

Fiscal Vulnerability to Crises with Perspective of Fiscal Consolidation: Cross-country Analysis¹

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Abstract

This study investigates fiscal vulnerability to crisis with perspective of fiscal consolidation by utilising Threshold and Quantile regression methods. We conduct stability analysis (forward, backward and moving screening) along with public debt overhang and financial net worth approaches in Value at Risk (VaR) and Conditional Value at Risk (CVaR) using data from 1960 to 2014 for a range of 53 selected economies. We find results in favour of fiscal consolidation as a policy response to avoid fiscal vulnerability to crisis unlike widely believed 90 per cent benchmark of public debt to GDP ratio. Further results indicate lack of single benchmark of public debt to GDP across all selected countries. Interestingly different countries appear with different optimal values (ranging from 61 to 88 %) of public debt to GDP which may trigger vulnerability to crisis. This study contributes in the existing literature mainly in two ways i) introduces new dimension of fiscal consolidation as a policy response in relevance with fiscal crisis and ii) uses threshold and quantile regressions as the appropriate methods of estimation.

Key Words: Fiscal Vulnerability, Fiscal Consolidation, Threshold Regression, Quantile Regression

JEL Classification: H30; H39

¹This is a detailed outlines on the topic as a part of my PhD thesis on Vulnerability to Crisis, Fiscal Consolidation and Financial Sector Stability: Evidence from the Selected Economies.

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1. Introduction

This study derives motivation from the recent debate and criticism emerged on estimates of public debt to GDP by Reinhart and Rogoff (2010) among many others considered as a single benchmark value of fiscal vulnerability to crisis. In the same vein, this study is also influenced by Mauro, Romeu, Binder, and Zaman (2015) as an alternative explanation to the fiscal vulnerability.

Reinhart and Rogoff (2010) calculated a threshold of 90 per cent public debt to GDP ratio as a single benchmark of vulnerability to crisis for a sample of 44 emerging and developed economies by using historical data information from 1790 to 2009. Recently, Herndon, Ash, and Pollin (2014) criticised findings of Reinhart and Rogoff replicating on the same data. They pointed out serious concerns including i) coding errors; ii) exclusion of available data in selective cases; and iii) inappropriate weighting. More recently Égert (2015) also reinvestigated the issue by using same data set and validated the above criticism by indicating 90 per cent public debt to GDP ratio as a misleading explanation of vulnerability to crisis. Mauro, et al. (2015) in the modern history of fiscal prudence and profligacy emphasizes on weaker policy response subject to increasing debt in the presence of deteriorating macroeconomic indicators mainly high inflation and low growth.

In general fiscal issues are discussed as increasing public debt⁶, growing social spending⁷, solvency risk exposure⁸ and ageing population⁹. The above issues ultimately lead to fiscal vulnerability, a situation which significantly reduces primary surplus subject to increased public debt over time. Literature has identified various approaches including Bohn (1998)¹⁰, single threshold, Public Debt Overhang, Fiscal Vulnerability Index and Financial Net Worth or Balance Sheet Approach and to assess fiscal vulnerability. Bohn (1998) analysed the fiscal vulnerability to crisis by estimating the parameter of public debt in association with primary surplus. The above study finds an economy vulnerable to crisis if the primary balance is depleting in response to increasing public debt.¹¹ However the above results do not consider presence of episodes of fiscal consolidation as a policy response. Single threshold and Public Debt Overhang approaches are mainly criticised due to the assumed homogenous association

⁶ For instance, see Reinhart and Rogoff (2011) .

⁷ Ghosh, Kim, Mendoza, Ostry, and Qureshi (2013) and Morgan and Astolfi (2015) observed this phenomena.

⁸ For instance, see Ciarlone, Piselli, and Trebeschi (2009) for further details.

⁹ For further details, please see Murray, Kroll, and Avena (2015).

¹⁰ An increasingly popular approach as suggested by Mauro, et al. (2015).

¹¹ This study used US data from 1916 to 1995, and reported US economy as non-vulnerable.

between debt and growth across the countries as also mentioned in (Égert, 2015, p. 3766). Fiscal Vulnerability Index approach is also based on the similar assumption since Z-score is constructed from the sample mean of public debt to GDP. Financial Net Worth approach has two major issues: i) increasing negative value, since the average value of FNW in OECD economies is recorded as - 65% of GDP in 2013 as compared to the pre-crisis value of - 38.1% (OECD., 2015, p. 60); and ii) the data is not available for most of the developing and emerging economies on financial assets and liabilities.

Broadly there are two main aspects as potential gaps in the available literature on this topic. These are i) the perspective of fiscal consolidation as a policy response to fiscal vulnerability and ii) technicalities involved to correctly estimate the parameter of fiscal vulnerability to crisis. This study overcomes these inadequacies by using Quantile and Threshold regression approaches which help to identify the relevant level of fiscal vulnerability in Bohn's settings along with stability analysis using forward, backward and moving screening procedures. Further we also attempt to incorporate the role of fiscal consolidation which may serve as an effect modifier to differentiate economies vulnerable to fiscal crisis from those which are not vulnerable to crisis. We achieve the above objectives by investigating a set of 53 countries including developing, emerging and developed economies for the period of 1960 to 2014.

Rest of the paper is organized as follows; section 2 presents the base model of analysis and methods of estimations, section 3 discusses data and results. Conclusion is presented in section 4.

2. Simple Model and Methods of Estimation

We use Bohn's (1998) model as the basic formulations of public debt in association with primary balances to measure the coefficient of vulnerability to fiscal crisis. Bohn (1998) categorises the debt and non-debt determinants of primary balance as in the following:

$$s_t = \alpha_0 + \rho d_t + \alpha_t GVAR_t + \alpha_Y YVAR_t + \varepsilon_t \quad (1)$$

where 's_t' is the ratio of primary surplus to GDP, 'd_t' the ratio of public debt to GDP, 'GVAR' is the level of temporary government spending, 'YVAR' is the business cycle indicator, and 'ε_t' refers to error term.

Both of these non-debt determinants of primary surplus captures the unusual variations in government spending and output respectively. These variations are calculated following Barro (1986), Valderrama (2005) and Mauro, et al. (2015) among several others.

$$GVAR_t = (G - G^{tr})/y \quad (2)$$

$$YVAR_t = (1 - (Y^{tr}/Y))(G^{tr}/y) \quad (3)$$

Where ‘G’ is the government expenditures, ‘G^{tr}’ is the trend in government expenditures, ‘Y’ is the GDP, ‘Y^{tr}’ is the trend in GDP, and ‘y’ is the GDP growth rate.

We adopt the following procedures to estimate the coefficient of vulnerability to crisis from Equation 1.

Linear specifications of threshold model are tested against two regimes as follows:

$$y_t = \beta X'_t + \delta_j Z'_t + \varepsilon_t \quad (4)$$

In this given setup, the explained variables are bifurcated into two groups, where Z regressors are regime specific; however, the coefficients of X regressor are the same across these two regimes. In case of a threshold variable ‘S_t’, its value increases in a way that threshold falls as follows:

$$\gamma_j = \gamma_j \leq S_t < \gamma_{j+1} \quad (5)$$

Therefore, the single threshold model with two regimes can be expressed as:

$$y_t = \beta X'_t + \delta_1 Z'_t + \varepsilon_t \quad \text{if } -\infty < S_t < \gamma_1 \quad (6)$$

$$y_t = \beta X'_t + \delta_2 Z'_t + \varepsilon_t \quad \text{if } \gamma_1 \leq S_t < \infty \quad (7)$$

Incorporating individual regime specifications into a single equation gives the following model:

$$y_t = \beta X'_t + \sum_{j=0}^m 1_j(S_t, \gamma) \cdot \delta_j Z'_t + \varepsilon_t \quad (8)$$

Threshold regression is performed with ordinary coefficient covariance matrix using threshold specification of Bai-Perron tests of L+1 vs. L sequentially determined threshold at 15% trimming percentage.

Further following Buchinsky (1994), as also appeared in McGuinness and Bennett (2007) quantile regression technique can be formally expressed as follows:

$$\ln q_i = x_i \beta_\omega + \mu_{\omega i} \quad (9)$$

Where the following quantile is used:

$$Quant_\omega(\ln q_i/x_i) = x_i \beta_\omega \quad (10)$$

The vector of exogenous variables is denoted with x_i . $Quant_\omega(\ln q_i/x_i)$ in the above equation denotes ω th conditional quantile with the condition of $(\ln q_i/x_i)$. In this setup, the ω th regression quantile ($0 < \omega < 1$) can be expressed as:

$$\min_{\beta \in R^k} \sum_i \rho_\omega(\ln q_i - x_i \beta_\omega) \quad (11)$$

Quantile regression is applied with Huber sandwich coefficient covariance with maximum iteration of 500 using the following sparsity estimations: i) method, Kernel (residual); ii) quantile method, Rankit (Cleveland); iii) bandwidth method, Hall-Sheather; and iv) kernel, Epanechnikov. For this purpose, quantile regression coefficients were estimated at five different quantiles (0.10, 0.25, 0.50, 0.75 and 0.90) using country-wise data from 1960 to 2011.

In the first stage we estimate simple regressions and conduct stability analysis (on coefficient) with three different programs forward, backward and moving screening procedures. In all of these programs, 33 different regressions were applied on individual country data. For instance, in forward screening, 1st regression is run on first twenty observations and then 21st value is added to arrive at the result of 2nd regression. Similarly, one observation is added to arrive at the next regression until 33rd regression. In backward screening, last (33rd) regression is run on the last twenty observations and then one observation starting from backward is added to arrive at the previous regression until 1st regression. In moving screening, 1st regression is run on the first twenty observations and then one next observation is replaced with one last observation until 33rd regression. These results enabled us to identify the year-wise vulnerability period in the entire sample.

Further for comparison purposes public debt overhang technique is applied in Value at Risk (VaR) and Conditional Value at Risk (CVaR) framework at 90%. For example, the public

debt overhang (VaR, 90%) value of 71.83¹² will indicate the 10% chances that the public debt (% of GDP) will be higher than 71.83; and the public debt overhang (CVaR, 90%) value of 86.19 will indicate that in worst 10% of the cases, the average public debt (% of GDP) will be 86.19. Financial Net Worth methods is also extended in the Value at Risk (VaR) and Conditional Value at Risk (CVaR) framework at 90% using the similar technique. However, the data on FNW is taken from OECD. (2014, p. 105) along with OECD Stat (710 Financial balance sheets – consolidated). However, the data for rest of the economies in the sample like Argentina, Bulgaria and Ghana¹³ is collected from International Financial Statistics.

Fiscal Vulnerability Index approach transforms public debt (% of GDP) into standardized Z-score by subtracting group average of public debt from individual country's value and then standardizing the value by dividing its corresponding standard deviation. This study found some conflicting results in terms of fiscal vulnerability due to the assumed homogenous association between debt and growth across the countries as pointed out in (Égert, 2015, p. 3766).

3. Data and Results

We use data for the sample of 53 countries from 1960 to 2011. We initially collect data from Mauro, Romeu, Binder, and Zaman (2013) for most of the variables¹⁴ and further updated from IMF, World Bank and World Economic Outlook online sources¹⁵. The data on Financial Net Worth is collected from OECD. (2014, p. 105) along with OECD Stat (710 Financial balance sheets – consolidated). Data on Financial Net Worth for rest of the economies in the sample like Argentina, Bulgaria and Ghana¹⁶ is collected from International Financial Statistics.

Based on the results, 30 out of 53 economies are categorized as vulnerable (Appendix A, Table A1). Debt coefficient of threshold (with model specification) and quantile regression is negative and significant in all of these economies (Appendix A, Table A1). Looking on the

¹² Value of Austria at 90%

¹³ For which the FNW data is not available on OCED.Stat

¹⁴ These variables include Government revenue, percent of GDP, Government expenditure, percent of GDP, Government primary expenditure, percent of GDP, Interest paid on public debt, percent of GDP, Government primary balance, percent of GDP, Gross public debt, percent of GDP, Real GDP growth rate, percent.

¹⁵ It is important to note that 'Government expenditure, per cent of GDP' provided in the 'A Modern History of Fiscal Prudence and Profligacy' are net of 'Interest paid on public debt, per cent of GDP', whilst the 'General government total expenditure' provided in the "WEOApr2015all" includes interest payments. That's why, extracting government expenditure from the government revenue (both as a per cent of GDP) from 2011 to 2015 collected from "WEOApr2015all" will give us the 'Government primary balance, per cent of GDP' from 2011 to 2015. So, 'Government primary balance, per cent of GDP' from 2012 to 2015 is calculated through taking the difference between 'Government revenue, per cent of GDP' and 'Government expenditure, and per cent of GDP'.

¹⁶ For which the FNW data is not available on OCED.Stat

FNW under VaR and CVaR framework results, Japan has the highest negative financial net worth (CVaR, 90%) of 188.95, whilst Nicaragua has the lowest value of 0.27. Public Debt Overhang (CVaR, 90%) is greater than 80% except Denmark, Finland, Mexico and Sweden (77.67%, 62.19%, 71.97%, and 76.82%). These values confirm the criticism on Reinhart and Rogoff (2010) by Égert (2015). Therefore, the analysis was extended to stability analysis to verify the Nicaragua, Denmark, Finland, Mexico and Sweden. Despite the fact that Nicaragua has the lowest FNW (CVaR, 90%) value of 0.27, the moving screening t-statistics (Appendix B, Figure B1) are negative and constantly declining and falls below the lower critical value. Moving screening test statistics for 1991 indicates the value falls below the lower critical value. In case of Finland, the backward screening test statistics is below the lower critical value throughout the sample period, and the moving screening test statistics is below the lower critical value from 1993 to 1998. Then, the Mexico is analysed through stability screening tests. None of the test statistics is below the lower critical values, hence the negative significant threshold value provides enough evidence for its vulnerability. In case of Sweden, the stability analysis in Figure B1 of Appendix B provides evidence where the moving screening test statistics is below the lower critical value from 1986 to 1992. Considering all this, 30 economies including Austria, Belgium, Canada, Chile, China, Denmark, Finland, France, Greece, Haiti, Honduras, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Mexico, New Zealand, Nicaragua, Pakistan, Poland, Portugal, Russian Federation, Sweden, Thailand, Turkey, UK and USA are categorized as vulnerable economies.

Debt coefficients for 23 countries¹⁷ are positive and insignificant except Ghana, Peru, Romania, South Africa, South Korea, Spain, Switzerland, and Venezuela (-0.01, -0.02, -0.28, -0.09, -0.01, -0.07, -0.01, -0.04), however, the test statistics for these cases falls in the non-rejection region indicating non-vulnerability to crisis (Appendix A, Table A2). Then, the threshold and quantile coefficients were analysed to arrive at fiscal vulnerabilities of individual economies. On running the threshold and quantile regression, none of the coefficients around threshold (with and without model specifications) and at all five quantiles were negative and significant (Appendix A, Table A2) indicating that these economies are non-vulnerable to crisis. Looking on the FNW (CVaR, 90%), its value for two of the economies (Colombia and Indonesia) is greater than 100%. Since, none of the threshold and

¹⁷ Argentina, Australia, Brazil, Bulgaria, Colombia, Costa Rica, Dominican Republic, Germany, Indonesia, Netherlands, Norway, Panama, Paraguay, Peru, Philippines, Romania, South Africa, South Korea, Spain, Switzerland, Uruguay, and Venezuela

quantile coefficients was negative significant, so all of the screening test statistics were observed. Looking on Figure B2 of Appendix B, all of the screening test statistics are falls above the lower critical values indicating non-vulnerability of these economies.

Further, the PDO (CVaR, 90%) values for Argentina, Bulgaria, Costa Rica, Ghana, Panama, and Uruguay (127.37%, 175.57%, 139.61%, 130.54%, 113.30%, and 101.49% respectively) are greater than 100 %, hence, needs some further investigation to arrive at their individual vulnerabilities. Stability analysis of Argentina (Appendix B, Figure B2) clearly indicates its non-vulnerability since none of the test statistics even falls in the negative region. Then, it was observed that all of the test statistics for forward, backward and moving screening for Bulgaria, Costa Rica, Ghana and Panama were above the lower critical value indicating the non-vulnerability for these economies.

Based on the results we may classify countries into two groups. In group one, six economies¹⁸ were non-vulnerable using data from 1960 to 2014 based on existing techniques like Bohn (1998), FVI, Public Debt Hangover, and FNW approaches. However, when analysed in our new proposed analytical setup, the economies are categorized as vulnerable in absence of fiscal consolidation (Appendix A, Table A1; and Appendix B, Figure B1). The main reason on including Denmark as vulnerable is that none of the fiscal consolidation episode is observed except 1983-86.¹⁹

4. Conclusion

This study predominantly relies on the threshold and quantile regression methods along with stability analysis incorporating forward, backward and moving screening. We observed 30 countries vulnerable to crisis mainly in the absence of fiscal consolidation. These results remain consistent across the threshold and quantile regression methods. Rest of countries in the sample appear non-vulnerable to crisis and the conclusion remain consistent in terms of persistence fiscal consolidation as a policy response in those economies.

¹⁸ Austria, Belgium, Denmark, Hungary, Iceland, and Mexico

¹⁹ 1983-86 is the large episode whilst 1990, 1996-97 are the only observed small fiscal consolidation episodes.

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Appendix A:

Table A1. Vulnerable Economies

		Austria	Belgium	Canada	Chile	China	Denmark	Finland	France	Greece	Haiti
Bond 1998 Approach	Pd co-eff	-0.02	-0.07	*-0.30	0.03	0.04	-0.08	*-0.22	*-0.23	*-0.13	-0.04
Fiscal Vulnerability Index	FVI	-0.03	1.23	0.63	-0.71	-0.92	-0.29	-0.60	-0.17	0.58	0.10
Public Debt Overhang in	PDO (VaR) %	71.83	126.92	95.16	51.90	25.84	67.98	55.73	82.32	144.89	133.15
CaR and CVaR Approach	PDO (CVaR) %	86.19	139.09	105.19	76.68	39.44	77.67	62.19	96.81	177.08	169.61
Financial Net Worth in CaR	FNW (VaR) - %	-47.03	-101.51	-72.29	-0.19	-1.87	-26.17	29.22	-67.18	-108.32	-6.75
and CVaR Approach	FNW (CVaR) - %	-69.63	-147.19	-109.29	-11.57	-1.94	-40.03	42.49	-99.63	-153.47	-6.84
Threshold Regression with	No Threshold, Co-eff					0.04			*-0.23		
Model Specificaiton	Threshold 1	34.14	98.36	85.43	16.55		61.99	14.29		74.02	
Approach	Co-eff (Dp<Th)	*-0.22	*-0.27	*-0.49	*-0.66		*-0.40	-0.17		-0.17	
	Observations	19.00	30.00	42.00	17.00		40.00	24.00		30.00	
	Co-eff (Dp=>Th)	0.00	*-0.45	*-0.98	0.03		-0.08	*-0.11		*-0.20	
	Observations	33.00	21.00	9.00	21.00		11.00	28.00		21.00	
Threshold Regression	No Threshold, Co-eff						-0.08				
without Model	Threshold 1		98.36	82.34		19.59				94.86	
Specificaiton Approach	Co-eff (Dp<Th)		0.04	*0.09		0.00				-0.02	
	Observations		31.00	39.00		20.00				33.00	
	Co-eff (Dp=>Th)		-0.12	*0.30		*-0.22				*-0.10	
	Observations		21.00	13.00		3.00				19.00	
Quantile Regression	0.10	-0.03	-0.37	*-0.35			-0.25	-0.04	*-0.38	*-0.36	
Approach	0.25	-0.02	-0.29	*-0.38	-0.01	-0.03	*-0.34	-0.05	*-0.33	*-0.21	
	0.50	-0.01	*-0.60	*-0.48	0.01	0.00	*-0.32	-0.01	*-0.39	-0.17	-0.01
	0.75	-0.02	*-0.41	*-0.55	0.02	0.06	*-0.27	-0.01	*-0.46	-0.07	
	0.90	-0.01	*-0.36	*-0.63			-0.09	-0.01	*-0.34	*-0.18	
Descriptive Stat - Public	Mean	46.88	91.34	70.02	22.99	15.59	37.73	27.08	41.91	68.29	51.67
Debt to GDP	Median	56.21	96.01	70.63	15.05	15.00	43.16	16.12	33.37	54.86	39.31
	Minimum	14.07	51.59	43.61	4.10	0.97	4.26	2.97	14.39	13.44	11.73
	Maximum	88.79	134.07	101.72	88.39	43.46	80.06	61.72	97.01	177.19	194.63
	SD	23.14	26.80	16.86	20.09	12.08	23.18	19.29	24.88	48.74	44.52
	Prob. of Vul	0.00	0.55	0.14	0.00	0.00	0.00	0.00	0.05	0.41	0.15
Public Debt % of GDP and	0-30	4.76			3.84	5.12	3.28	3.69	4.22	5.36	6.41
GDP Growth Rate -Mean	30-60	2.27	4.30	3.70	6.53	8.29	0.86	2.02	2.24	2.13	4.91
	60-90	1.85	3.42	3.02	6.66		2.69		1.08	1.27	-0.25
	90 and above		1.78	3.29					0.42	1.26	4.27
Public Debt % of GDP and	0-30	4.95			4.36	4.96	3.21	3.17	4.65	6.52	5.80
GDP Growth Rate -Median	30-60	2.32	4.20	3.75	7.97	7.72	0.88	2.92	2.20	2.26	5.12
	60-90	2.22	3.75	2.92	6.86		2.83		1.55	0.70	-0.25
	90 and above		1.83	3.45					0.42	2.30	4.40

Table A1. Vulnerable Economies - Continued

		Honduras	Hungary	Iceland	India	Ireland	Israel	Italy	Japan	Mexico	New Zealand
Bond 1998 Approach	Pd co-eff	-0.04	0.03	-0.04	-0.02	*-0.13	*-0.04	-0.02	*-0.16	0.01	-0.06
Fiscal Vulnerability Index	FVI	-0.04	0.94	-0.34	0.06	0.47	1.84	0.93	1.21	-0.33	0.02
Public Debt Overhang in CaR and CVaR Approach	PDO (VaR) %	96.46	101.82	82.07	77.85	107.75	154.32	121.55	220.00	56.80	68.05
	PDO (CVaR) %	112.79	122.09	96.48	87.27	121.37	217.09	135.91	253.84	71.97	82.11
Financial Net Worth in CaR and CVaR Approach	FNW (VaR) - %	-14.50	-63.52	-57.38	-9.63	-73.36	-76.90	-107.76	-118.86	-34.26	5.53
	FNW (CVaR) - %	-18.28	-90.19	-81.95	-10.16	-114.24	-137.78	-158.69	-188.95	-60.84	5.52
Threshold Regression with Model Specificaiton Approach	No Threshold, Co-eff						*-0.04				
	Threshold 1	71.17	72.88	30.50	70.37	94.51		56.64	78.42	51.91	47.58
	Co-eff (Dp<Th)	*-0.05	*-0.55	*0.19	-0.15	-0.01		*-0.16	*-0.49	*-0.19	0.07
	Observations	39.00	12.00	27.00	38.00	45.00		18.00	32.00	42.00	22.00
	Co-eff (Dp=>Th)	0.08	*0.19	*-0.04	*-0.23	0.00		*0.15	*-0.20	*-0.08	0.02
	Observations	13.00	10.00	25.00	13.00	7.00		34.00	19.00	9.00	19.00
Threshold Regression without Model Specificaiton Approach	No Threshold, Co-eff		0.03		-0.02						
	Threshold 1							67.48	53.98		
	Co-eff (Dp<Th)							*-0.08	*0.05		
	Observations							25.00	45.00		
	Co-eff (Dp=>Th)							*-0.06	0.06		
	Observations							27.00	7.00		
Quantile Regression Approach	0.10	-0.05		-0.03	0.01	*-0.85		*0.08	*-0.52	0.04	
	0.25	-0.02	0.09	-0.01	-0.06	*-0.66	-0.03	0.06	*-0.36	0.00	*-0.14
	0.50	0.02	0.12	-0.01	-0.11	*-0.57	-0.02	*0.07	*-0.44	-0.07	*-0.09
	0.75	0.03	-0.14	0.02	-0.21	*-0.46	-0.01	*0.06	*-0.51	-0.17	-0.06
	0.90	*0.06		0.09	-0.23	*-0.37		*0.05	*-0.55	*-0.19	
Descriptive Stat - Public Debt to GDP	Mean	46.50	80.94	35.98	50.19	64.49	112.55	80.90	90.74	36.41	48.64
	Median	43.15	79.11	30.87	37.85	51.17	98.45	89.56	68.17	41.59	50.23
	Minimum	8.22	52.66	5.56	28.96	24.68	62.14	27.17	4.44	4.13	17.35
	Maximum	116.56	127.64	99.21	84.30	123.32	283.96	133.76	246.42	78.14	86.46
	SD	31.14	19.82	25.14	19.73	28.61	48.22	34.61	78.47	18.86	17.07
	Prob. of Vul	0.11	0.24	0.05	0.00	0.29	0.62	0.50	0.38	0.00	0.00
Public Debt % of GDP and GDP Growth Rate -Mean	0-30	3.98		5.61	3.75	5.54		4.47	8.14	4.66	2.20
	30-60	2.58	5.14	2.76	3.31	5.03		4.66	4.43	3.71	2.33
	60-90	0.64	2.94	-0.43	4.00	3.95	4.63	2.28	3.65	3.79	2.88
	90 and above	-2.13	9.12	0.07		3.08	2.25	0.89	0.90		
Public Debt % of GDP and GDP Growth Rate -Median	0-30	3.34		5.35	2.90	5.69		4.44	8.47	5.40	3.16
	30-60	2.79	5.32	3.33	3.39	5.32		5.46	4.39	4.05	2.36
	60-90	0.36	4.53	0.59	4.93	3.20	3.40	2.83	3.38	4.61	2.59
	90 and above	-2.70	9.04	1.18		3.09	2.94	1.46	1.59		

Table A1. Vulnerable Economies - Continued

		Nicaragua	Pakistan	Polnad	Portugal	Russian Federation	Thailand	Turkey	Sweden	UK	USA
Bond 1998 Approach	Pd co-eff	*-0.01	0.02	-0.16	0.01	*-0.31	-0.06	-0.02	-0.05	*-0.43	*-0.57
Fiscal Vulnerability Index	FVI	2.22	0.31	0.10	0.03	-0.26	-0.59	-0.33	-0.23	0.38	0.38
Public Debt Overhang in	PDO (VaR) %	225.39	78.77	61.95	93.32	59.86	47.53	52.09	69.85	94.61	95.19
CaR and CVaR Approach	PDO (CVaR) %	253.99	89.93	71.29	127.34	88.14	55.96	68.25	76.82	115.44	109.60
Financial Net Worth in CaR	FNW (VaR) - %	-0.17	-10.08	-33.91	-70.70	-1.21	-2.32	-1.51	-6.18	-74.24	-106.46
and CVaR Approach	FNW (CVaR) - %	-0.27	-16.60	-49.15	-108.11	-1.27	-2.36	-1.53	-13.49	-104.62	-150.15
Threshold Regression with	No Threshold, Co-eff			-0.16						*-0.43	
Model Specificaiton	Threshold 1		73.29		48.48	22.32	15.03	46.08	40.19		64.21
Approach	Co-eff (Dp<Th)		*-0.29		-0.03	*-1.27	*-0.91	0.09	-0.19		0.02
	Observations		31.00		24.00	7.00	14.00	33.00	23.00		40.00
	Co-eff (Dp=>Th)		-0.02		*-0.11	*-0.16	0.03	*-0.15	*-0.55		*-0.38
	Observations		13.00		28.00	34.00	38.00	9.00	28.00		12.00
Threshold Regression	No Threshold, Co-eff								-0.05		
without Model	Threshold 1		73.29	66.50		14.24				73.24	
Specificaiton Approach	Co-eff (Dp<Th)		-0.01	-0.09		*-2.46				-0.07	
	Observations		32.00	18.00		6.00				39.00	
	Co-eff (Dp=>Th)		-0.03	*-2.16		-0.04				-0.07	
	Observations		14.00	4.00		36.00				13.00	
Quantile Regression	0.10		0.16		0.04		0.01	*0.11	*-0.82	*-0.46	*-0.72
Approach	0.25		-0.12	*-0.28	0.02		-0.02	*0.08	*-0.80	*-0.52	*-0.66
	0.50	-0.02	0.03	-0.27	0.03	-0.10	-0.03	0.15	-0.64	*-0.63	*-0.66
	0.75		-0.03	-0.15	0.01		-0.04	*0.18	*-0.38	*-0.69	*-0.57
	0.90		-0.06		0.01		-0.03	*0.22	*-0.31	*-0.73	*-0.49
Descriptive Stat - Public	Mean	126.10	58.77	51.55	49.00	38.84	27.37	36.28	39.85	61.43	61.37
Debt to GDP	Median	114.22	60.18	49.21	50.21	26.34	23.71	33.44	40.24	50.13	60.31
	Minimum	30.19	19.54	36.79	13.50	7.88	4.16	19.04	1.60	37.47	41.05
	Maximum	266.59	91.07	70.56	130.18	116.00	57.16	77.56	73.29	117.94	105.06
	SD	78.93	17.81	9.57	30.68	31.17	14.54	12.32	18.37	23.01	17.38
	Prob. of Vul	0.53	0.02	0.00	0.11	0.08	0.00	0.00	0.00	0.14	0.11
Public Debt % of GDP and	0-30		11.54		5.81	3.74	5.35	4.42	4.22		
GDP Growth Rate -Mean	30-60	5.66	7.38	4.45	2.86	2.97	5.35	4.72	1.88	2.37	3.39
	60-90	3.55	5.16	4.54	0.33	-3.87		1.91	2.71	1.75	2.71
	90 and above	3.43			-0.87	-11.60				3.36	2.34
Public Debt % of GDP and	0-30		11.67		6.46	4.30	5.71	5.04	4.27		
GDP Growth Rate -Median	30-60	5.44	7.02	4.40	3.66	4.70	5.07	4.86	2.33	2.68	3.75
	60-90	3.39	4.19	4.82	0.76	-5.30		5.27	3.36	2.13	3.05
	90 and above	3.74			-1.13	-11.60				2.79	2.32

Note: i) Pd co-efficient is the coefficient of public debt (% of GDP) extracted from Bond model.

ii) VaR and CVaR in Public Debt Overhang and Financial Net Worth approaches is estimated at 90%.

iii) In case of economies where no threshold is detected (with or without model specifications), the coefficient of Bohn 1998 is used in the above table.

iv) Four slots of public debt to GDP for the GDP growth mean and median are used following Reinhart and Rogoff (2010).

Table A2. Non-vulnerable Economies

		Argentina	Australia	Brazil	Bulgaria	Colombia	Costa Rica	Dominican Republic	Germany
Bond 1998	Pd co-eff	0.01	0.01	0.04	0.03	0.04	0.01	0.01	0.00
Fiscal Vulnerability	FVI	-0.14	-0.66	-0.17	0.56	-0.76	0.10	-0.52	-0.13
Public Debt Overhang in CaR and CVaR	PDO (VaR) %	76.46	34.44	68.06	104.33	38.54	114.01	62.53	73.11
	PDO (CVaR) %	127.37	40.52	77.24	175.57	45.09	139.61	78.80	83.44
Financial Net Worth in CaR and CVaR	FNW (VaR) - %	-2.92	-19.86	-6.70	-4.67	-88.38	-36.09	-0.49	-50.31
	FNW (CVaR) - %	-2.97	-34.31	-6.91	-4.88	-132.36	-36.09	-0.64	-71.98
Threshold Regression with Model Specificaiton	No Threshold, Co-eff	0.01	0.01		0.03				0.00
	Threshold 1			36.60		30.82	33.06	38.47	
	Co-eff (Dp<Th)			*0.28		-0.06	-0.12	*2.66	
	Observations			20.00		40.00	22.00	24.00	
	Co-eff (Dp=>Th)			0.01		-0.04	0.01	*5.57	
Threshold Regression without Model Specificaiton	No Threshold, Co-eff								
	Threshold 1								
	Co-eff (Dp<Th)								
	Observations								
	Co-eff (Dp=>Th)								
Quantile Regression	0.10	-0.01	0.10	*0.06		-0.03	*0.02		-0.02
	0.25	0.00	0.05	*0.05		0.04	0.01	0.03	0.00
	0.50	0.00	0.06	*0.04	*0.06	*0.08	0.01	0.01	0.00
	0.75	-0.02	0.05	0.02		0.07	0.01	0.04	0.00
	0.90	-0.01	0.00	-0.01		*0.08	0.01		0.00
Descriptive Stat - Public Debt to GDP	Mean	43.09	24.70	42.09	67.89	21.22	51.68	29.89	43.57
	Median	36.05	23.21	37.60	40.67	16.50	37.02	24.31	40.67
	Minimum	8.39	9.63	13.85	13.69	7.20	16.12	13.09	17.63
	Maximum	164.97	41.23	79.80	289.55	45.63	158.35	86.87	83.24
	SD	33.21	7.65	19.11	68.06	11.31	35.06	18.31	20.79
	Prob. of Vul	0.07	0.00	0.00	0.25	0.00	0.16	0.00	0.00
Public Debt % of GDP and GDP Growth Rate -Mean	0-30	3.48	3.27	7.42	3.00	4.27	5.88	5.24	3.90
	30-60	2.67	4.34	2.91	4.77	4.27	5.01	3.99	2.10
	60-90	5.18		3.21	-0.94		4.10	4.42	1.24
	90 and above	0.00			7.13		2.46		
Public Debt % of GDP and GDP Growth Rate -Median	0-30	3.76	3.56	8.32	1.55	4.53	6.58	5.58	4.21
	30-60	2.44	4.08	3.28	4.78	4.39	5.05	4.78	1.89
	60-90	6.29		2.74	2.22		3.24	4.49	1.40
	90 and above	0.95			7.40		3.82		

Table A2. Non-vulnerable Economies - Continued

		Ghana	Indonesia	Netherlands	Norway	Panama	Paraguay	Peru	Philippines
Bond 1998	Pd co-eff	-0.01	0.01	0.00	0.06	0.03	0.02	-0.02	0.04
Fiscal Vulnerability	FVI	-0.17	-0.23	0.31	-0.35	0.30	-0.50	-0.39	-0.26
Public Debt Overhang in CaR and CVaR	PDO (VaR) %	86.47	60.52	75.74	52.74	99.48	57.11	49.93	66.34
	PDO (CVaR) %	103.54	84.29	82.33	60.62	113.30	68.46	60.44	76.40
Financial Net Worth in CaR and CVaR	FNW (VaR) - %	-10.89	-107.35	-42.76	80.63	2.84	18.68	0.69	-1.54
	FNW (CVaR) - %	-10.90	-142.91	-61.85	102.44	2.97	19.85	0.64	-2.08
Threshold Regression with Model Specificalton	No Threshold, Co-eff	-0.01	0.01	0.00			0.02	-0.02	
	Threshold 1				49.61	91.28			14.81
	Co-eff (Dp<Th)				0.12	*0.07			-0.88
	Observations				43.00	39.00			7.00
	Co-eff (Dp=>Th)				*1.30	0.38			*0.07
	Observations				9.00	9.00			45.00
Threshold Regression without Model Specificalton	No Threshold, Co-eff								
	Threshold 1								
	Co-eff (Dp<Th)								
	Observations								
	Co-eff (Dp=>Th)								
Quantile Regression	0.10	-0.02		-0.09	0.03	0.03		0.04	0.04
	0.25	-0.02	0.00	0.02	0.10	0.04	0.01	-0.01	*0.07
	0.50	-0.02	0.02	0.02	*0.27	*0.07	0.02	0.01	*0.06
	0.75	-0.03	0.01	0.04	*0.36	*0.08	0.02	-0.02	*0.05
	0.90	0.00		0.03	*0.35	*0.11		-0.08	0.02
Descriptive Stat - Public Debt to GDP	Mean	42.12	39.86	58.76	35.68	58.50	30.58	34.18	38.78
	Median	32.72	36.91	59.13	32.99	63.89	21.36	34.71	42.51
	Minimum	5.04	16.43	37.80	22.32	17.77	12.04	12.08	11.53
	Maximum	123.35	95.89	78.48	60.50	112.65	72.61	63.44	79.22
	SD	27.01	18.58	12.06	10.06	28.20	17.51	13.21	20.01
Public Debt % of GDP and GDP Growth Rate -Mean	Prob. of Vul	0.06	0.04	0.00	0.00	0.16	0.00	0.00	0.00
	0-30	0.82	2.73		3.95	7.64	5.66	5.51	5.15
	30-60	5.58	5.06	3.26	3.04	7.30	2.85	1.05	3.03
	60-90	4.36	4.69	2.62	2.28	4.02	2.46	-4.08	4.83
	90 and above	3.94				2.46			
Public Debt % of GDP and GDP Growth Rate -Median	0-30	2.27	4.83		3.83	8.36	5.64	5.95	5.22
	30-60	5.20	5.53	2.74	3.02	7.97	3.42	3.15	3.73
	60-90	4.45	4.41	2.87	2.28	3.92	3.09	-4.08	4.93
	90 and above	4.00				2.85			

Table A2. Non-vulnerable Economies - Continued

		Romania	South Africa	South Korea	Spain	Switzerland	Uruguay	Venezuela
Bond 1998	Pd co-eff	-0.28	-0.09	-0.01	-0.07	-0.01	0.04	-0.04
Fiscal Vulnerability	FVI	-0.79	-0.27	-0.87	-0.29	-0.17	0.08	-0.46
Public Debt Overhang in CaR and CVaR	PDO (VaR) %	31.04	45.93	33.44	67.48	63.72	90.14	64.78
	PDO (CVaR) %	39.52	52.24	37.13	91.11	72.82	101.49	74.64
Financial Net Worth in CaR and CVaR	FNW (VaR) - %	-2.55	-4.55	33.15	-58.59	-13.35	-3.58	-14.71
	FNW (CVaR) - %	-2.71	-4.69	58.51	-87.54	-20.79	-3.64	-14.79
Threshold Regression with Model Specificaiton	No Threshold, Co-eff	-0.28	-0.09	-0.01		-0.01		-0.04
	Threshold 1				52.19		63.17	
	Co-eff (Dp<Th)				0.04		0.06	
	Observations				39.00		27.00	
	Co-eff (Dp=>Th)				-0.13		-0.06	
Threshold Regression without Model Specificaiton	No Threshold, Co-eff							
	Threshold 1							
	Co-eff (Dp<Th)							
	Observations							
	Co-eff (Dp=>Th)							
Quantile Regression	0.10	-0.12	-0.01	-0.03	-0.05			-0.13
	0.25	-0.09	-0.04	-0.05	0.02	-0.03	0.03	-0.08
	0.50	-0.15	-0.01	-0.02	0.00	-0.01	0.03	-0.28
	0.75		0.07	0.02	0.04	0.01	0.05	-0.20
	0.90		0.10	-0.03	0.01			-0.09
Descriptive Stat - Public Debt to GDP	Mean	20.16	38.44	17.32	37.96	41.96	50.99	31.76
	Median	17.76	39.35	16.69	37.33	44.27	42.68	32.30
	Minimum	1.03	23.20	2.63	8.21	6.99	16.64	4.95
	Maximum	40.55	52.92	36.90	99.44	72.24	99.89	79.09
	SD	11.29	6.93	9.37	24.08	17.97	25.50	21.60
	Prob. of Vul	0.00	0.00	0.00	0.05	0.00	0.13	0.00
Public Debt % of GDP and GDP Growth Rate -Mean	0-30	1.01	2.76	5.52	4.69	4.69	4.78	5.57
	30-60	1.55	3.26	3.78	2.79	1.70	5.18	1.86
	60-90				2.03	1.98	2.86	3.98
	90 and above				-0.16		4.20	
Public Debt % of GDP and GDP Growth Rate -Median	0-30	3.51	4.39	5.12	4.34	4.83	4.54	5.63
	30-60	2.45	3.15	3.63	3.26	1.90	5.40	2.88
	60-90				2.59	2.30	3.50	3.73
	90 and above				-0.16		3.89	

Note: i) Pd co-efficient is the coefficient of public debt (% of GDP) extracted from Bond model.

ii) VaR and CVaR in Public Debt Overhang and Financial Net Worth approaches is estimated at 90%.

iii) In case of economies where no threshold is detected (with or without model specifications), the coefficient of Bohn 1998 is used in the above table.

iv) Four slots of public debt to GDP for the GDP growth mean and median are used following Reinhart and Rogoff (2010).

Appendix B

Figure B1: Vulnerable Economies - Stability Analysis (forward, backward and moving screening)

..... F-teststate - - - B-teststate - - - M-teststate - - - Pb — Lower CV — Upper CV

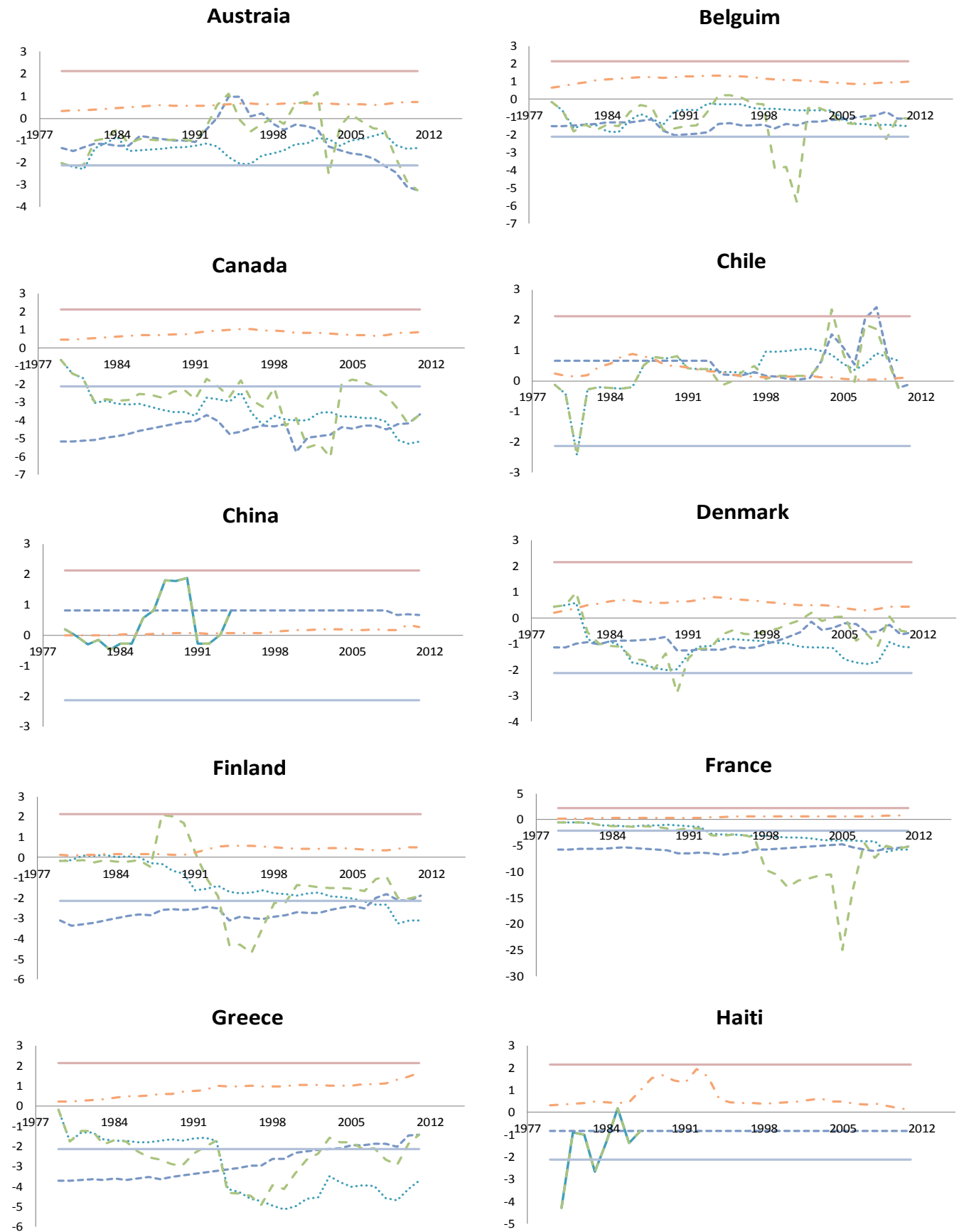
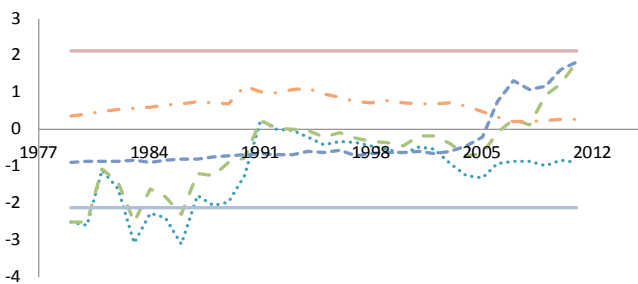


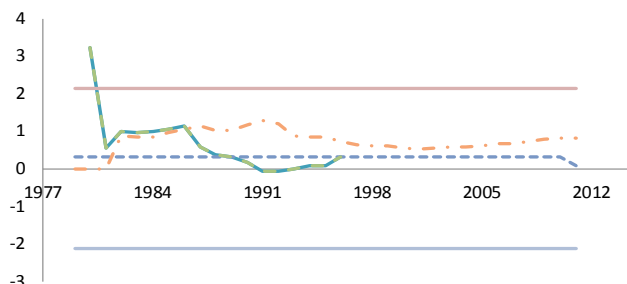
Figure B1: Vulnerable Economies - Stability Analysis (forward, backward and moving screening) - Continued

F-teststate B-teststate M-teststate Pb Lower CV Upper CV

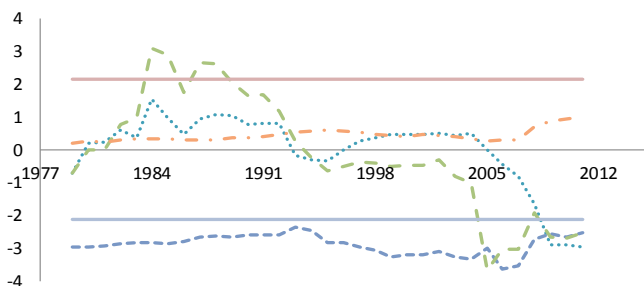
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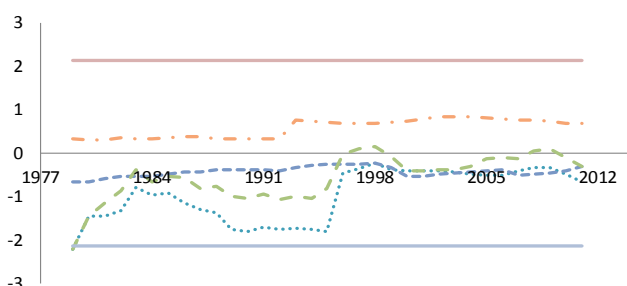
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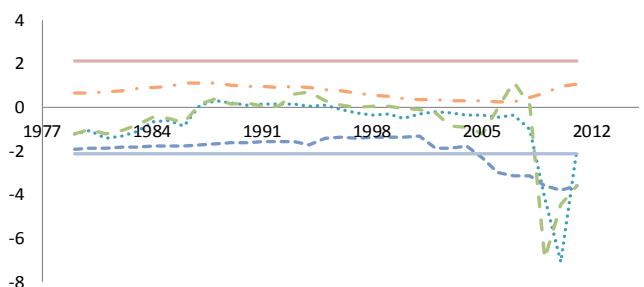
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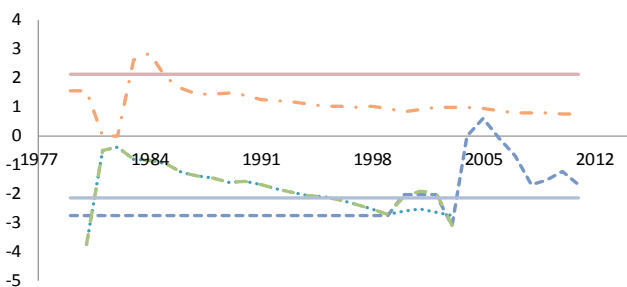
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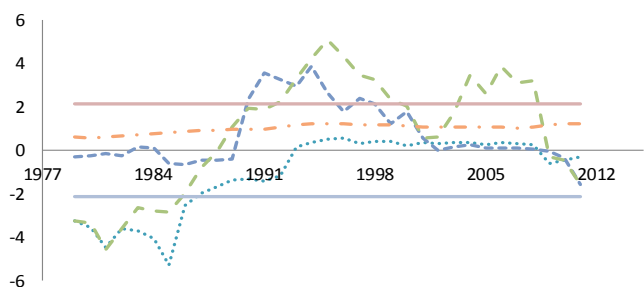
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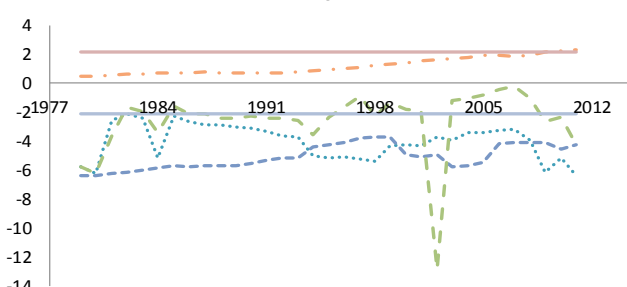
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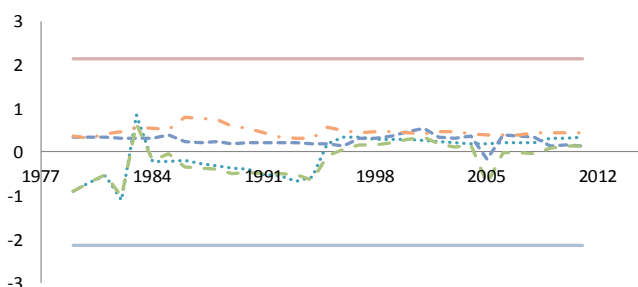
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Japan



Mexico



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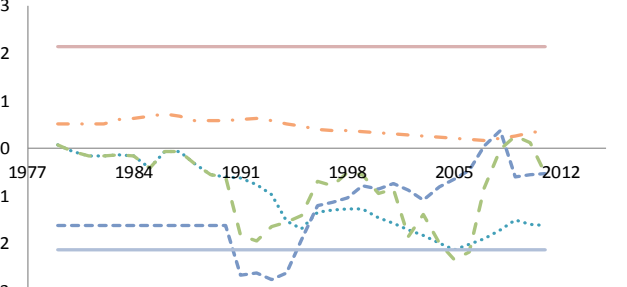


Figure B1: Vulnerable Economies - Stability Analysis (forward, backward and moving screening) - Continued

..... F-teststate - - - B-teststate - - - M-teststate - - - Pb — Lower CV — Upper CV

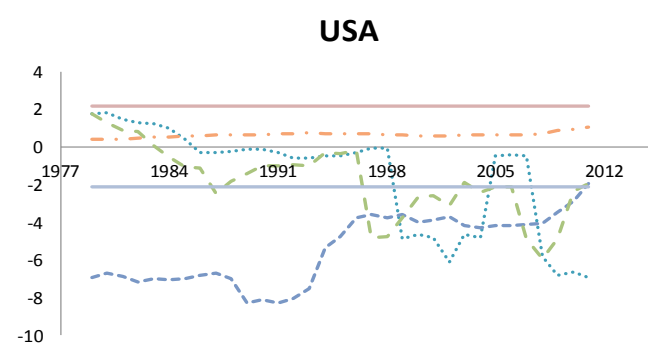
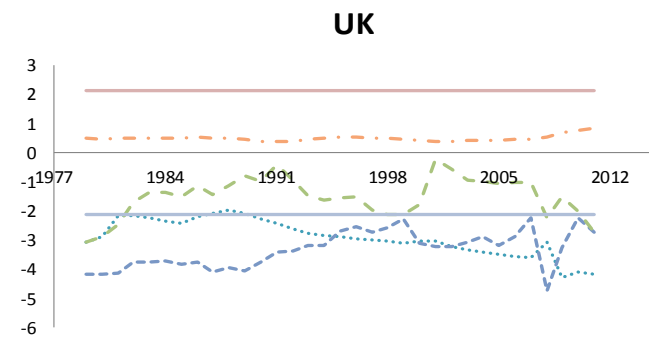
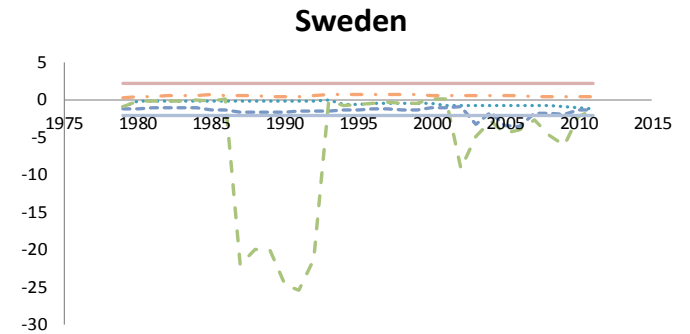
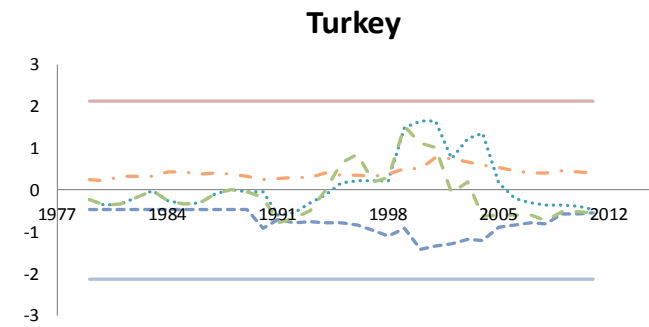
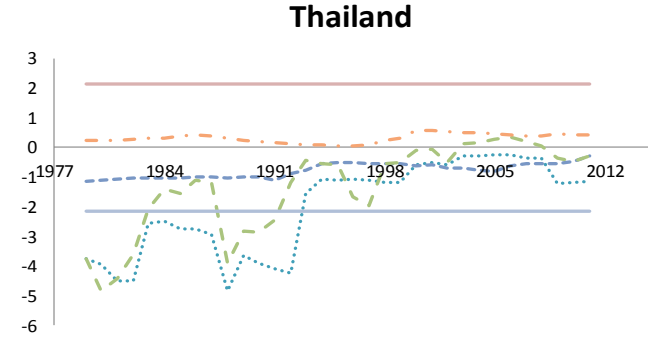
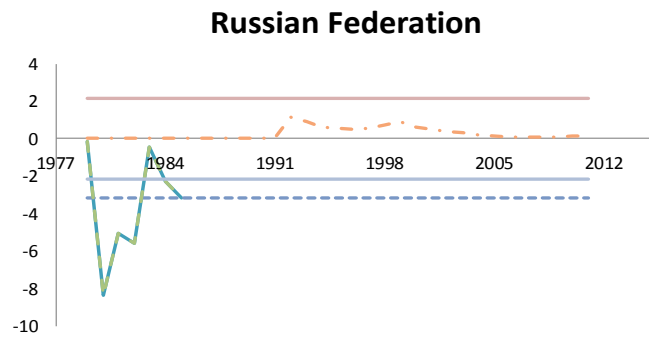
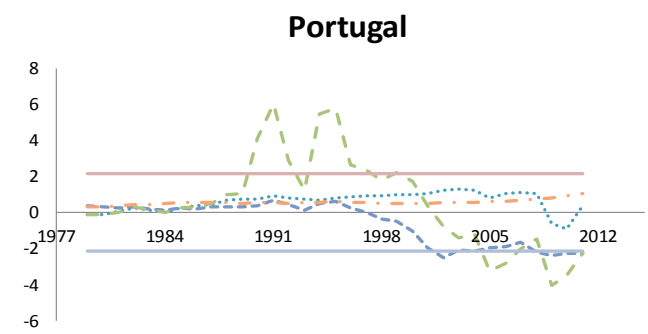
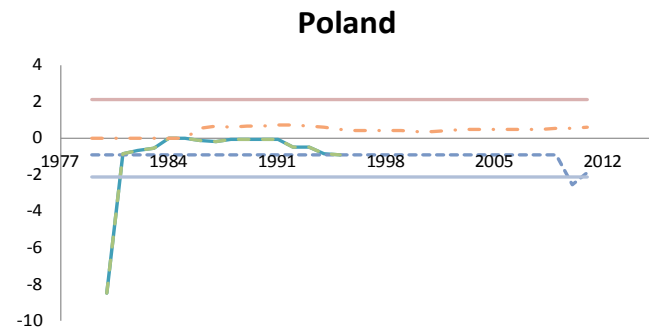
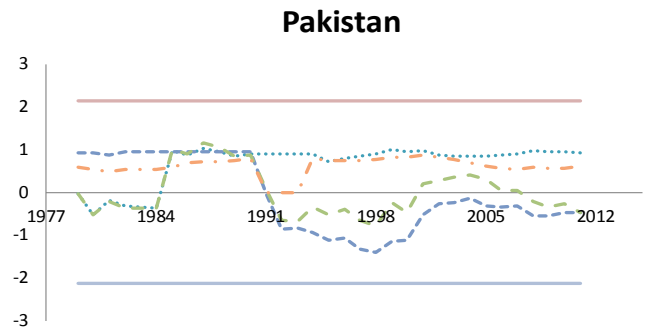
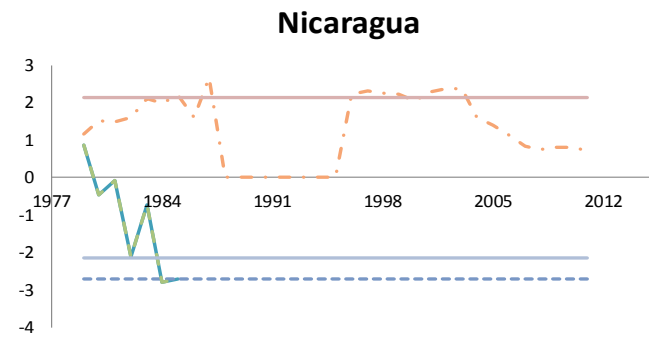


Figure B2: Non-vulnerable Economies - Stability Analysis (forward, backward and moving screening)

F-teststate B-teststate M-teststate Pb Lower CV Upper CV

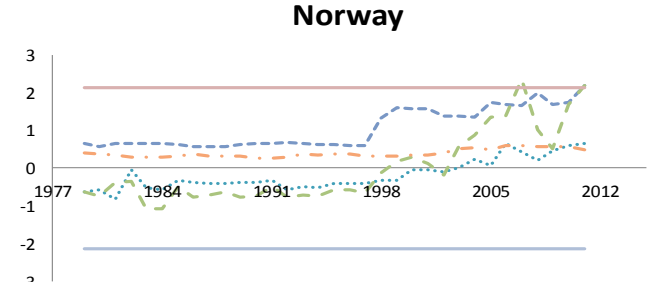
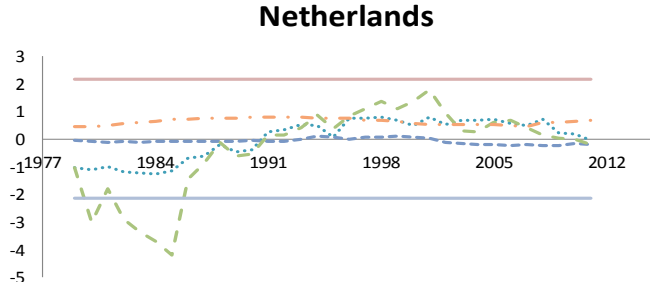
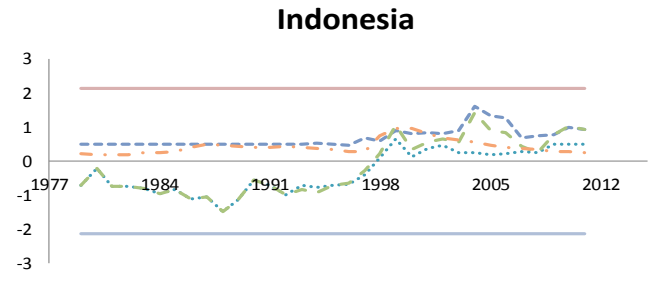
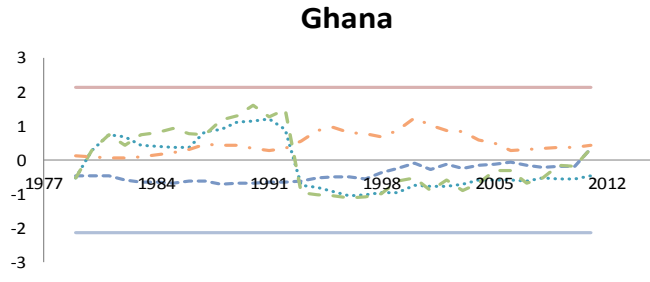
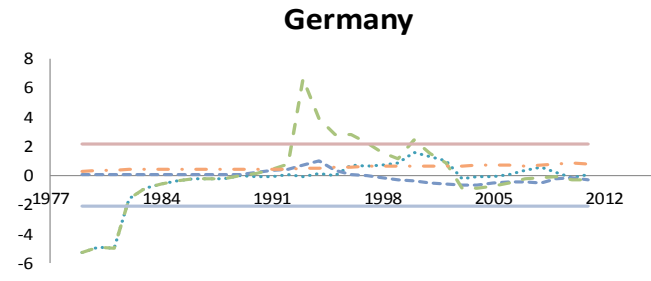
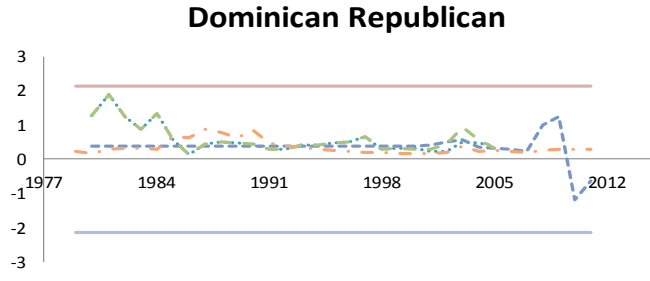
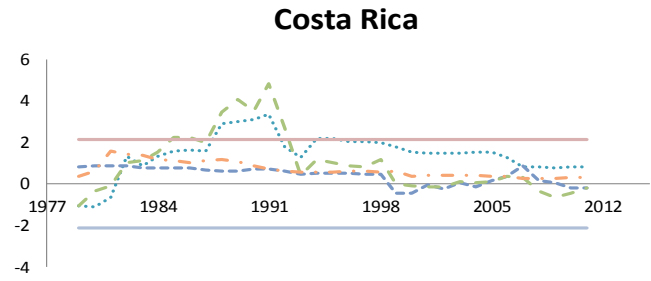
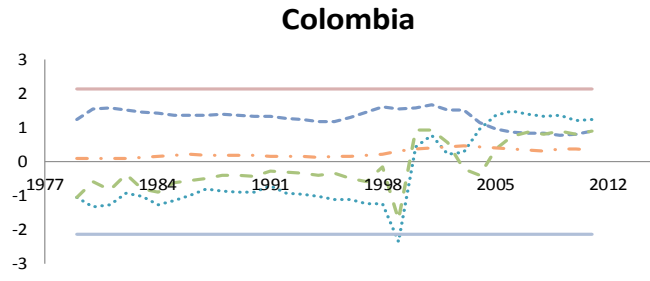
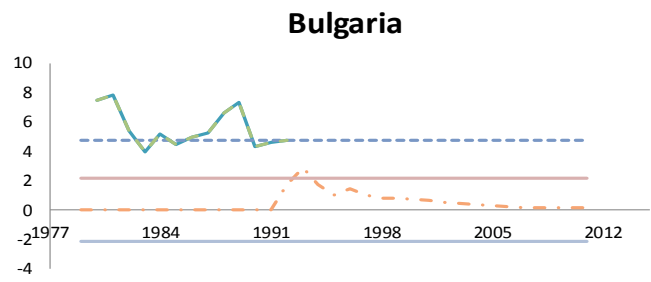
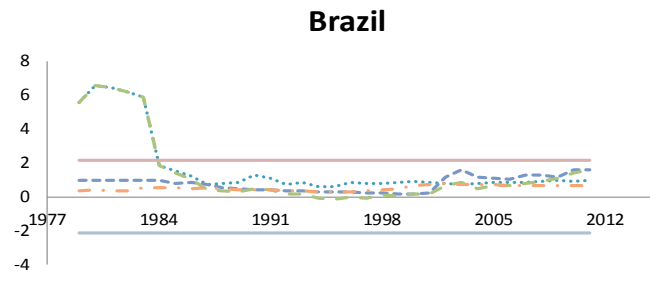
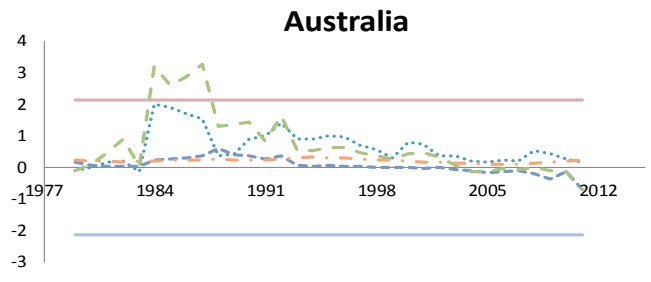
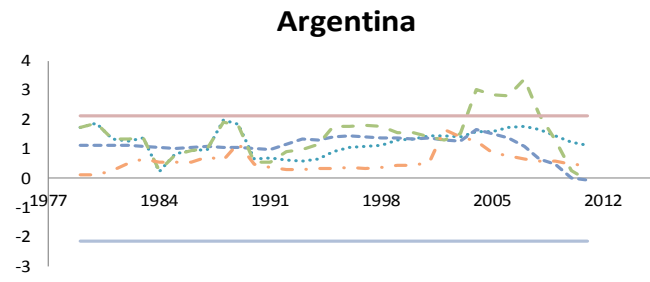


Figure B2: Non-vulnerable Economies - Stability Analysis (forward, backward and moving screening) - Continued

F-teststate B-teststate M-teststate Pb Lower CV Upper CV

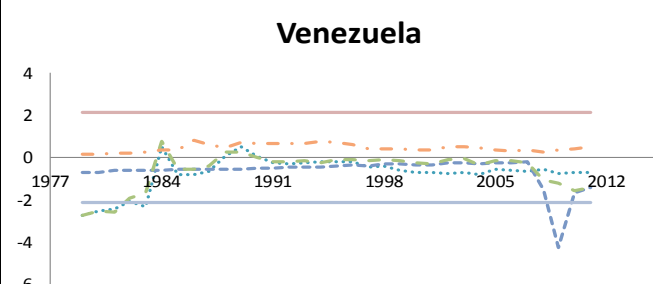
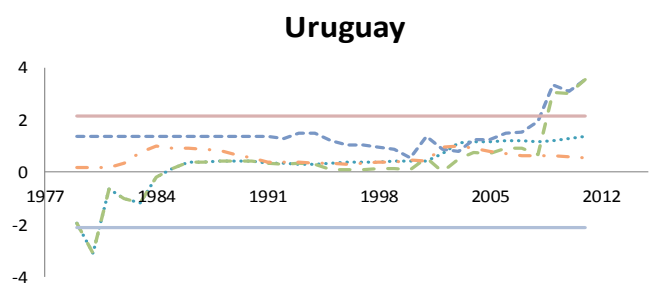
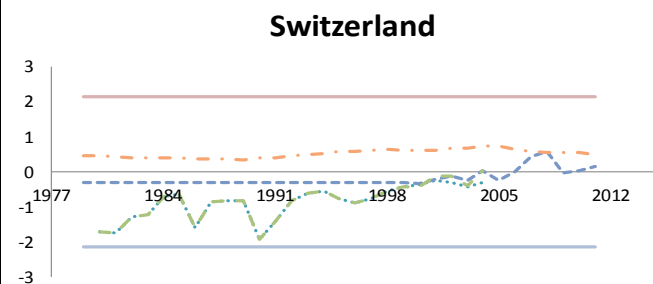
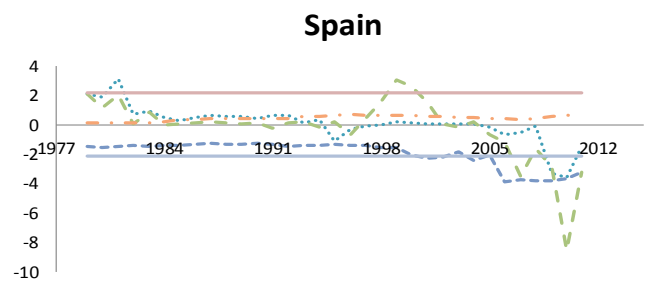
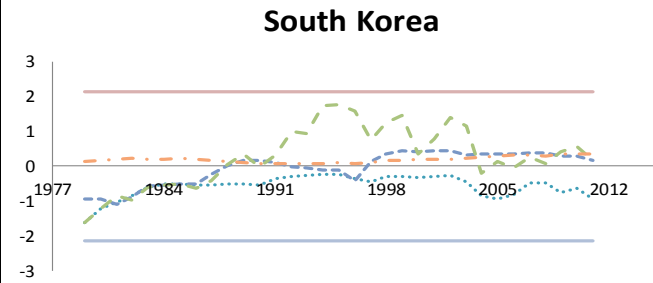
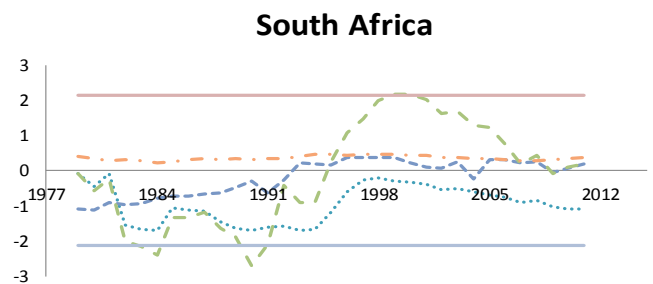
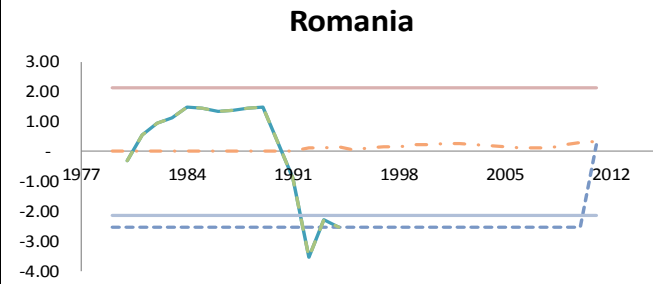
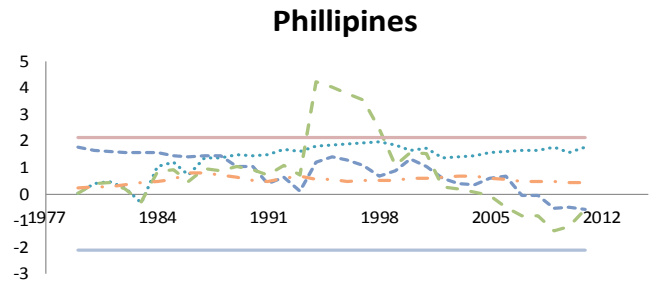
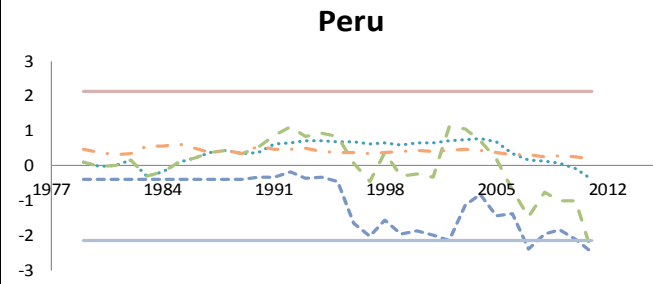
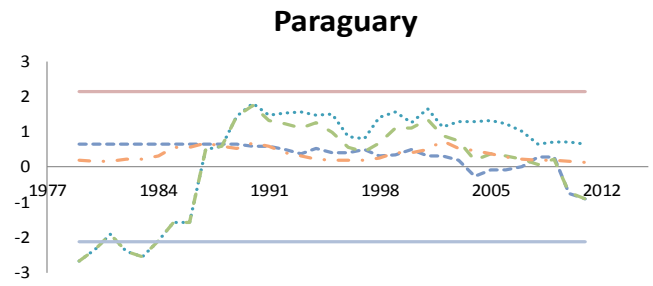
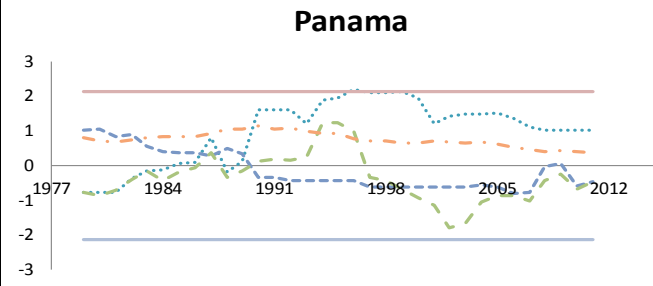
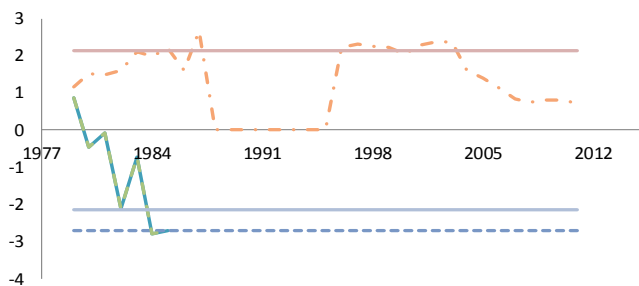


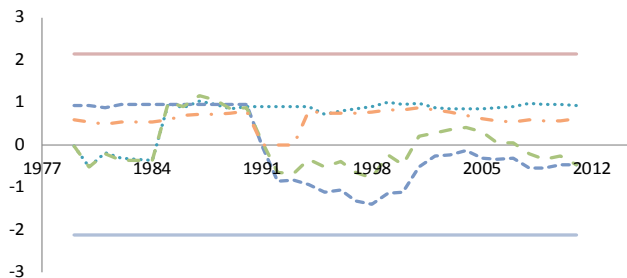
Figure B2: Vulnerable Economies - Stability Analysis (forward, backward and moving screening) - Continued

F-teststate B-teststate M-teststate Pb Lower CV Upper CV

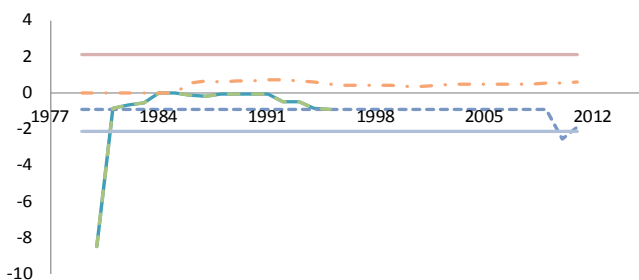
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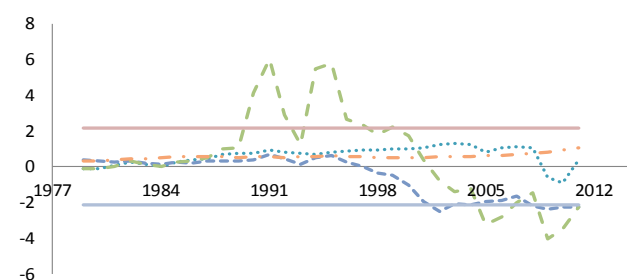
Pakistan



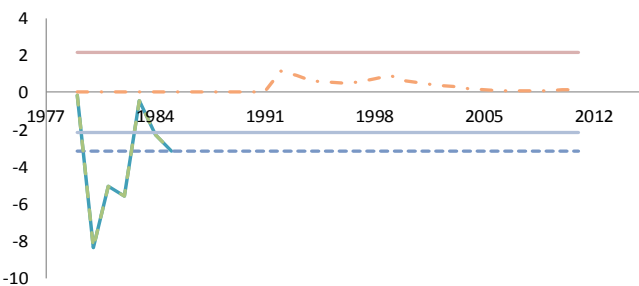
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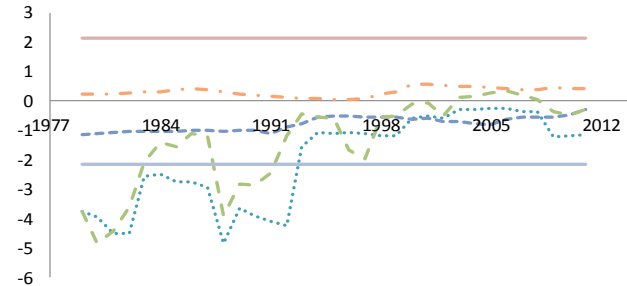
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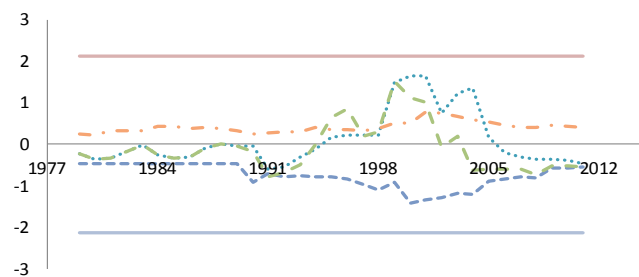
Russian Federation



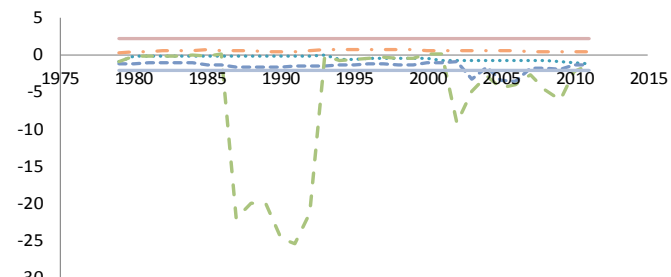
Thailand



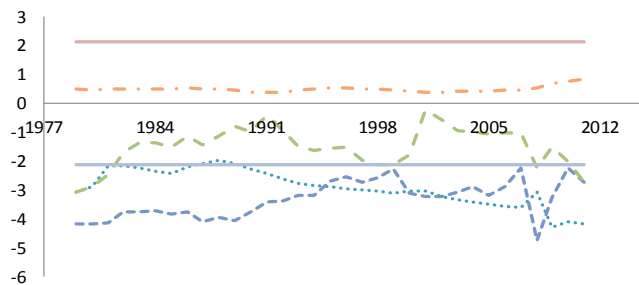
Turkey



Sweden



UK



USA

