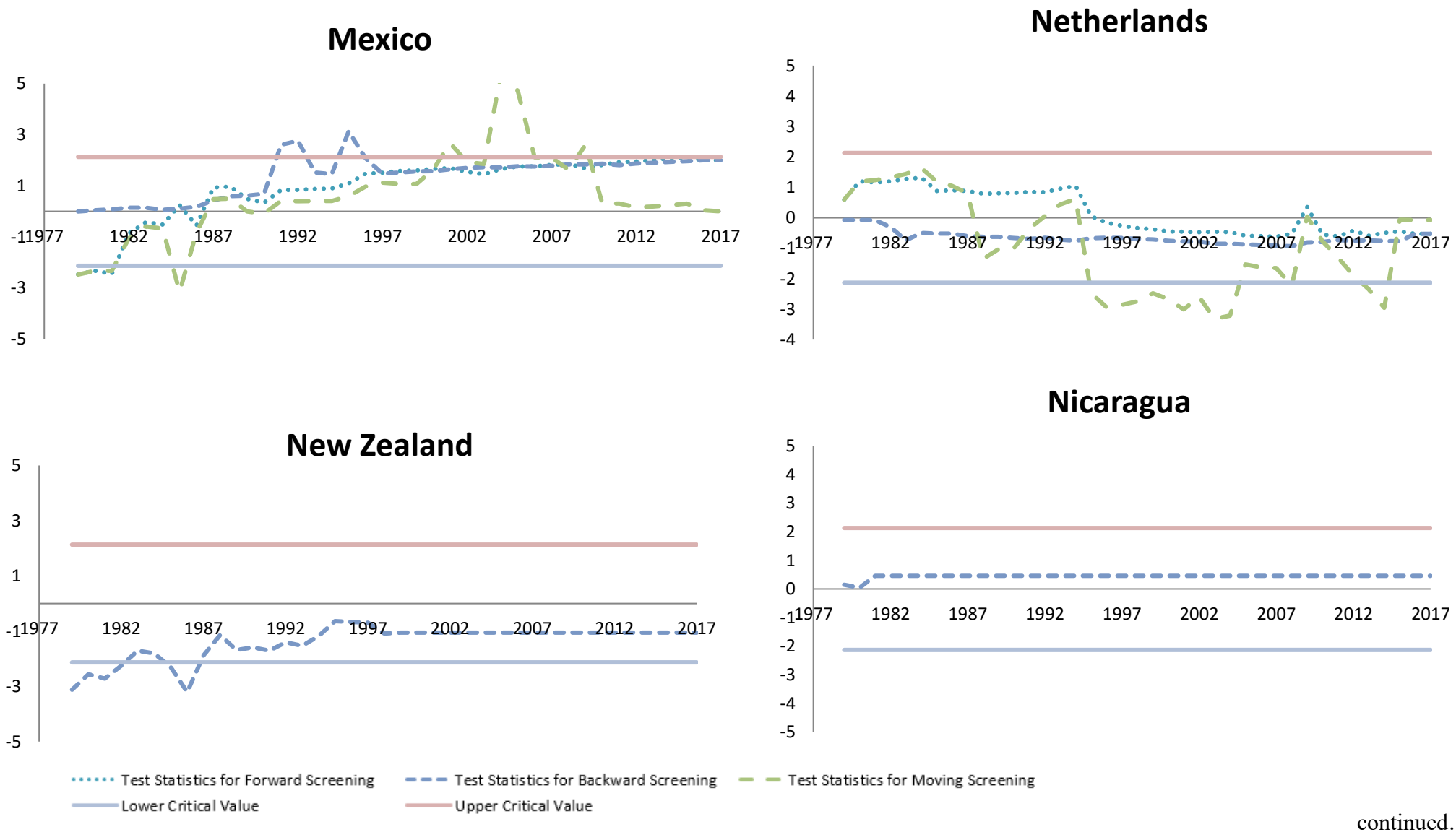

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Figure E1 (...continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

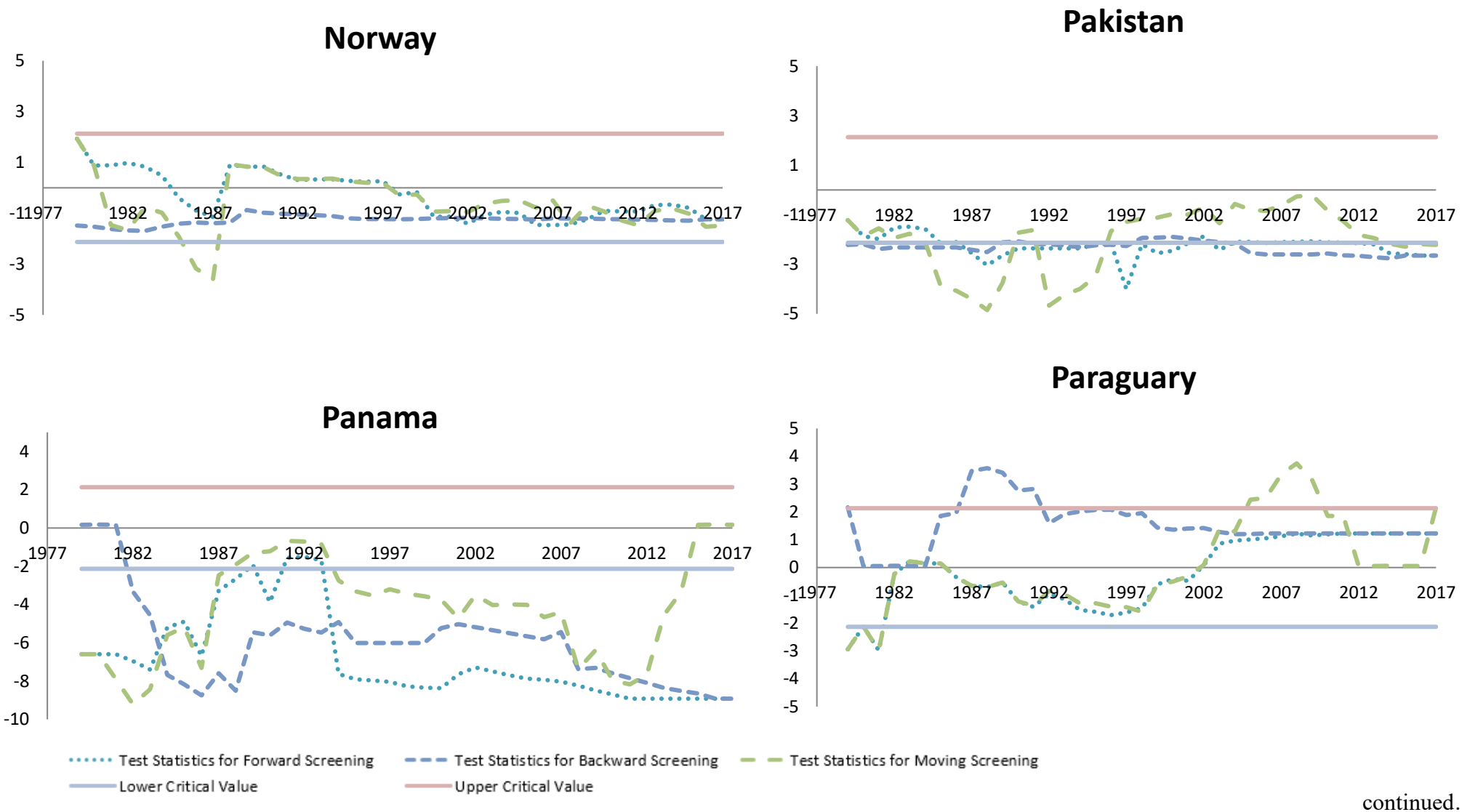

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

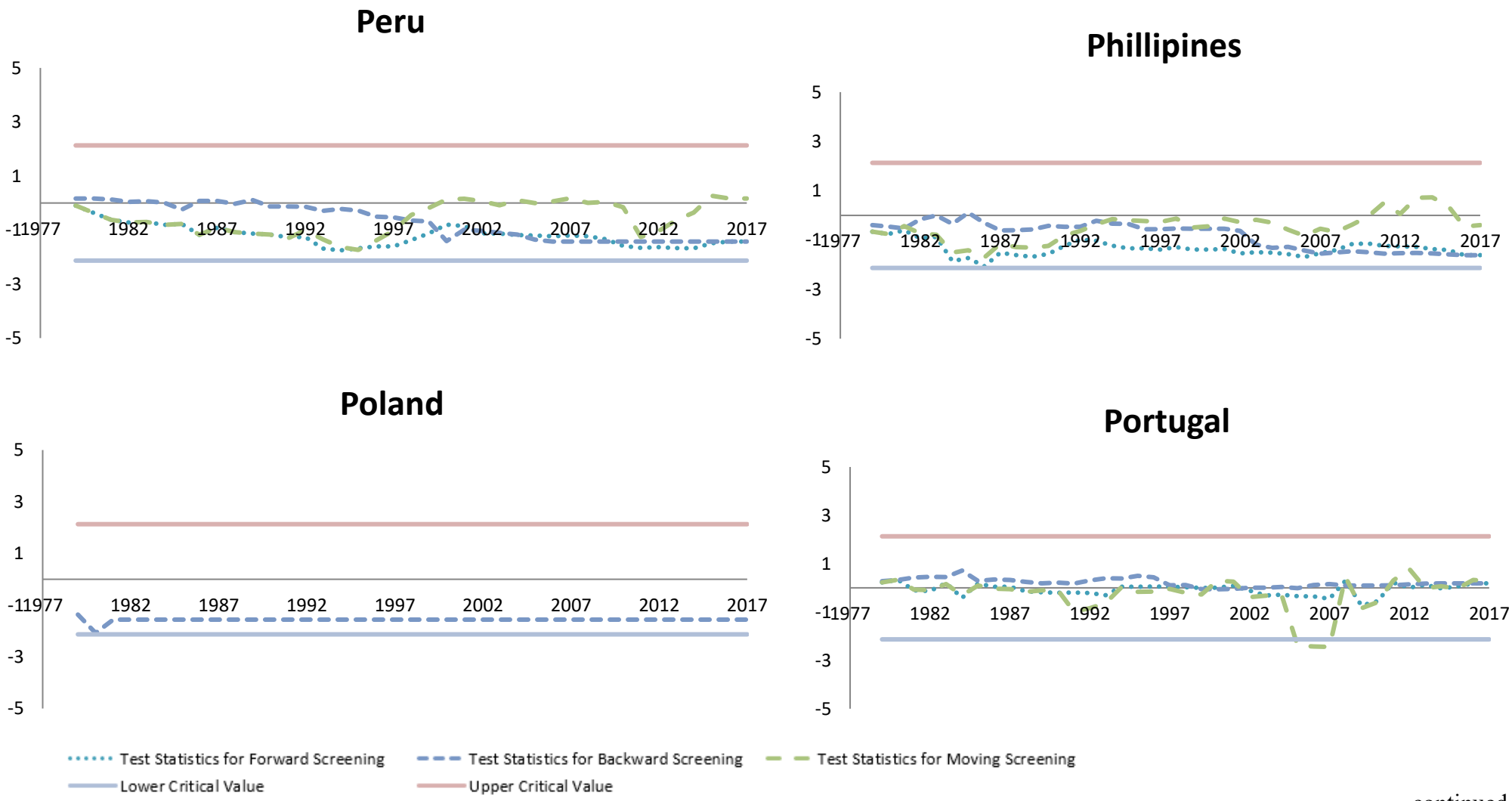

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Figure E1 (...continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

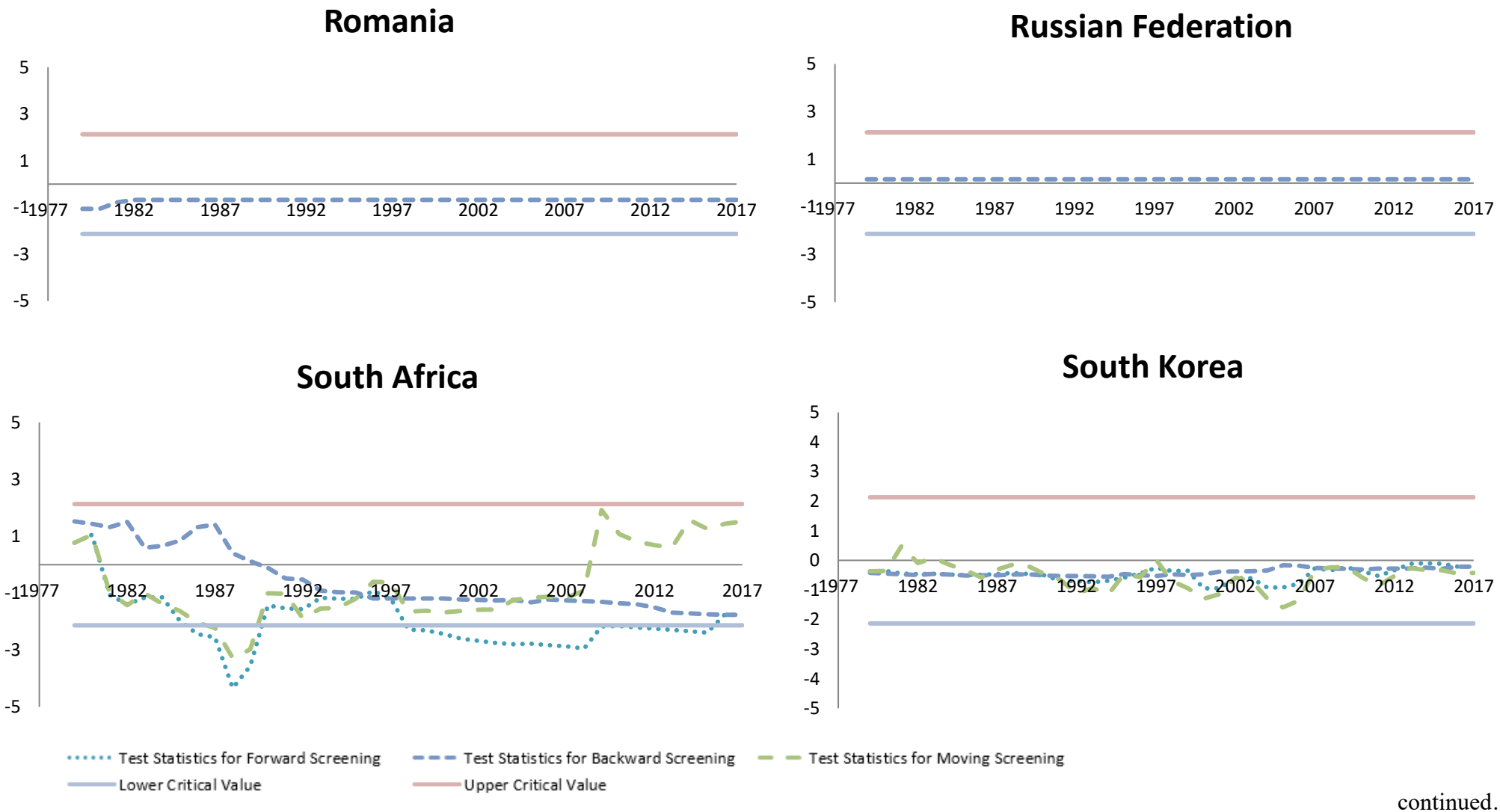

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Figure E1 (…continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

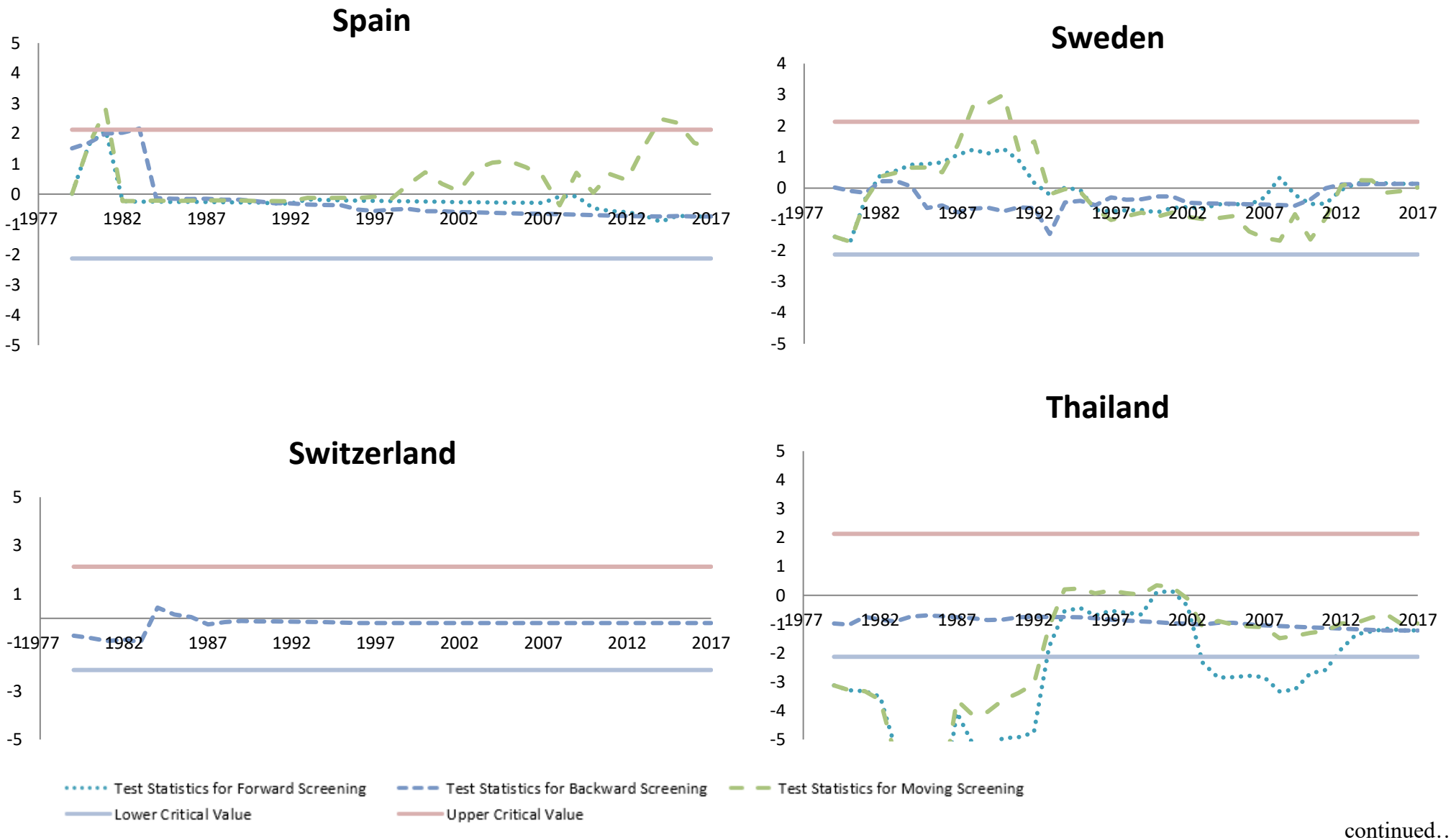

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Figure E1 (...continued): Stability Analysis (Forward, Backward and Moving Screening Processes)

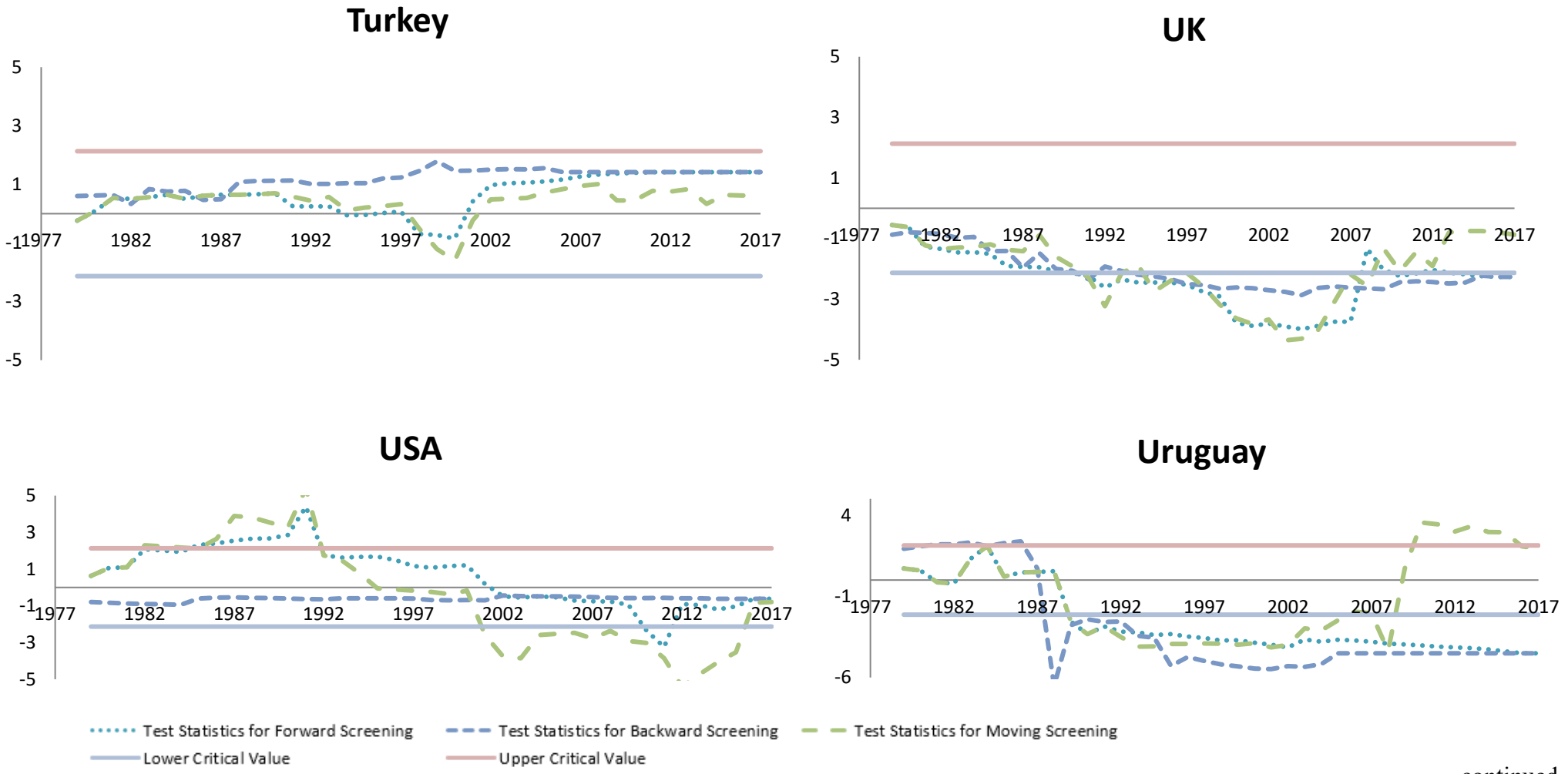

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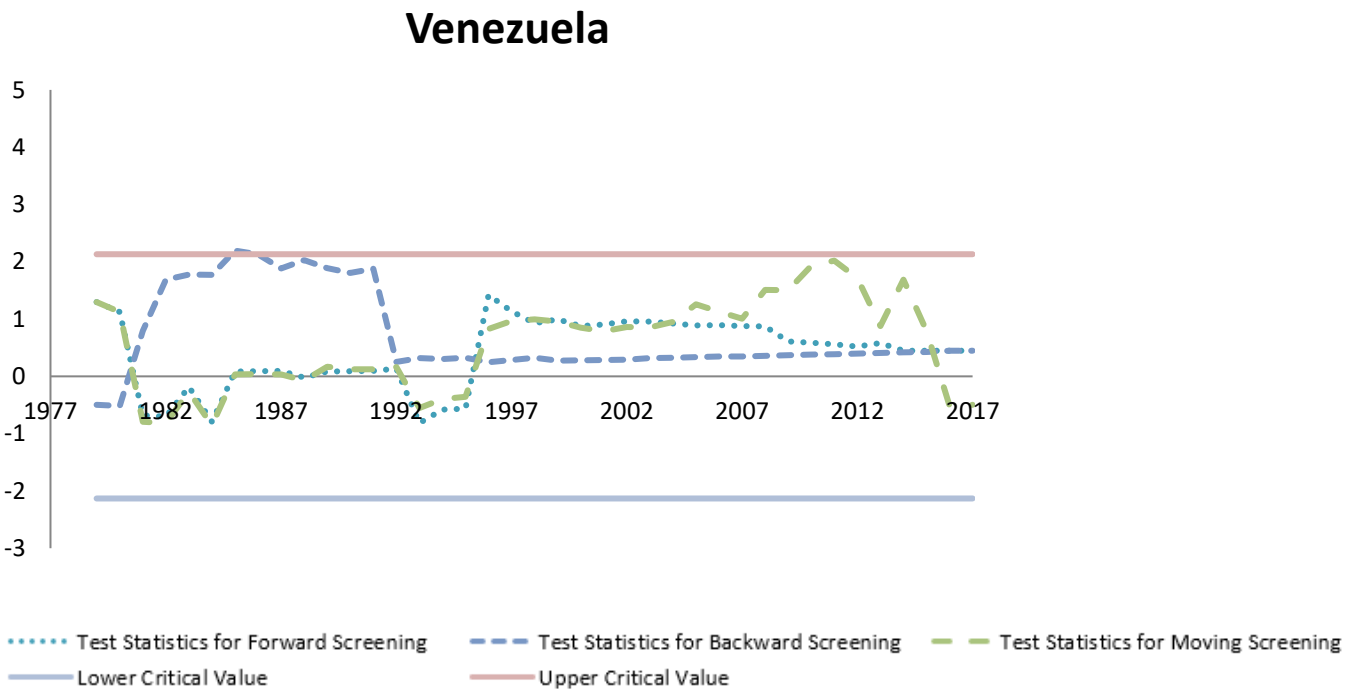
Figure E1 (...continued): Stability Analysis (Forward, Backward and Moving Screening Processes)



Appendix F (Chapter 7)

Table F1: Fiscal Consolidation, Threshold and Descriptive Approach

Year	PB	PD	CAPB	1st CAPB	2nd CAPB	FC	Descriptive Approach
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1986	1.80	23.00	-15.00				0
1987	3.30	22.00	9.6.00	24.00		1	1
1988	4.20	25.00	21.00	12.00	-13.00	1	1
1989	3.30	23.00	29.00	7.60	-4.00	1	0
1990	1.10	22.00	4.00	-25.00	-32.00	0	0
1991	-1.90	23.00	-63.00	-67.00	-42.00	0	0
1992	-2.70	27.00	-63.00	-0.70	66.00	1	0
1993	-0.70	30.00	-42.00	22.00	23.00	1	0
1994	-0.20	31.00	-23.00	18.00	-3.40	1	1
1995	0.80	31.00	-23.00	0.30	-18.00	1	1
1996	1.80	29.00	-19.00	4.50	4.20	1	1
1997	2.60	26.00	-15.00	3.80	-0.70	1	1
1998	2.70	24.00	0.80	16.00	12.00	1	1
1999	3.80	23.00	7.00	6.20	-9.30	1	1
2000	1.30	19.00	6.00	-1.00	-7.20	0	0
2001	1.70	17.00	-0.10	-6.00	-5.00	0	0
2002	2.80	15.00	12.00	12.00	18.00	1	0
2003	2.50	13.00	7.70	-4.00	-16.00	0	0
2004	2.60	12.00	16.00	8.70	13.00	1	0
2005	3.00	11.00	16.00	-0.90	-9.60	0	0
2006	2.60	9.90	7.90	-7.60	-6.70	0	0
2007	2.80	9.60	25.00	17.00	25.00	1	0
2008	-2.00	12.00	13.00	-12.00	-29.00	0	N/A
2009	-3.70	17.00	-3.80	-17.00	-4.80	0	N/A
2010	-3.40	21.00	-14.00	-10.00	6.60	0	N/A
2011	-4.00	24.00	-25.00	-11.00	-1.20	0	N/A
2012	-3.40	28.00	-15.00	10.00	22.00	1	N/A
2013	-3.10	31.00	-29.00	-14.00	-24.00	0	N/A
2014	-3.60	34.00	-30.00	-1.70	12.00	0	N/A
2015	-3.30	38.00					N/A

Note. Fiscal consolidation under the descriptive approach/narrative technique (Devries et al., 2011) was calculated using calendar year data. We calculated fiscal consolidation using fiscal year data because of the unavailability of calendar year data for all 53 economies. We applied a broader approach to calculate fiscal consolidation episodes, where we analysed the changes in CAPB by taking its first and second differences of CAPB. If the first or second difference of CAPB was positive for a specific period, we classified that period as a fiscal consolidation episode. 'PB' and 'PD' in Columns 2 and 3 indicate 'primary balance' and 'public debt' as per cent of GDP, respectively. We present CAPB in Column 4. We present first and second difference of CAPB in Columns 5 and 6, respectively. We present fiscal consolidation episodes using a broader and descriptive approach in Columns 7 and 8 of this table, respectively.

Table F2: Year-wise Fiscal Consolidation Episodes

Country	Years of Fiscal Consolidation Episodes								
Argentina	2010								
Australia	1993	2007							
Austria	1997	2001	2005	2011					
Belgium	2006	2010							
Bolivia	1994	1995	1999	2000	2006	2008	2010		
Brazil	1990	1994	1999						
Bulgaria	1995	1996	2001	2008 2010					
Chile	1989	1992	2000	2006	2007	2010	2011		
China	2007	2011							
Colombia	2000	2012							
Costa Rica	1991	1992	1995	2012					
Denmark	2010								
Dominican Republic	1989	1992	2000	2005	2007				
Finland	1989	2000	2010	2011					
France	2011								
Germany	1989	1994	1996	2000	2007	2011			
Ghana	1991	2000	2003	2009	2011	2013			
Greece	1991	1994	2005	2010					
Haiti	2004	2007	2010						
Honduras	1989	1991	1995	1998	2000	2004	2010		
Hong Kong	2006	2007	2009	2010	2013	2016			
Hungary	1990	1994	1996	1999	2000	2003	2004	2007	2011
Iceland	1991	1995	2000	2005	2010				
India	2007								
Indonesia	1990								

continued…

Table F2 (…continued): Year-wise Fiscal Consolidation Episodes

Ireland	2000	2006	2007	2011	2016					
Israel	1991	1995	2000	2010						
Italy	1997	2000	2007							
Japan	2001	2010								
Mexico	1995									
Netherlands	1991	1993	1996	2000	2008	2010				
New Zealand	1990	2012								
Nicaragua	1991	1995	1997	2001	2002	2006				
Norway	1990	1995	1996	2000	2004	2005	2006	2008	2010	2011
Pakistan	1989	1990	1994	2003	2009					
Panama	1990	1994	2005	2006	2007					
Paraguay	1989	1990	1993	1994	2001	2003	2004			
Peru	1989	1991	2000	2006	2007	2010	2011			
Philippines	2011									
Poland	1990	1993	2007	2011						
Portugal	1992	1995	2002	2006	2007	2011				
Romania	1990	1991	1993							
Russian Federation	1999	2000	2005	2008	2010	2011				
South Africa	1990	1995	2010							
South Korea	2000	2010								
Spain	1994	2007	2010	2013						
Sweden	1989	1994	2000	2010						
Thailand	1993	2000	2003	2015						
Turkey	1990	1994	1995	1998	1999	2002	2010			
United Kingdom	2000	2010	2011							
United Kingdom	2010									

continued…

Table F2 (…continued): Year-wise Fiscal Consolidation Episodes

United Kingdom	2011										
United States of America	2010	2015									
Venezuela	1989	1990	1993	1995	1996	1999	2000	2002	2003	2010	2012

Note. A fiscal consolidation episode is a period in which the CAPB improves by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year (Ardagna, 2009). For calculation of CAPB, the data for government revenue and primary balance from 2012 to 21016 were extracted from a fiscal affairs database using STA-T1, STA-T3, STA-T5, STA-T7, STA-T9 and STA-T10. Later, primary surplus was calculated as (government revenue − primary expenditure). Data of output gap were extracted from Dataset: Economic Outlook Number 100, *November 2016 (OECD, 2016). Output gaps are deviations of actual GDP from potential GDP as a per cent of potential GDP.*

Appendix G (Chapter 8)

Table G1: Role of Fiscal Consolidation on Financial Stability

Country	FC	BS_CAR		TGE_Total_Tier	TGE_Z-score	TGE_SMC
		Tier-1	Tier-2			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Argentina	FC - I		0.08	0.23	0.59	
	FC - II		-0.53	0.15	0.43	
Australia	FC - I	0.70**	0.70**	-0.95**	1.13	7.13
	FC - II	0.37	0.62**	-0.07	0.43	7.34
Austria	FC - I		5.13**	-1.54**	-1.88	-2.42
	FC - II		1.77	0.22	-1.33	-1.48
Belgium	FC - I			1.93**	1.26	6.88
	FC - II			0.64***	-0.14	-1.11
Brazil	FC - I	0.16	0.617**	-1.66	1.51	
	FC - II		2.62**	-0.13	-0.04	-6.24
Bulgaria	FC - I	0.02	-0.14	1.33	-0.52	-5.62
	FC - II	0.28	0.06	-0.13	0.08	-4.15
Canada	FC - I					
	FC - II	4.43	4.49	1.63	0.44	-12.63
Chile	FC - I	0.05	-0.02	0.20	-0.08	6.35
	FC - II	0.09	0.00	0.02	-0.02	1.31
China	FC - I	-0.39	-1.45	0.08	3.05	62.34**
	FC - II	3.02	0.94	-0.56	0.60	18.06
Colombia	FC - I			2.44*	-0.55*	
	FC - II			-0.12	-0.02	
Costa Rica	FC - I					
	FC - II			-0.20	-0.17	1.82**
Denmark	FC - I	0.26	0.39	-3.23	-1.27*	
	FC - II	0.47	1.18	-0.30	-0.16	3.47
Domin. Republic	FC - I			-2.52*	-0.99	
	FC - II			-0.09	-0.33	
Finland	FC - I			-2.18*	-4.94***	49.65
	FC - II			-0.27	-0.25	-2.18
France	FC - I	-0.44	-0.12	0.47**	-0.69	-0.86
	FC - II	-3.26**	-2.70*	0.22	-1.12	-1.16
Germany	FC - I	-0.28***	-0.20**	-0.08	0.45	-3.33
	FC - II	-0.44*	-0.31**	0.10	-2.18***	-4.46
Ghana	FC - I			-1.35	1.13*	-0.58
	FC - II			-0.12	-0.01	-0.18
Greece	FC - I	-0.06	-0.39	-0.68	1.02	1.54
	FC - II	0.07	-0.91	0.21	0.47	16.94**
Haiti	FC - I	-0.05	-0.08		-0.61	
	FC - II	0.09	0.04		-0.32	
Honduras	FC - I			-0.20	-0.79	
	FC - II			0.02	0.08	

continued...

Table G1 (continued…): Role of Fiscal Consolidation on Financial Stability

Country	FC	BS_CAR		TGE_Total_Tier	TGE_Z-score	TGE_SMC
		Tier-1	Tier-2			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hungary	FC - I	-0.24	0.03	-1.09**	-0.25	2.68
	FC - II	0.10*	0.04	-0.14	-0.03	-0.42
Iceland	FC - I		0.57	0.53	-0.06	
	FC - II		1.23*	0.36**	0.02	
India	FC - I			-0.65	-0.41	89.53***
	FC - II			-0.26	-0.41	27.50
Indonesia	FC - I	1.27*	1.25*			
	FC - II		1.25*	-0.93*	-0.08	-0.73
Ireland	FC - I	0.54**	0.48	1.67**	-0.28	2.72
	FC - II	1.54**	0.07	0.10*	-0.01	-0.08
Israel	FC - I	0.02	0.14	0.44	0.02	8.94
	FC - II	0.01	0.16	-0.04	-0.08	1.17
Italy	FC - I	0.57	0.29	-0.04	0.99	1.06
	FC - II	0.09	-0.17	0.04	1.78	1.18
Japan	FC - I	0.07*	0.09***	0.34	0.42	-9.08
	FC - II	0.06	0.10*	0.10	0.23	-4.01
Mexico	FC - I	0.02	0.37			
	FC - II			0.01	-1.87**	-2.20
Netherlands	FC - I	-0.02	-0.02	-0.74	-0.89	6.10
	FC - II	-0.01	-0.25**	-0.31	0.64	0.65
New Zealand	FC - I	-1.32**	-1.25*			
	FC - II				2.15	-5.31
Nicaragua	FC - I				0.19	
	FC - II				-0.25	
Norway	FC - I	0.00	-0.03	-1.07*	0.27	-21.38**
	FC - II	-0.02	-0.09**	-0.11	0.05	-2.72*
Pakistan	FC - I	-0.68	0.37	0.06	1.74	-7.38
	FC - II	-2.13	0.51	-0.13	0.45	5.55
Panama	FC - I			-2.82**	-2.14*	7.79**
	FC - II			-0.56**	-0.29	1.43*
Paraguay	FC - I			-0.21	-0.44	
	FC - II			0.49	-0.02	
Peru	FC - I			-0.02	-0.08	12.87*
	FC - II			-0.01	-0.21	1.52
Philippines	FC - I		-1.61**	-0.12	-0.76	-7.49
	FC - II		-1.37	0.15	0.20	-9.27
Poland	FC - I			-0.42	0.28	9.98
	FC - II			-0.05	0.09	0.67
Portugal	FC - I		1.83***	-0.06	1.32	4.63
	FC - II		0.30***	-0.26**	0.00	0.32
Romania	FC - I					
	FC - II			-0.92	0.40	3.53***

continued…

Table G1 (continued…): Role of Fiscal Consolidation on Financial Stability

Country	FC	BS_CAR		TGE_Total_Tier	TGE_Z-score	TGE_SMC
		Tier-1	Tier-2			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Russia	FC - I	0.88***	-0.06	2.26	-0.02	
	FC - II	0.56	0.21	0.22	-0.04	
South Africa	FC - I	-0.43	-0.17	0.08	-3.45	31.02
	FC - II	-0.59	0.19	-0.51	2.69	-21.77
South Korea	FC - I	0.13**	0.25**	-0.54	-0.78	-2.70
	FC - II	0.26	0.47*	-0.08	-0.07	0.68
Spain	FC - I	0.48	0.34***	0.19	0.07	29.85**
	FC - II	0.24	0.34	-0.07	0.07	5.46**
Sweden	FC - I	-0.04	0.31	-0.68	0.42	-12.67
	FC - II	0.18	0.69	-0.27	-0.03	-6.53
Switzerland	FC - I	-9.31	2.48			
	FC - II	0.00	0.00	-0.52	1.46	-38.65
Thailand	FC - I	0.06	0.10			
	FC - II	0.13	0.20	-0.42	-0.07	-4.05
Turkey	FC - I			-5.43**	0.27	8.90*
	FC - II			-0.85	0.07	0.74
UK	FC - I	-0.01	0.08	-1.24***	2.18	-24.62
	FC - II	-0.20	0.03	-0.12	0.58	-5.09
Uruguay	FC - I			6.24	-0.78	
	FC - II			0.45	-0.15*	
USA	FC - I	0.05	0.06**	0.93**	0.72	20.65
	FC - II	0.22*	0.16**	0.19**	0.07	5.28*
Venezuela	FC - I	0.42***	0.19	0.50	-2.18	
	FC - II	0.63***	0.22	0.27	-0.23	

Note: *The first column presents the country name. The second column presents the fiscal consolidation measures. Fiscal consolidation is measured as a period in which the CAPB improves by at least 1.5 per cent of GDP, or a period of two consecutive years in which the CAPB improves by at least one per cent of GDP per year (Ardagna, 2009). We labelled this strictly defined episode 'FC-I'. Further, we used the change in CAPB as an alternate measure of fiscal consolidation and labelled it 'FC-II'. Columns 3 and 4 present the results of the disaggregated analysis, where* BS_CAR *indicates the capital adequacy ratios using Bankscope data. Columns 5 to 7 present the results of the aggregate analysis using data from TGE database.* TGE_Total_Tier *indicates the banking system regulatory capital to risk-weighted assets, as defined by TGE database.* TGE_Z-score *indicates the z-score as defined by TGE database, while* TGE_SMC *indicates the stock market capitalisation as defined by TGE database. *, ** and *** indicate statistical significance at 10, five and one per cent, respectively.*