Developing Financial Stress Indices: in the context of Basel III

CARIBBEAN CENTRE FOR MONEY AND FINANCE
ASSESSING MACRO-PRUDENTIAL VULNERABILITIES AND POLICYFRAMEWORKS IN A REGIONAL CONTEXT

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Background

- As already highlighted, Financial Stress Indices can be identified via EWS models

- These variables can be tracked to forewarn crises but also suggest policy instruments that might mitigate systemic risk.

- Basel III requires countercyclical buffers be imposed on banking systems.

- For CCBs to be valid we need to prove the conditioning variable (credit-GDP-gap) is a useful Financial Stress Index

- We will exploit a logit EWS approach to test the role of credit – GDP – gaps in the OECD, LA & Asia

- This is equivalent to testing whether the costs of CCBs (tax on banking systems) outweighs their benefits (reduced crisis probabilities)

- If this is not the case, CCBs may be an unnecessary tax on the banking system → real GDP suffers

Context

- Basel III has raised capital and liquidity standards to reduce systemic banking crises

- BIS recommendations are based on univariate, non-parametric (SE-EWS) analysis of credit/ GDP "gaps" and not on capital/ liquidity directly

- No regional analysis conducted: e.g. OECD vs. Asia vs. Latin America

- $\uparrow$ capital acts as a tax therefore empirical link between crises and capital should underpin recommendations. Similarly liquidity requirements ($\downarrow$ profit margins). Not clear that capital and liquidity were deficient in all economies suffering crises: this is a testable proposition.

- Lack of data! Extant multivariate EWS which examines capital and liquidity in OECD: Barrell et. al. (2010)

- Last wave of crises before sub-prime: Asia and Latin America. So now need to focus on these regions.

- We have constructed a capital dataset and use standard approaches from the literature to test for capital + liquidity against crises in Asia and Latin America

Capital and Liquidity: why they matter

- Regulatory capital: loss absorbing capacity to buffer against insolvency. Highest quality: common equity or retained earnings (Tier 1) vs. lower quality e.g. subordinated debt (Tier 2)

- *Capital charge = EA x RW x GCR*

  EA = amount of exposure; RW = risk weight of exposure; GCR = general capital requirement

- Risk weighting: e.g. residential mortgages: 50%; secured commercial property loans: 100%

- Liquidity: observed that banks with healthy capital faced problems due to poor liquidity management and market risk.

- Hence (by 2015) the introduction of LCR (short term resilience: 30 day acute stress test; minimum 60% in cash or govt. securities) and (by 2018) NSFR (longer term resilience: less reliance on short term wholesale funds).

The New Capital Structure

Basel III: Capital Requirements and Buffers (%)			
	Common Equity (after deductions)	Tier 1 Capital	Total Capital
Minimum	4.5	6	8
Conservation Buffer	2.5		
Minimum + Conservation Buffer	7.0	8.5	10.5
Countercylical Buffer	**0 - 2.5**		

Previous and Recent EWS

- Demirguc and Detragiache (1998, World Bank): first logit design with macro, financial and institutional variables. GDP growth consistently important but other indicators not stable. Contemporaneous so not true EWS.

- Kaminsky and Reinhart (1999; AER): signal extraction (non parametric, univariate) and event studies (parametric, univariate) on B + C crises.

- Drehmann et. al. (2010; BIS): signal extraction on credit/GDP gap for EWS; 18 OECD countries.

- Barrell et. al. (2010; JBF): include capital and liquidity for first time in OECD logit; 14 countries, 1980 – 2007.

- C + L both improve EWS accuracy out-of-sample and multivariate logit works better

Comparison of out-of-sample performance

1 year forecasting horizon for 2008		
	Number Crises Correctly Called	Number of False Alarms
Borio and Drehmann (2010)	**3/9** (misses US, Germany, Netherlands, Spain, Denmark, Sweden)	**3** (Finland, Norway, New Zealand)
Barrell et al (2010)	**6/9** (misses Sweden, Netherlands, Germany)	**0**

• Therefore we will continue with the logit framework. But need an alternative assessment mechanism for model selection (crises are lumped in middle of sample)

• Use Schulerick and Taylor (2012; AER) method: Receiver Operating Curves (ROCs)

• Supplement with event studies used on previous crisis work: K&R (1999; AER); Hemming et. al./ Roubini et. al. (2003; IMF); S&T (2012; AER).

Strategy

STAGE 1:

- Investigate whether different FSIs are relevant for different regions
- If so, → one size fits all CCB policy inappropriate
- In that case, move on to stage 2

STAGE 2:

- Directly compare OECD vs. LA + Asia
- If differences remain and they are statistically sound then CCB proposal will unnecessarily tax banking systems in some economies

Data

Capital:

- no publicly available time series (pre-1995) for LA or Asia. We source from "The Banker" – an industry publication which lists BIS risk weighted ratios of top 1000 banks.

- Assumption: capital in top bank in a country will be representative of capital health in terms of systemic risk (note BIS focus on SIFIs)

- Missing observations interpolated with IMF GFSR/ Country Report (Article IV) data

Liquidity:

- Use definition of narrow liquidity (source IFS):

$$\frac{cash + reserves + claims\ on\ (central\ bank + government)}{total\ assets}$$

- Country selection constrained by Banker coverage: 8 Latin America; 6 Asia:
ARGENTINA, BRAZIL, CHILE, MEXICO, PANAMA, PERU, URUGUAY, VENEZUELA;
INDONESIA, KOREA, MALAYSIA, PHILIPPINES, SINGAPORE, THAILAND

- Time domain: 1980 – 2010

Dependent Variable:

Systemic crises as defined by D&D (2005):

- non-performing loans/ total banking system assets> 10%, or

- public bailout cost > 2% of GDP, or

- systemic crisis caused large scale bank nationalisation, or

- extensive bank runs were visible and if not, emergency government intervention occurred.

- These criteria generate 14 systemic banking crises in Latin

Crises

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
_ARG	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
_BRA	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_CHI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_MEX	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_PAN	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_PER	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_URU	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
_VEN	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_IND	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
_KOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
_MEX	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_PHI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
_SIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
_THA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	3	2	2	0	0	0	0	1	1	1	0	1	1	3	1	0	3	1	0	0	1	1	0	0	0	0	0	0

- Only 2 crises (Argentina and Uruguay) occur after 1998 and none at all after 2002; out-of-sample prediction for not possible

Remaining Variables

- Use "traditional" crisis determinants from literature

List of Variables	
	1. Real GDP Growth
Variables used in previous studies: Demirguc-Kunt and Detragiache (1998; 2005); Davis and Karim (2008).	2. Domestic Credit/ GDP
	3. Inflation
	4. Budget Balance/ GDP
	5. M2/ Foreign Exchange Reserves
	6. Exchange Rate
	7. Real Domestic Credit Growth
	8. Terms of Trade
	9. GDP per Capita
Variables introduced by B&K.	10. Liquidity
	11. Capital Ratio
	12. Current Balance as % GDP[***]
[***] already used in previous studies	

Stage 1: Event Studies

- Univariate graphical approach: how variables behave around the time of an event (crisis).

- Preliminary analysis: Want to know if behaviour around the event is significantly different from "tranquil" periods.

- Choose three year window before and after crisis year – the "abnormal" period.

- Compare average behaviour in abnormal period (bold line) against average behaviour in tranquil period (dashed grey line).

- Use 95% confidence intervals (dotted lines) to assess significant deviation: if the bold line depicting the crisis episodes is outside the 95 percent confidence interval, the respective variable behaves significantly different during the event window.

- Focus only on interesting cases and new variables; disadvantage: does not take variable combinations into account

Latin America
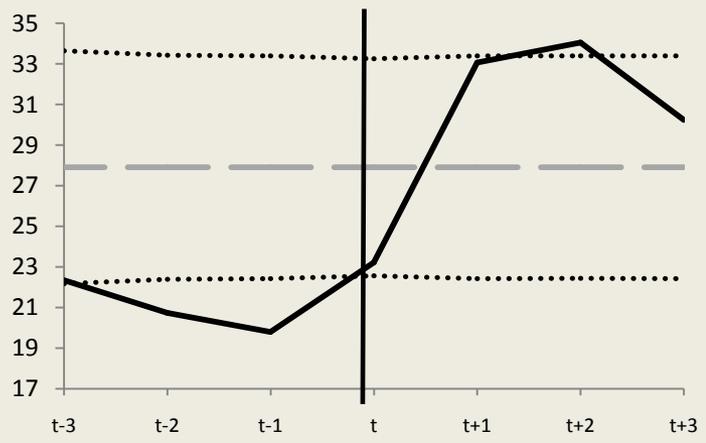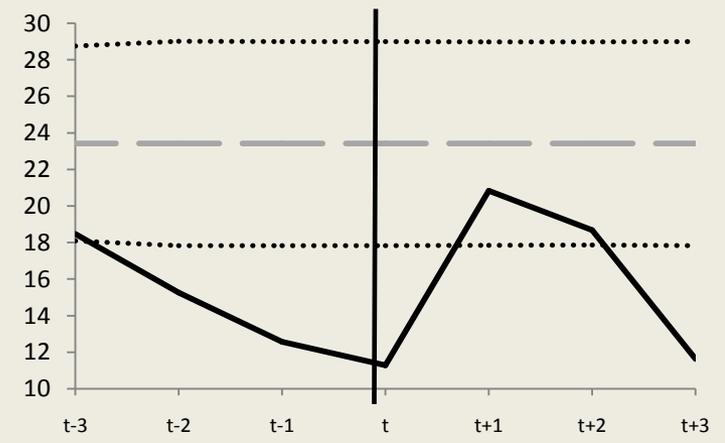
Capital Adequacy
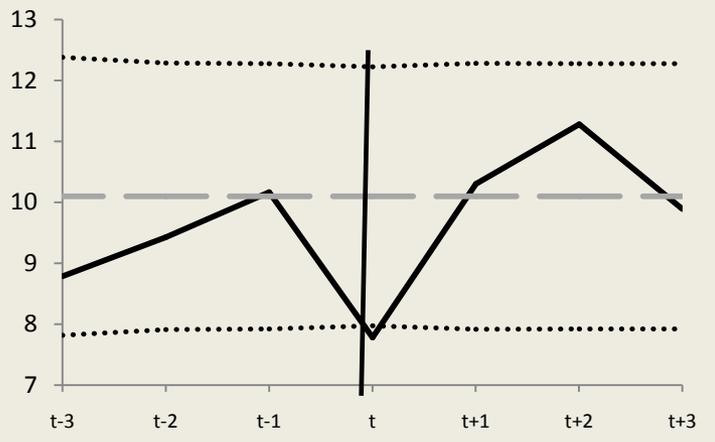
Liquidity

Asia
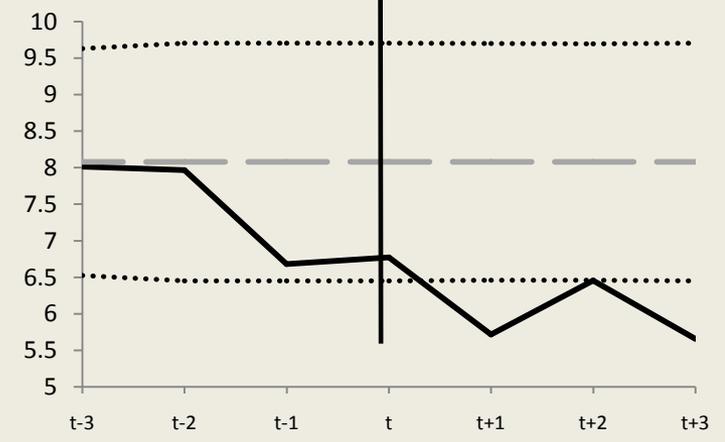
Capital Adequacy

Liquidity

Latin America

Domestic Credit/ GDP
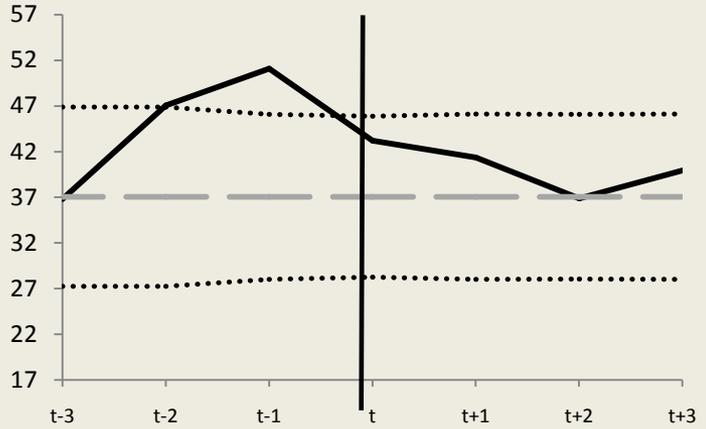
Current Account

Asia

Domestic Credit/ GDP
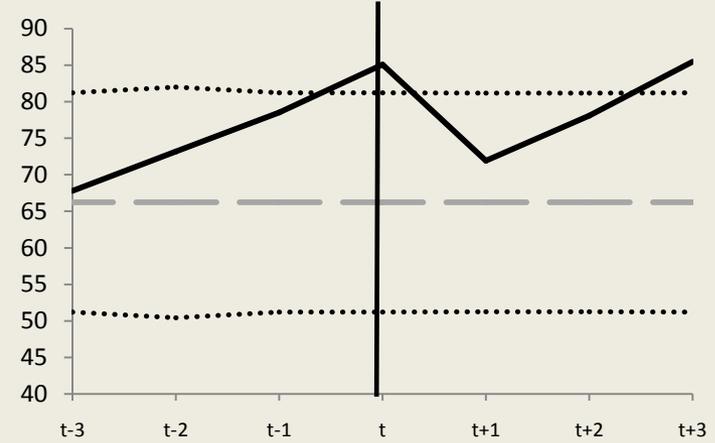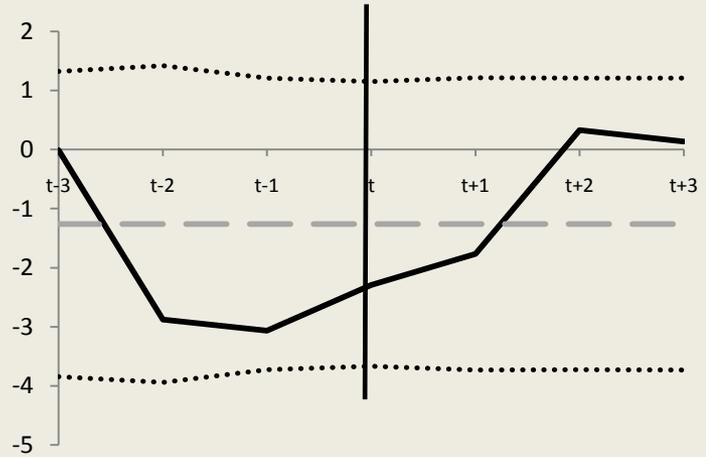
Current Account
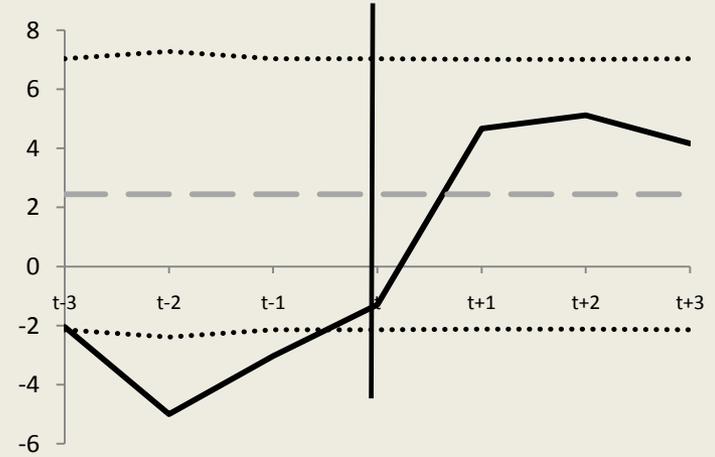
Latin America

M2/ Foreign Exchange Reserves

Terms of Trade (2000=100)
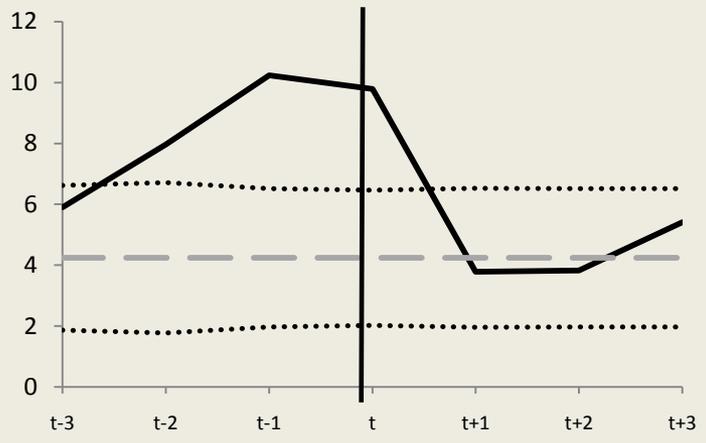
Asia

M2/ Foreign Exchange Reserves
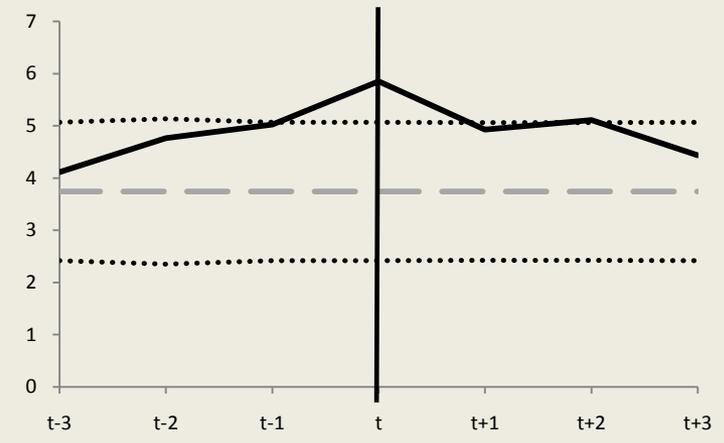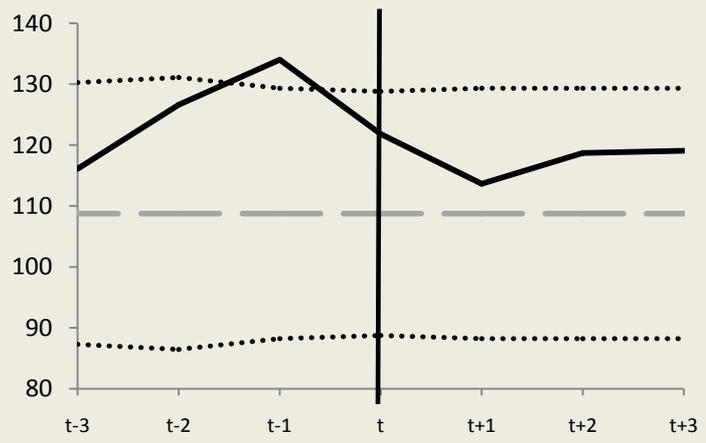
Terms of Trade (2000=100)
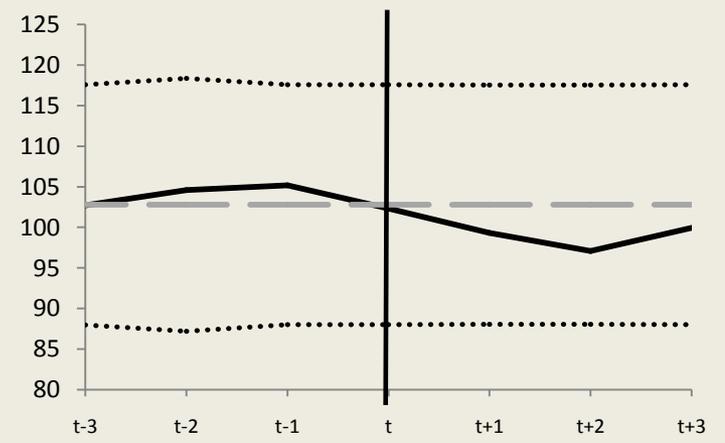
Robustness: Multivariate Logit Approach

- We have no priors regarding the relative significance of competing variables (no unified model linking macro, financial and regulatory variables to crisis risk exists)

- We also know that crisis determinants vary across regions due to different levels of financial development (bank based vs. market based)

- Additionally, the extant literature has a strong policy emphasis (c.f. Drehmann et. al.'s SE approach)

- Parsimony and forecasting accuracy have the highest impact in terms of EWS toolkit design; Basel III has distilled macroprudential risks into two variables only

- $\therefore$ we start with a general to specific approach on the pooled sample. All variables are lagged (-1) for EWS structure. We compare this to equivalents for regional samples to see if they differ.

- Model accuracy is then judged on in-sample prediction and ROCs.

Pooled Result

Regression Number	1	2	3	4	5	6	7	8	9	10
Terms of trade(-1)	-0.013 (0.029)	-0.013 (0.029)	-0.014 (0.024)	-0.015 (0.012)	-0.016 (0.007)	-0.018 (0.001)	-0.019 (0.001)	-0.023 (0)	-0.02 (0)	-0.019 (0)
Δ Domestic Credit/ GDP(-1)	0.049 (0.051)	0.049 (0.051)	0.049 (0.052)	0.049 (0.056)	0.053 (0.031)	0.055 (0.026)	0.053 (0.034)	0.052 (0.03)	0.065 (0.005)	0.069 (0.002)
Capital Adequacy Ratio(-1)	-0.132 (0.041)	-0.132 (0.041)	-0.135 (0.035)	-0.147 (0.02)	-0.142 (0.021)	-0.131 (0.024)	-0.141 (0.019)	-0.153 (0.007)	-0.142 (0.01)	-0.145 (0.006)
Current Account Balance (% of GDP)(-1)	-0.06 (0.261)	-0.06 (0.261)	-0.054 (0.285)	-0.062 (0.2)	-0.06 (0.208)	-0.069 (0.152)	-0.079 (0.09)	-0.081 (0.079)	-0.084 (0.07)	
M2 Money/ Forex Reserves(-1)	0.048 (0.231)	0.048 (0.231)	0.047 (0.247)	0.046 (0.261)	0.049 (0.232)	0.049 (0.232)	0.064 (0.102)	0.072 (0.092)		
Liquidity Ratio(-1)	-0.035 (0.061)	-0.035 (0.061)	-0.035 (0.062)	-0.035 (0.055)	-0.033 (0.063)	-0.034 (0.055)	-0.025 (0.107)			
Budget Balance (% of GDP)(-1)	-0.092 (0.379)	-0.092 (0.379)	-0.103 (0.306)	-0.108 (0.273)	-0.111 (0.259)	-0.11 (0.271)				
Exchange Rate(-1)	0 (0.434)	0 (0.434)	0 (0.427)	0 (0.441)	0 (0.444)					
Inflation(-1)	0 (0.599)	0 (0.599)	0 (0.54)	0 (0.508)						
GDP per Capita(-1)	0 (0.557)	0 (0.557)	0 (0.559)							
ΔGDP(-1)	-0.019 (0.723)	-0.019 (0.723)								
Δ Domestic Credit(-1)	0 (0.984)									

BUT: Latin America and Asia are Significantly Different: F STAT = 2.91; F CRIT (@1%) = 2.32

LATIN AMERICA

Regression Number	1	2	3	4	5	6	7	8	9	10
Capital Adequacy Ratio(-1)	-0.136 (0.139)	-0.136 (0.137)	-0.134 (0.139)	-0.124 (0.117)	-0.125 (0.103)	-0.122 (0.11)	-0.117 (0.096)	-0.157 (0.003)	-0.18 (0)	-0.219 (0)
Liquidity Ratio(-1)	-0.032 (0.237)	-0.032 (0.237)	-0.031 (0.237)	-0.027 (0.209)	-0.028 (0.175)	-0.03 (0.156)	-0.033 (0.098)	-0.041 (0.023)	-0.039 (0.026)	-0.047 (0.008)
Δ Domestic Credit/ GDP(-1)	0.056 (0.151)	0.056 (0.151)	0.059 (0.151)	0.057 (0.055)	0.062 (0.034)	0.063 (0.031)	0.07 (0.012)	0.072 (0.011)	0.071 (0.013)	0.062 (0.022)
Exchange Rate(-1)	-0.123 (0.306)	-0.123 (0.306)	-0.127 (0.306)	-0.115 (0.285)	-0.106 (0.296)	-0.102 (0.311)	-0.104 (0.278)	-0.14 (0.118)	-0.136 (0.145)	
ΔGDP(-1)	-0.081 (0.34)	-0.081 (0.34)	-0.083 (0.34)	-0.086 (0.303)	-0.064 (0.382)	-0.048 (0.456)	-0.053 (0.408)	-0.067 (0.281)		
Terms of trade(-1)	-0.011 (0.406)	-0.011 (0.406)	-0.011 (0.406)	-0.009 (0.37)	-0.009 (0.334)	-0.009 (0.341)	-0.006 (0.443)			
M2 Money/ Forex Reserves(-1)	0.037 (0.402)	0.037 (0.402)	0.038 (0.402)	0.039 (0.371)	0.034 (0.426)	0.03 (0.463)				
Current Account Balance (% of GDP)(-1)	-0.036 (0.649)	-0.036 (0.649)	-0.036 (0.649)	-0.045 (0.548)	-0.035 (0.625)					
Budget Balance (% of GDP)(-1)	0.142 (0.617)	0.142 (0.617)	0.146 (0.617)	0.157 (0.576)						
GDP per Capita(-1)	0 (0.773)	0 (0.773)	0 (0.773)							
Inflation(-1)	0 (0.874)	0 (0.875)								
Δ Domestic Credit(-1)	0 (0.996)									

Asia

Regression Number	1	2	3	4	5	6	7	8	9	10
Current Account Balance (% of GDP)(-1)	-0.201 (0.131)	-0.211 (0.108)	-0.224 (0.084)	-0.242 (0.062)	-0.207 (0.06)	-0.195 (0.04)	-0.197 (0.036)	-0.199 (0.036)	-0.189 (0.036)	-0.194 (0.012)
Liquidity Ratio(-1)	-0.075 (0.209)	-0.072 (0.214)	-0.088 (0.053)	-0.082 (0.052)	-0.079 (0.054)	-0.064 (0.051)	-0.063 (0.051)	-0.065 (0.038)	-0.071 (0.025)	-0.063 (0.041)
Terms of trade(-1)	-0.019 (0.344)	-0.014 (0.304)	-0.017 (0.157)	-0.019 (0.131)	-0.02 (0.092)	-0.018 (0.081)	-0.016 (0.059)	-0.017 (0.025)	-0.016 (0.026)	-0.021 (0)
GDP per Capita(-1)	0 (0.305)	0 (0.303)	0 (0.189)	0 (0.229)	0 (0.26)	0 (0.343)	0 (0.331)	0 (0.354)	0 (0.331)	
Budget Balance (% of GDP)(-1)	0.337 (0.411)	0.377 (0.338)	0.322 (0.383)	0.305 (0.4)	0.277 (0.44)	0.203 (0.454)	0.179 (0.489)	0.182 (0.484)		
Inflation(-1)	-0.083 (0.548)	-0.084 (0.514)	-0.103 (0.419)	-0.134 (0.27)	-0.109 (0.317)	-0.03 (0.668)	-0.021 (0.731)			
M2 Money/ Forex Reserves(-1)	0.217 (0.297)	0.214 (0.291)	0.224 (0.273)	0.213 (0.286)	0.205 (0.298)	0.063 (0.699)				
Δ Domestic Credit(-1)	0 (0.352)	0 (0.353)	0 (0.284)	0 (0.385)	0 (0.468)					
Δ Domestic Credit/ GDP(-1)	-0.046 (0.506)	-0.046 (0.503)	-0.05 (0.459)	-0.037 (0.584)						
Exchange Rate(-1)	0 (0.543)	0 (0.563)	0 (0.559)							
Capital Adequacy Ratio(-1)	-0.08 (0.74)	-0.097 (0.672)								
ΔGDP(-1)	0.059 (0.745)									

Stage 2: Focus on CCB

- Test validity of countercyclical buffer based on:
  - Signal extraction methods over heterogeneous countries suggest credit to GDP matters
  - BIS suggest calibrating off an HP filtered credit to GDP Gap and present evidence

- But.. evidence on role of credit as driving factor weak
  - Heterogeneous samples are misleading
  - Signal extraction is biased and unscientific (univariate, non-parametric)

- How we *should* calibrate the buffer: Find out what affects crises: test all versions of credit:
    - Credit to GDP Gap
    - Credit to GDP ratio
    - Credit to GDP growth

- Check if credit's role is consistent across regions (OECD vs. LA and Asia)

OECD Credit to GDP Gap

	1	2	3	4	5	6	7	8
Liquidity Ratio(-2)	-0.11 (0.007)	-0.111 (0.007)	-0.115 (0.006)	-0.115 (0.006)	-0.137 (0)	-0.154 (0)	-0.155 (0)	-0.142 (0)
Capital Adequacy Ratio(-2)	-0.281 (0.004)	-0.294 (0.001)	-0.281 (0.001)	-0.272 (0.002)	-0.263 (0.002)	-0.277 (0.001)	-0.258 (0.002)	-0.193 (0.005)
Current Account Balance (% of GDP)(-2)	-0.222 (0.007)	-0.229 (0.004)	-0.243 (0.003)	-0.257 (0.001)	-0.242 (0.003)	-0.215 (0.005)	-0.216 (0.005)	-0.2 (0.008)
ΔGDP(-2)	0.179 (0.209)	0.177 (0.217)	0.147 (0.283)	0.197 (0.113)	0.22 (0.068)	0.214 (0.069)	0.185 (0.116)	
Credit to GDP Gap(-2)	3.868 (0.192)	3.718 (0.204)	3.415 (0.241)	3.69 (0.195)	3.993 (0.164)	3.685 (0.199)		
Inflation(-2)	-0.101 (0.197)	-0.1 (0.202)	-0.097 (0.215)	-0.085 (0.258)	-0.08 (0.286)			
Budget Balance (% of GDP)(-2)	0.054 (0.431)	0.058 (0.386)	0.061 (0.362)	0.073 (0.267)				
Δ Domestic Credit(-2)	0.041 (0.372)	0.04 (0.384)	0.038 (0.406)					
Exchange Rate(-2)	-0.006 (0.404)	-0.007 (0.386)						
M2 Money/ Forex Reserves(-2)	0 (0.736)							

OECD Credit to GDP ratio

Regression Number	1	2	3	4	5	6	7	8
Liquidity Ratio(-2)	-0.119 (0.005)	-0.119 (0.005)	-0.122 (0.004)	-0.139 (0.001)	-0.128 (0.001)	-0.132 (0.001)	-0.155 (0)	-0.142 (0)
Capital Adequacy Ratio(-2)	-0.326 (0.004)	-0.337 (0.002)	-0.337 (0.002)	-0.351 (0.001)	-0.28 (0.001)	-0.271 (0.001)	-0.258 (0.002)	-0.193 (0.005)
Current Account Balance (% of GDP)(-2)	-0.24 (0.004)	-0.246 (0.003)	-0.262 (0.002)	-0.238 (0.002)	-0.222 (0.004)	-0.233 (0.002)	-0.216 (0.005)	-0.2 (0.008)
ΔGDP(-2)	0.128 (0.364)	0.129 (0.366)	0.171 (0.197)	0.167 (0.196)	0.185 (0.144)	0.163 (0.179)	0.185 (0.116)	
Budget Balance (% of GDP)(-2)	0.073 (0.297)	0.077 (0.268)	0.089 (0.185)	0.084 (0.203)	0.071 (0.259)	0.073 (0.251)		
Exchange Rate(-2)	-0.01 (0.265)	-0.01 (0.275)	-0.011 (0.235)	-0.011 (0.244)	-0.005 (0.471)			
Domestic Credit/ GDP(-2)	0.543 (0.327)	0.48 (0.369)	0.589 (0.256)	0.582 (0.259)				
Inflation(-2)	-0.089 (0.243)	-0.088 (0.248)	-0.076 (0.297)					
Δ Domestic Credit(-2)	0.037 (0.442)	0.037 (0.443)						
M2 Money/ Forex Reserves(-2)	0 (0.679)							

OECD Credit to GDP Growth

Regression Number	1	2	3	4	5	6	7	8
Liquidity Ratio(-2)	-0.112 (0.006)	-0.113 (0.006)	-0.11 (0.007)	-0.114 (0.006)	-0.107 (0.007)	-0.126 (0)	-0.145 (0)	-0.142 (0)
Capital Adequacy Ratio(-2)	-0.287 (0.004)	-0.289 (0.002)	-0.281 (0.002)	-0.271 (0.002)	-0.245 (0.002)	-0.236 (0.003)	-0.248 (0.001)	-0.193 (0.005)
Current Account Balance (% of GDP)(-2)	-0.226 (0.006)	-0.228 (0.004)	-0.228 (0.005)	-0.241 (0.003)	-0.23 (0.003)	-0.213 (0.006)	-0.187 (0.011)	-0.2 (0.008)
Δ Domestic Credit/ GDP(-2)	0.053 (0.347)	0.053 (0.349)	0.048 (0.299)	0.046 (0.319)	0.061 (0.144)	0.072 (0.07)	0.06 (0.109)	
Inflation(-2)	-0.06 (0.46)	-0.06 (0.463)	-0.091 (0.232)	-0.09 (0.241)	-0.093 (0.219)	-0.095 (0.212)		
Budget Balance (% of GDP)(-2)	0.064 (0.337)	0.065 (0.326)	0.063 (0.345)	0.065 (0.329)	0.067 (0.308)			
ΔGDP(-2)	0.136 (0.342)	0.136 (0.343)	0.132 (0.349)	0.109 (0.42)				
Exchange Rate(-2)	-0.005 (0.479)	-0.005 (0.474)	-0.006 (0.44)					
Δ Domestic Credit(-2)	-1.355 (0.731)	-1.372 (0.727)						
M2 Money/ Forex Reserves(-2)	0 (0.957)							

LA and A Credit Gap

	1	2	3	4	5	6	7	8
Liquidity Ratio(-2)	-0.054 (0.001)	-0.055 (0.001)	-0.049 (0.001)	-0.049 (0)	-0.048 (0)	-0.048 (0)	-0.048 (0)	-0.054 (0)
Capital Adequacy Ratio(-2)	-0.176 (0.003)	-0.175 (0.002)	-0.213 (0)	-0.226 (0)	-0.224 (0)	-0.227 (0)	-0.242 (0)	-0.249 (0)
Current Account Balance (% of GDP)(-2)	-0.095 (0.048)	-0.094 (0.042)	-0.082 (0.06)	-0.079 (0.067)	-0.08 (0.063)	-0.078 (0.068)	-0.07 (0.084)	-0.08 (0.057)
Exchange Rate(-2)	0 (0.285)	0 (0.283)	-0.001 (0.236)	-0.001 (0.217)	-0.001 (0.216)	-0.001 (0.209)	-0.001 (0.176)	
ΔGDP(-2)	-0.054 (0.306)	-0.053 (0.29)	-0.034 (0.486)	-0.034 (0.48)	-0.039 (0.412)	-0.032 (0.488)		
Credit to GDP Gap(-2)	-0.046 (0.369)	-0.046 (0.365)	-0.037 (0.435)	-0.037 (0.425)	-0.038 (0.42)			
Inflation(-2)	0 (0.555)	0 (0.553)	0 (0.544)	0 (0.559)				
M2 Money/ Forex Reserves(-2)	-0.048 (0.368)	-0.049 (0.351)	-0.024 (0.61)					
Δ Domestic Credit(-2)	0 (0.82)	0 (0.825)						
Budget Balance (% of GDP)(-2)	0.007 (0.938)							

LA and EA Credit to GDP ratio

Regression Number	1	2	3	4	5	6	7
Liquidity Ratio(-2)	-0.053 (0.002)	-0.053 (0.002)	-0.047 (0.002)	-0.047 (0.002)	-0.046 (0.002)	-0.049 (0)	-0.052 (0)
Domestic Credit/ GDP(-2)	-0.019 (0.027)	-0.019 (0.017)	-0.019 (0.015)	-0.019 (0.012)	-0.019 (0.011)	-0.018 (0.012)	-0.021 (0.003)
Capital Adequacy Ratio(-2)	-0.11 (0.076)	-0.108 (0.075)	-0.13 (0.03)	-0.132 (0.027)	-0.131 (0.027)	-0.128 (0.026)	-0.12 (0.032)
Current Account Balance (% of GDP)(-2)	-0.11 (0.04)	-0.11 (0.04)	-0.099 (0.053)	-0.098 (0.05)	-0.097 (0.05)	-0.088 (0.066)	-0.097 (0.05)
Exchange Rate(-2)	0 (0.434)	0 (0.435)	0 (0.387)	0 (0.363)	0 (0.358)	0 (0.344)	
Budget Balance (% of GDP)(-2)	0.08 (0.438)	0.076 (0.444)	0.063 (0.508)	0.06 (0.512)	0.059 (0.521)		
Inflation(-2)	0 (0.635)	0 (0.629)	0 (0.619)	0 (0.585)			
ΔGDP(-2)	-0.027 (0.621)	-0.027 (0.625)	-0.006 (0.906)				
Δ Domestic Credit(-2)	0 (0.886)	0 (0.895)					
M2 Money/ Forex Reserves(-2)	0.007 (0.891)						

LA and EA Credit to GDP Growth

Regression Number	1	2	3	4	5	6	7
Liquidity Ratio(-2)	-0.053 (0.002)	-0.053 (0.002)	-0.047 (0.002)	-0.047 (0.002)	-0.046 (0.002)	-0.049 (0)	-0.052 (0)
Domestic Credit/ GDP(-2)	-0.019 (0.027)	-0.019 (0.017)	-0.019 (0.015)	-0.019 (0.012)	-0.019 (0.011)	-0.018 (0.012)	-0.021 (0.003)
Capital Adequacy Ratio(-2)	-0.11 (0.076)	-0.108 (0.075)	-0.13 (0.03)	-0.132 (0.027)	-0.131 (0.027)	-0.128 (0.026)	-0.12 (0.032)
Current Account Balance (% of GDP)(-2)	-0.11 (0.04)	-0.11 (0.04)	-0.099 (0.053)	-0.098 (0.05)	-0.097 (0.05)	-0.088 (0.066)	-0.097 (0.05)
Exchange Rate(-2)	0 (0.434)	0 (0.435)	0 (0.387)	0 (0.363)	0 (0.358)	0 (0.344)	
Budget Balance (% of GDP)(-2)	0.08 (0.438)	0.076 (0.444)	0.063 (0.508)	0.06 (0.512)	0.059 (0.521)		
Inflation(-2)	0 (0.635)	0 (0.629)	0 (0.619)	0 (0.585)			
ΔGDP(-2)	-0.027 (0.621)	-0.027 (0.625)	-0.006 (0.906)				
Δ Domestic Credit(-2)	0 (0.886)	0 (0.895)					
M2 Money/ Forex Reserves(-2)	0.007 (0.891)						

Lessons from LA and A

- There does appear to be a role for credit to GDP but it is not the credit gap
  - What is the role of financial liberalisation
  - Role for exchange rate through reserves

- LA and EA look different from OECD

- Bottom Line: Three different starting points give three different answers
  - We have to have a method for choosing between models
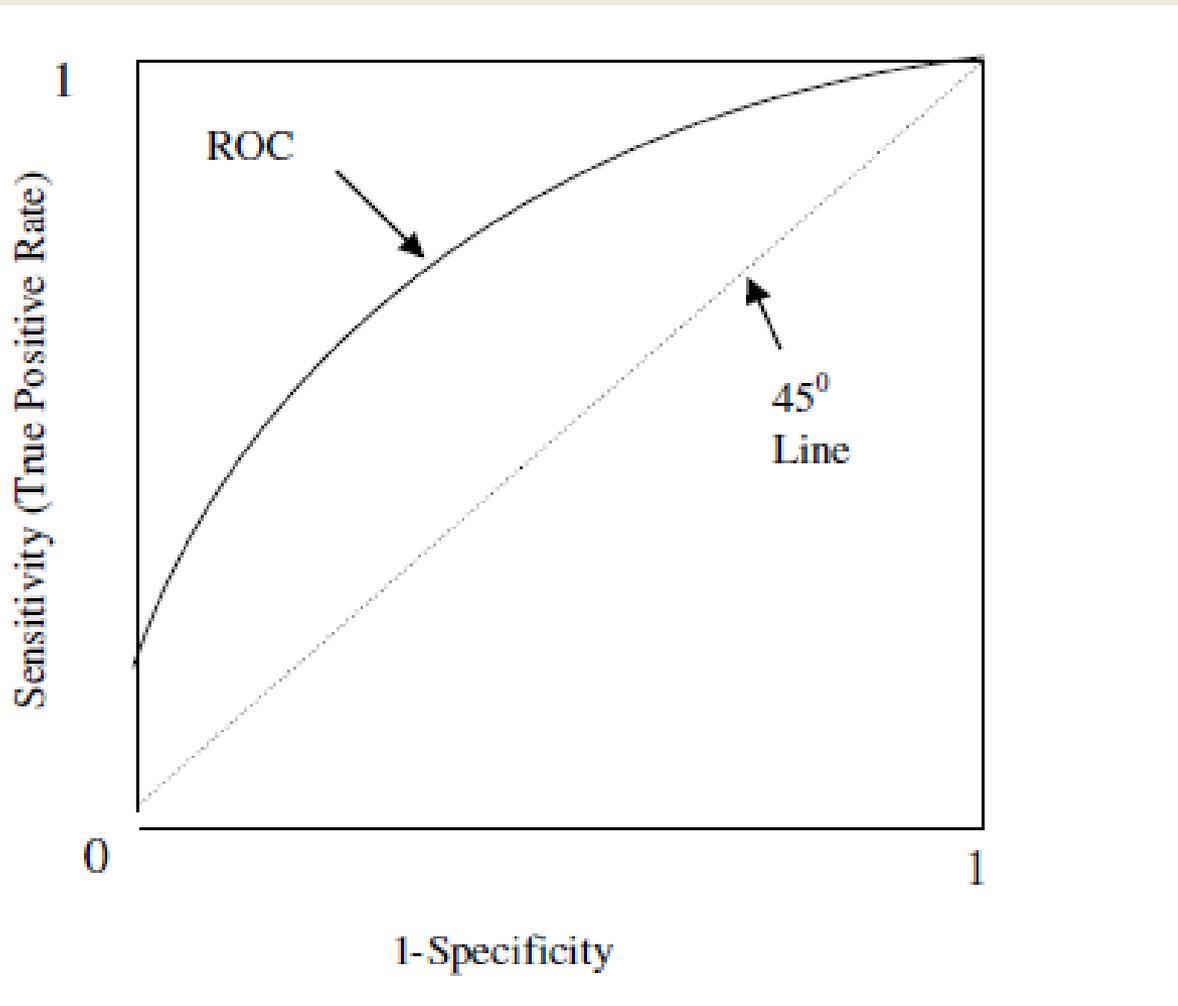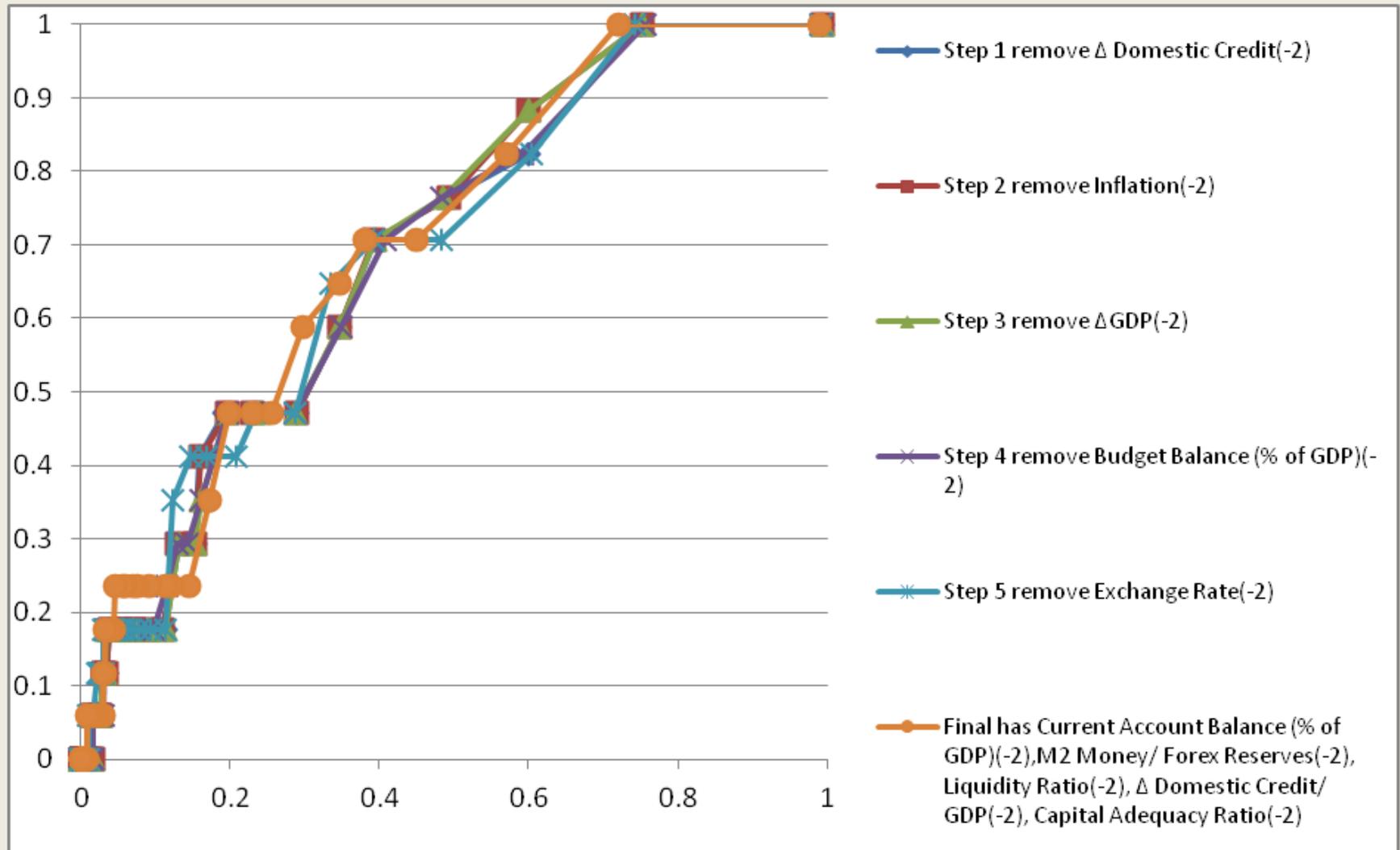 - Use ROC curves and the area below (AUC)

ROC Intuition

Figure 1: Receiver Operating Characteristic Curves

LA and A ROCs

Legend:
- Step 1 remove Δ Domestic Credit(-2)
- Step 2 remove Inflation(-2)
- Step 3 remove ΔGDP(-2)
- Step 4 remove Budget Balance (% of GDP)(-2)
- Step 5 remove Exchange Rate(-2)
- Final has Current Account Balance (% of GDP)(-2), M2 Money/ Forex Reserves(-2), Liquidity Ratio(-2), Δ Domestic Credit/ GDP(-2), Capital Adequacy Ratio(-2)

Conclusion

- We have used FSIs to evaluate CCBs

- Evidence on role of credit as driving factor weak
  - heterogeneous samples are misleading
  - Signal extraction is biased and unscientific

- The Countercyclical buffer is likely to be counter productive!
  - There is no evidence to suggest it will reduce the incidence of financial crises or stress
  - It may impose costs in terms of real output

- What we actually should do is:
    Condition against things **<u>relevant</u>** for problem –
    - house prices, current accounts, OBS in deregulated markets
    - credit growth, current account, currency problems in others