CNB CZECH NATIONAL BANK

Is There an Empirical Link?

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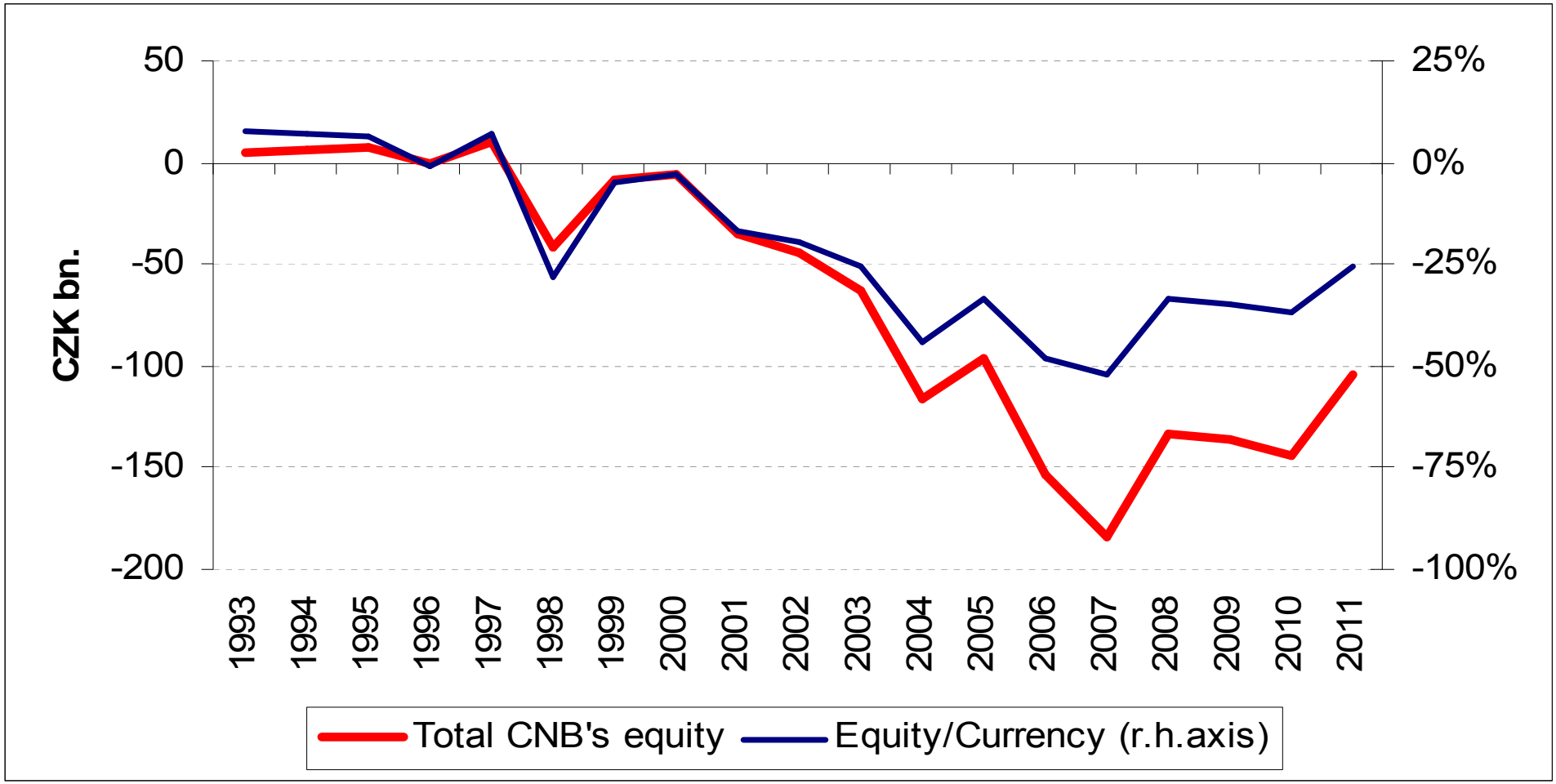
Outline

- Motivation
- Literature review
- Proxies for CBFS and stylized facts
- Control variables
- CBFS and inflation – estimation results
- Recursive estimations
- Conclusions

Motivation – CNB‘s Negative Equity



- Since the crisis‘ outbreak, CNB‘s negative equity has declined, but is still there.
- ECB Convergence Report 2010: ”In particular, any situation should be avoided whereby for a prolonged period of time an NCB’s net equity is below the level of its statutory capital or is even negative

Motivation

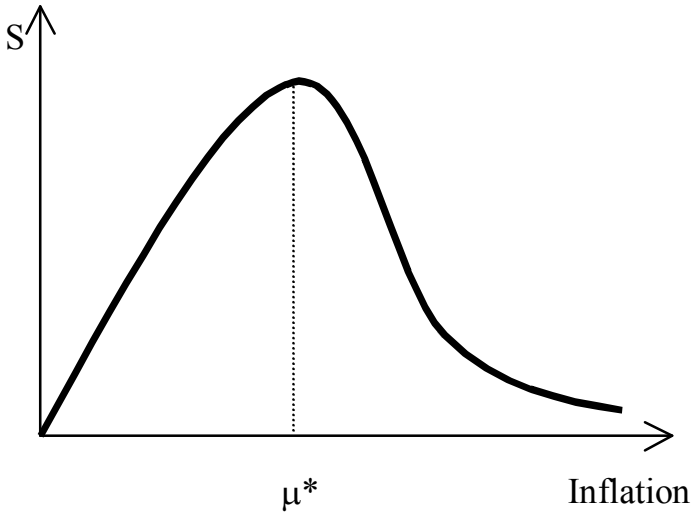
- ”As demonstrated by the experience of several central banks, including three that have participated in the Study Group – the Central Bank of Chile (CBC), the Czech National Bank (CNB) and the Bank of Mexico (BoM) – central banks can successfully operate with negative equity for extended periods.“

- ”However, there are several examples where the outcomes were not benign. The analysis of these two sets of cases suggests that there are conditions that must be satisfied for continued policy success alongside low or negative capital. Three conditions are key: 1. Policy frameworks need to be sound…2. The reason for losses is politically acceptable…3. Long-term financial strength must be undoubted.“

CB finances $\Rightarrow$ Inflation $\Rightarrow$ CB finances

- We focus on this second link (partly ala Sargent and Wallace (1981), but no due to a need to finance government, but the CB itself).
- Much less obvious and definitely much less explored (but the existing papers claim the link is there).
- Non-linearity potentially more significant (threshold-effects; source of the CB loss could play an important role, etc.).

- This link is obvious and well explored in the literature, going back e.g. to Cagan (1956).
- Non-linearity relevant mainly for high inflation rates (?).



Literature review – empirical papers

- Stella (2003): Mean inflation for the 'weak' CBs was 26%, twice as high as for the strong group (significant at all standard levels).
- Stella (2008; 2011): Similar results as in the previous paper.
- Ize (2006): Average inflation rate was 9.5% for the 'weak' central banks and 3.5% for the strong ones.
- Klüh and Stella (2008): Found a relatively stable negative relationship between CBFS and inflation, robust to the choice of the key explanatory variable, control variables and the econometric technique. But only a relatively strong impairment of the CB's balance sheet would result in a significantly higher inflation.
- Adler, et al. (2012): Found out that CBFS can be a statistically significant factor explaining large negative interest rate deviations from an estimated forward-looking Taylor rule.

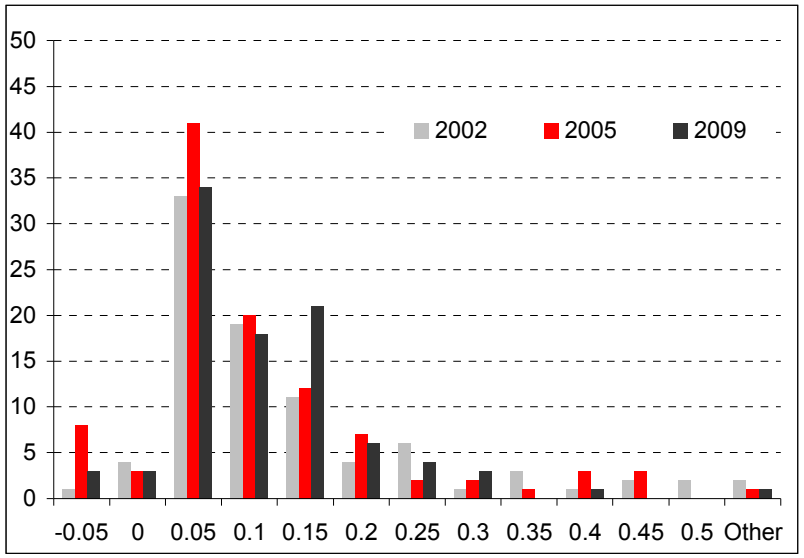
Proxies for CBFS - definitions

- $$ETA = \frac{equity}{total\ assets}$$ (BankSccope)
- $$CBFS_1 = \frac{equity + other\ items\ net}{total\ assets}$$ (IFS) (BankSccope)
- $$NNIBL = \frac{equity + (non\,\text{int}\,erest\ bearing\ liabilities - nonearning\ assets) - fixed\ assets}{total\ assets}$$
- $ROAA$ (BankSccope)
- $ROAE$ (BankSccope)

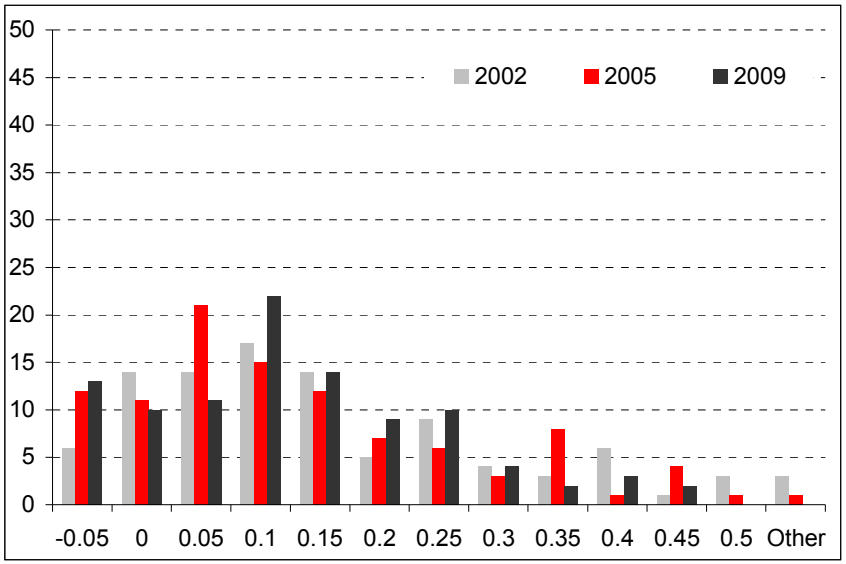
- Finding a good proxi is difficult, due both to accounting differences and economic considerations.
- Strategy of using five alternative measures and testing, which one delivers plausible results.

Proxies for CBFS - histograms

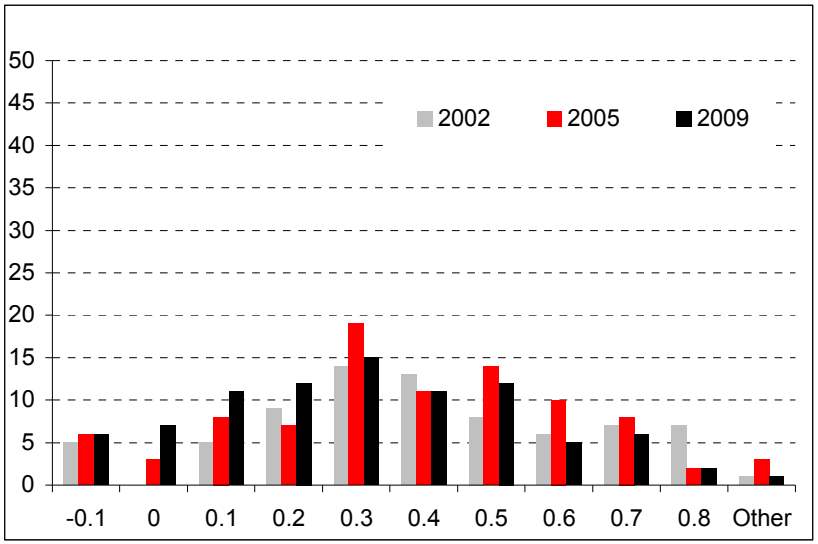
ETA



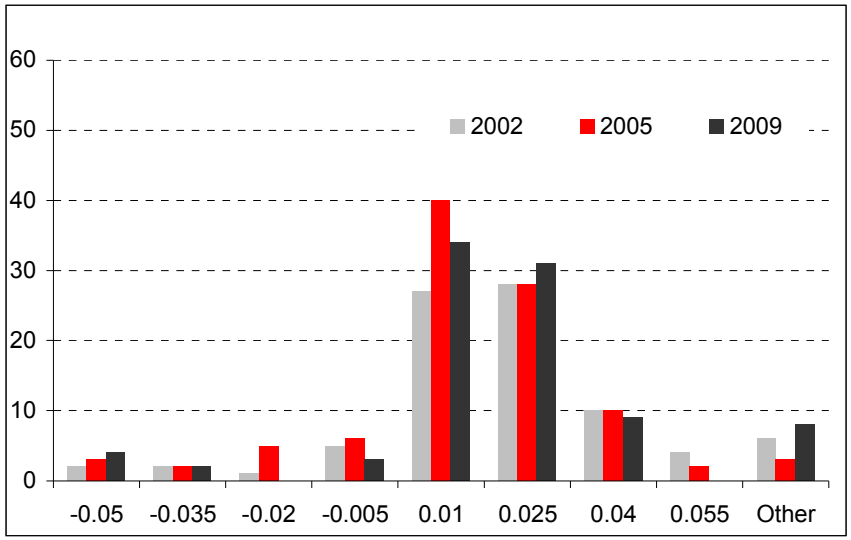
CBFS1



NNIBL



ROAA



Control variables

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Table 4.1: Estimation results for structural inflation determinants (control variables)

	Model I. (baseline)				Model II.	
	OLS		Fixed	Random	OLS	Fixed
	Robust	Cluster	effect	effects	Cluster	effect
Price of oil	0.0427***	0.0427***	0.0293**	0.0405***	0.0349***	0.0289**
	(0.0084)	(0.0101)	(0.0146)	(0.0107)	(0.0105)	(0.0125)
Real GDP per capita	-0.0005***	-0.0005*	-0.0006***	-0.0006**		
	(0.0001)	(0.0003)	(0.0002)	(0.0003)		
Trade openness	-0.0085	-0.0085	0.1386***	0.018	-0.0026	0.1392***
	(0.0057)	(0.0098)	(0.0494)	(0.0165)	(0.008)	(0.0477)
Capital account openness	-0.0069***	-0.0069***	-0.0079*	-0.0076***	-0.0027	-0.007
	(0.0014)	(0.0026)	(0.0047)	(0.0022)	(0.002)	(0.0052)
Fixed regime	-0.0175***	-0.0175**	0.0075	-0.0093	-0.0104	0.0064
	(0.0044)	(0.0081)	(0.0084)	(0.006)	(0.0069)	(0.0082)
Inflation targeting	-0.0295***	-0.0295***	-0.0382***	-0.0275***	-0.0141**	-0.0392***
	(0.004)	(0.0071)	(0.0137)	(0.0069)	(0.0062)	(0.0133)
Government efficiency					-0.023***	0.0052
					(0.0037)	(0.011)
Government deficit					0.0192	-0.1325
					(0.0449)	(0.1229)
Constant	0.0676***	0.0676***	-0.0074	0.0531***	0.0582***	-0.0207
	(0.0068)	(0.0106)	(0.0221)	(0.0091)	(0.0091)	(0.0244)
Observations	840	840	840	840	840	840
R2 (adjusted/within)	0.207	0.207	0.122		0.28	0.12
F	42.95	21.14	12.85		31.30	13.10
Chi2				109.73		

Note: Dependent variable is *d*.Standard errors in parentheses, R-sq is adjusted for OLS estimation and within for estimate with fixed effects. The statistical significance is *** at 1%, ** at 5% and * at 10%.

Estimation results – Pooled OLS

Pooled OLS

Price of oil	0.048*** (0.0102)	0.05*** (0.0115)	0.048*** (0.0092)	0.054*** (0.01)	0.0573*** (0.01)	0.0587*** (0.0103)
Real GDP per capita	-0.0004 (0.0003)	-0.001** (0.0002)	-0.001* (0.0003)	-0.0004 (0.0003)	-0.0007*** (0.0002)	-0.0007*** (0.0002)
Trade openness	-0.0093 (0.0084)	-0.0079 (0.0077)	-0.0034 (0.0104)	-0.0112 (0.0089)	-0.0089 (0.0068)	-0.0082 (0.0071)
Cap account openness	-0.006*** (0.0024)	-0.007*** (0.0024)	-0.006** (0.003)	-0.007*** (0.0024)	-0.0053** (0.0023)	-0.0053** (0.0023)
Fixed regime	-0.0169** (0.0077)	-0.0184** (0.0076)	-0.0127 (0.0089)	-0.0182** (0.008)	-0.0175** (0.0069)	-0.018** (0.0072)
Inflation targeting	-0.031*** (0.0068)	-0.031*** (0.0068)	-0.026*** (0.0078)	-0.031*** (0.0069)	-0.0278*** (0.0066)	-0.0273*** (0.0068)
Constant	0.066*** (0.0102)	0.069*** (0.011)	0.063*** (0.01)	0.0603*** (0.0103)	0.0583*** (0.0093)	0.0572*** (0.0097)
$CBFS_1$ (t-1)	-0.0322** (0.0133)					
NNIBL (t-1)		-0.0196** (0.0093)				
NNIBL (t-1) /CBI			-0.0132** (0.0055)			
ETA(t-1)				0.0007 (0.0205)		
ROAA (t-1)					-0.0783 (0.0672)	
ROAE (t-1)						-0.0003 (0.0016)
Observations	711	625	465	705	684	672
R2 (adj)	0,25	0,28	0,29	0,24	0,27	0,27
F	20,29	23,45	9,26	20,24	20,04	19,94

Estimation results – Fixed effects

Fixed effects

Price of oil	0.04***	0.048***	0.038***	0.052***	0.0492***	0.0509***
	(0.0143)	(0.0148)	(0.0117)	(0.0121)	(0.0135)	(0.0138)
Real GDP per capita	-0.001***	-0.001	-0.001	-0.001***	-0.001	-0.001
	(0.0002)	(0.0008)	(0.0008)	(0.0002)	(0.0008)	(0.0008)
Trade openness	0.1136**	0.1098**	0.0943***	0.0984**	0.0991**	0.0951**
	(0.0468)	(0.0511)	(0.0326)	(0.0416)	(0.0435)	(0.043)
Cap account openness	-0.01	-0.014	-0.011*	-0.012	-0.0115	-0.0105
	(0.0091)	(0.0102)	(0.0064)	(0.0089)	(0.0081)	(0.0081)
Fixed regime	0.0009	0.003	0.0074	0.0012	0.0006	0.0024
	(0.0079)	(0.0088)	(0.0079)	(0.0073)	(0.0076)	(0.0071)
Inflation targeting	-0.025***	-0.037***	-0.035***	-0.025***	-0.0279***	-0.0264**
	(0.0091)	(0.0093)	(0.0073)	(0.0077)	(0.0097)	(0.0124)
Constant	0.005	-0.001	0.016	0.0015	0.0089	0.0082
	(0.021)	(0.0238)	(0.0206)	(0.02)	(0.0222)	(0.0219)
$CBFS_1$ (t-1)	-0.004					
	(0.025)					
NNIBL (t-1)		0.0266**				
		(0.013)				
NNIBL (t-1) /CBI			-0.0034			
			(0.0051)			
ETA(t-1)				0.055*		
				(0.0292)		
ROAA (t-1)					0.0709*	
					(0.0371)	
ROAE (t-1)						0.0005
						(0.0011)
Observations	711	625	465	705	684	672
R2 (within)	0,13	0,16	0,20	0,16	0,15	0,15
F	11,24	13,60	12,56	13,78	13,33	12,48

Estimation results – PCSE

PCSE

Price of oil	0.078*** (0.0214)	0.0789*** (0.0196)	0.086*** (0.0195)	0.0843*** (0.0186)	0.0854*** (0.0181)
Real GDP per capita	-0.0005*** (0.0001)	-0.0007*** (0.0002)	-0.0006*** (0.0001)	-0.0007*** (0.0002)	-0.0007*** (0.0002)
Trade openness	-0.0038 (0.0093)	-0.0016 (0.0082)	-0.0065 (0.0089)	-0.0028 (0.0083)	-0.0029 (0.0076)
Cap account openness	-0.0066*** (0.0013)	-0.0072*** (0.0014)	-0.0067*** (0.0013)	-0.0059*** (0.0016)	-0.0062*** (0.0018)
Fixed regime	-0.0162*** (0.0042)	-0.0188*** (0.0041)	-0.0167*** (0.0043)	-0.0171*** (0.0048)	-0.0171*** (0.0049)
Inflation targeting	-0.0274*** (0.0063)	-0.0269*** (0.0062)	-0.0271*** (0.0066)	-0.0253*** (0.0056)	-0.0254*** (0.0053)
Constant	0.046*** (0.0152)	0.0451*** (0.0147)	0.0387*** (0.0148)	0.04*** (0.0134)	0.0401*** (0.0132)
$CBFS_1$ (t-1)	-0.0182 (0.0119)				
NNIBL (t-1)		0.0005 (0.0111)			
ETA (t-1)			0.0312 (0.0212)		
ROAA (t-1)				0.027 (0.0581)	
ROAE (t-1)					-0.0002 (0.0012)
Observations	711	625	705	684	672
R2	0,25	0,27	0,27	0,29	0,29
Wald chi2	98,52	102,81	91,23	90,65	88,80
Common AR(1)	0,50	0,47	0,52	0,52	0,52

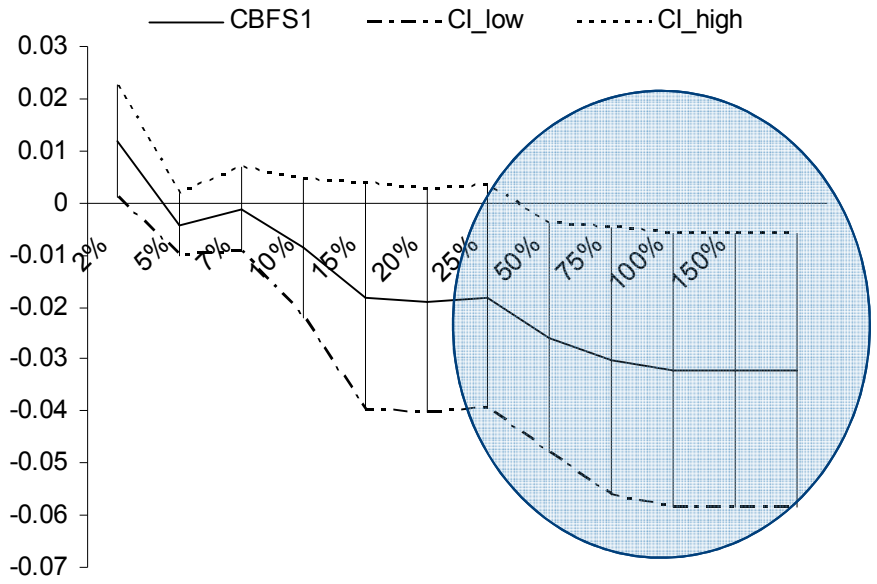
Price of oil (growth)	0.0517*** (0.0101)
Real GDP per capita	-0.0005*** (0.0001)
Trade openness	-0.0031 (0.0102)
Cap account openness	-0.0069*** (0.0013)
Fixed regime	-0.0129*** (0.0042)
Inflation targeting	-0.022*** (0.0072)
Constant	0.0777*** (0.0092)
CBFS1 (t-1)	-0.0216* (0.0118)
Observations	711
R2	0,2812949
Wald chi2	90,206318
Common AR(1)	0,56

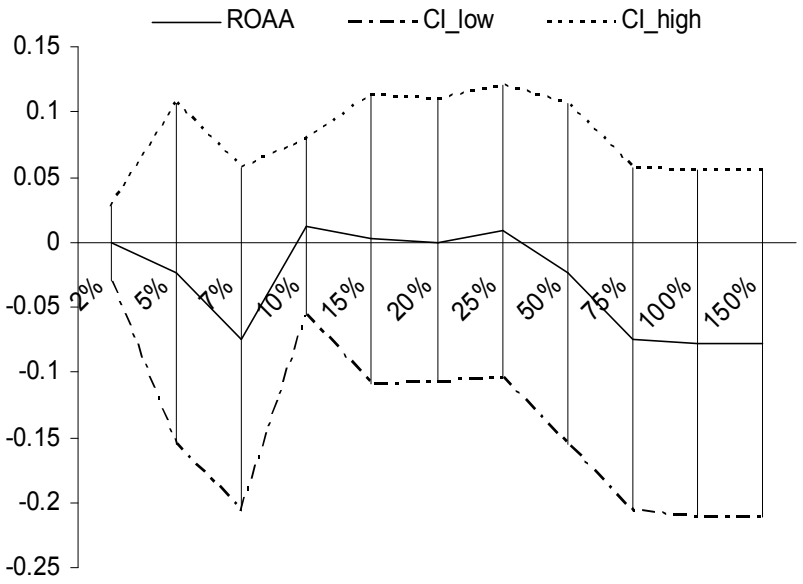
Estimation results – GMM

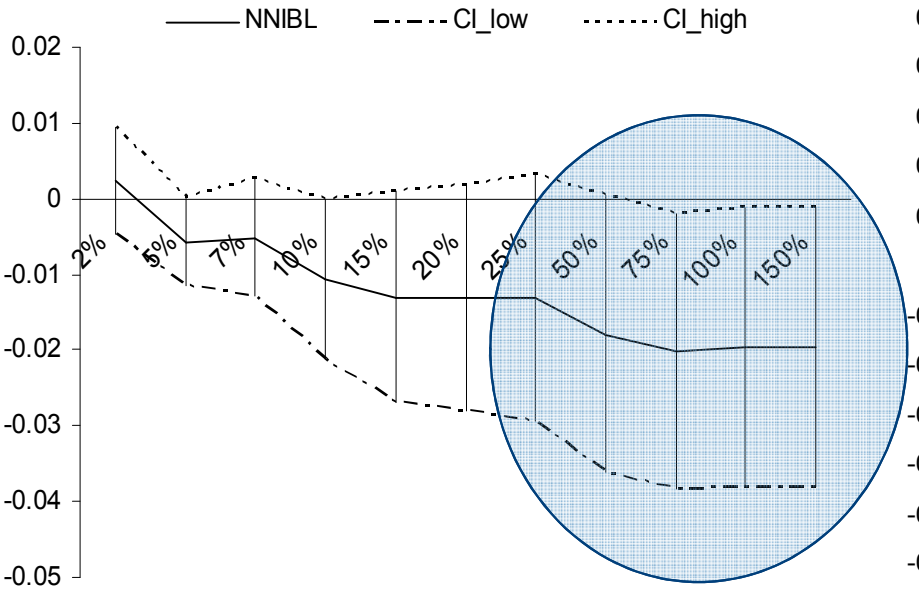
DYNAMIC MODEL FIRST LAG - ORTHOGONAL TRANSF

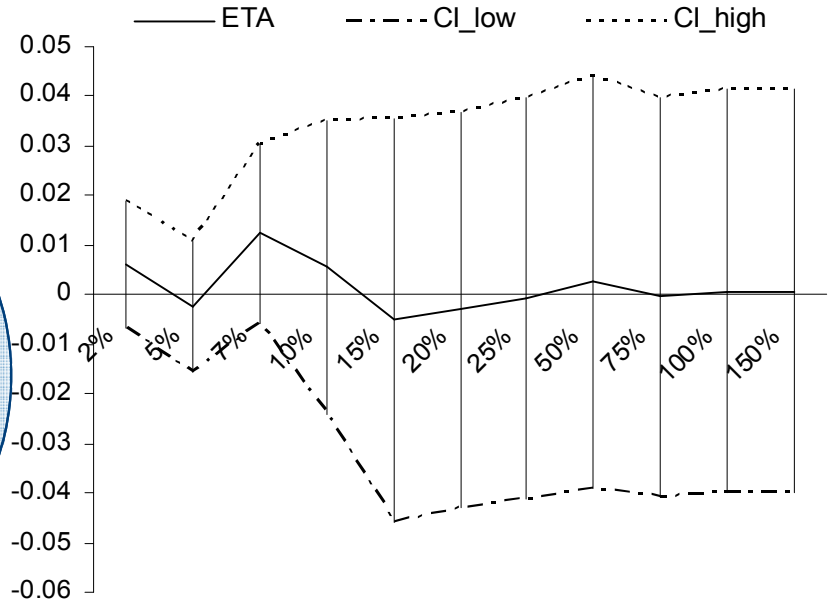
Price of oil	0.171***	0.163***	0.162***	0.160***	0.171***
	(0.0162)	(0.0157)	(0.0151)	(0.0150)	(0.0168)
Real GDP per capita	0.000255***	-0.000419***	0.000462***	-0.000230	-0.000415**
	(7.11e-05)	(0.000176)	(0.000155)	(0.000183)	(0.000182)
Trade openness	-0.00355	-0.00301	-0.00447	-0.00192	-0.000604
	(0.00442)	(0.00426)	(0.00472)	(0.00514)	(0.00533)
Cap account openness	-0.00133	-0.00240*	-0.00230*	-0.00259*	-0.00209
	(0.00122)	(0.00135)	(0.00123)	(0.00132)	(0.00139)
Fixed regime	-0.00682**	-0.00900**	-0.00909**	-0.00756*	-0.00915*
	(0.00344)	(0.00411)	(0.00415)	(0.00404)	(0.00465)
Inflation targeting	-0.0108**	-0.0157***	-0.0145***	-0.0149***	-0.0106*
	(0.00436)	(0.00501)	(0.00466)	(0.00448)	(0.00628)
Lagged dependent	0.577***	0.452***	0.424***	0.445***	0.518***
	(0.0987)	(0.107)	(0.104)	(0.104)	(0.112)
Constant	-0.0945***	-0.0692***	-0.0686***	-0.0702***	-0.0889***
	(0.0202)	(0.0186)	(0.0211)	(0.0201)	(0.0234)
$CBFS_1$	0.0128				
	(0.0243)				
ROAA		-0.280**			
		(0.138)			
ROAE			0.000197		
			(0.0103)		
ETA				-0.0595	
				(0.0505)	
NNIBL					0.0122
					(0.0209)
Observations	712	690	680	710	638
Number of code	105	105	105	105	100
P-value Hansen test	0.133	0.0816	0.297	0.182	0.117

Recursive estimations – OLS, according to inflation

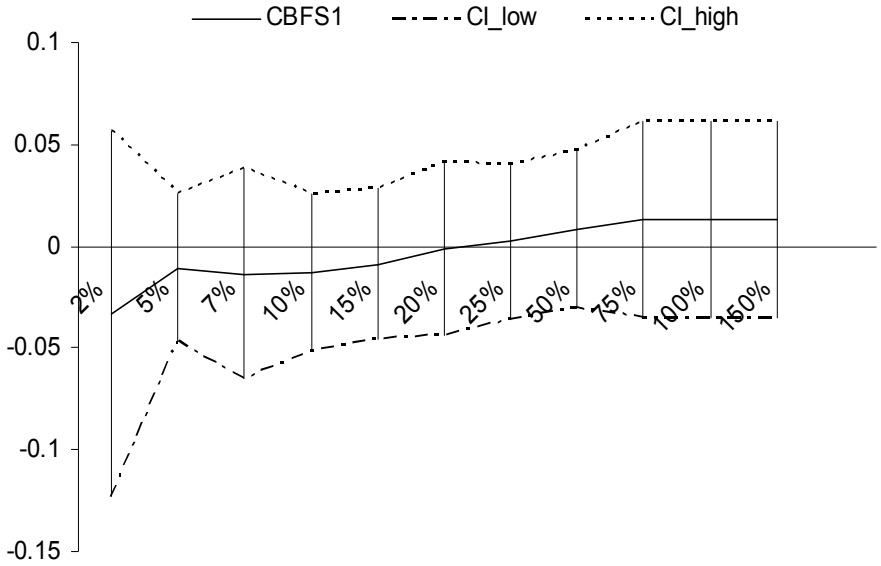


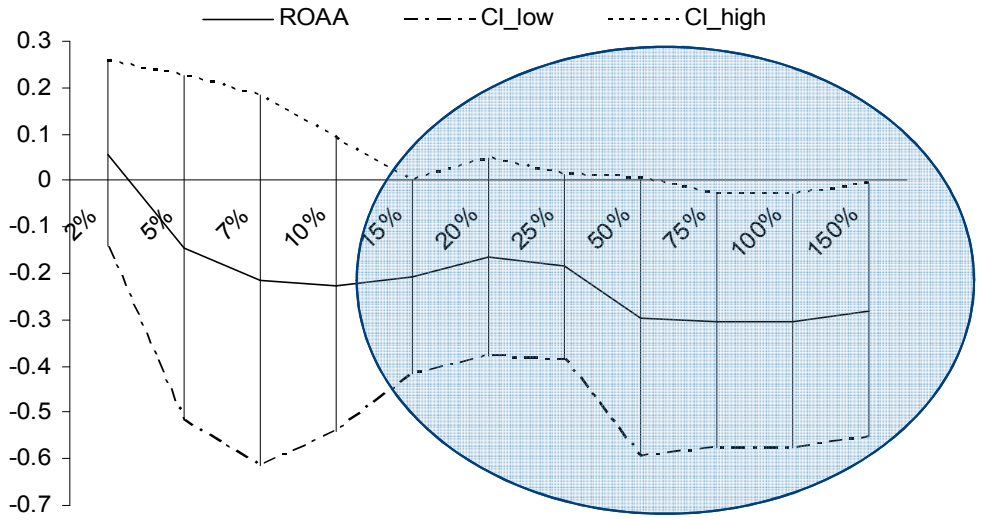


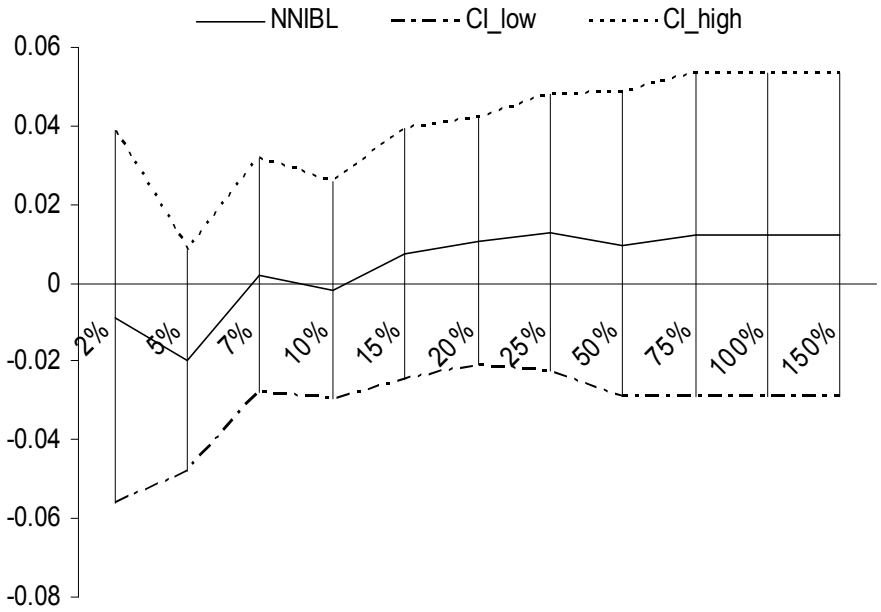


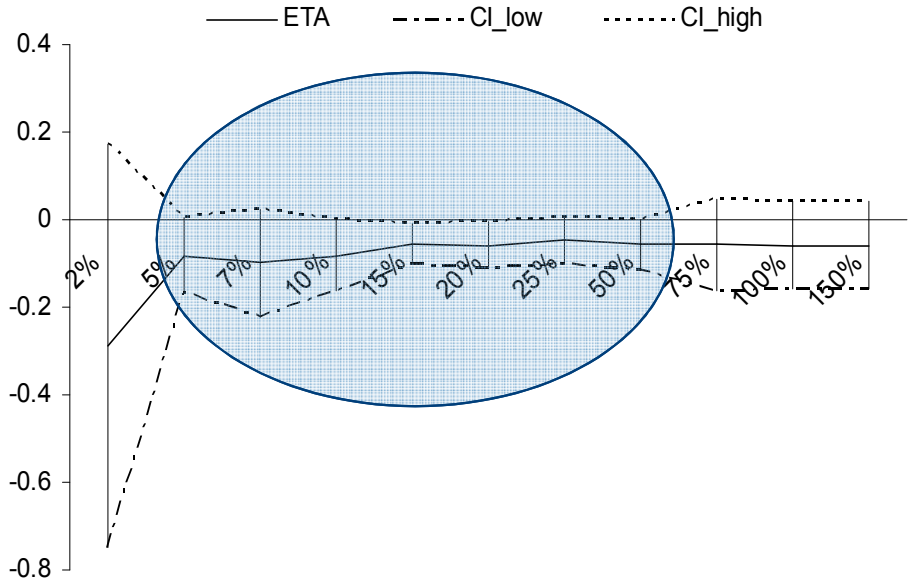


Recursive estimations – GMM, according to inflation









Conclusions

- The link from the (reported) CBFS to inflation can be found, if one really wants to
- But it is rather weak and definitely not as robust as suggested by the previous research
- Potential problem with reverse causality being identified especially with the fixed effects panel estimations (to be addressed by using the GMM in the revised version)
- Non-linearity identified in some cases (in line with our priors and previous research)
- The control variables (especially the IT regime ☺) perform generally better than the CBFS in our regressions

Thank you for your attention