Is there evidence of fiscal dominance in Costa Rica?

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Our aim

Is to evaluate Costa Rican data, from 1991 until 2019, in order to determine if there is fiscal dominance by

- estimating the Central Bank's reaction function considering fiscal variables, in order to quantify their effect on the monetary policy rate,

- estimating if there is an impact from the fiscal deficit on the inflation rate, and

- by evaluating the relationship between the primary fiscal deficit and public.
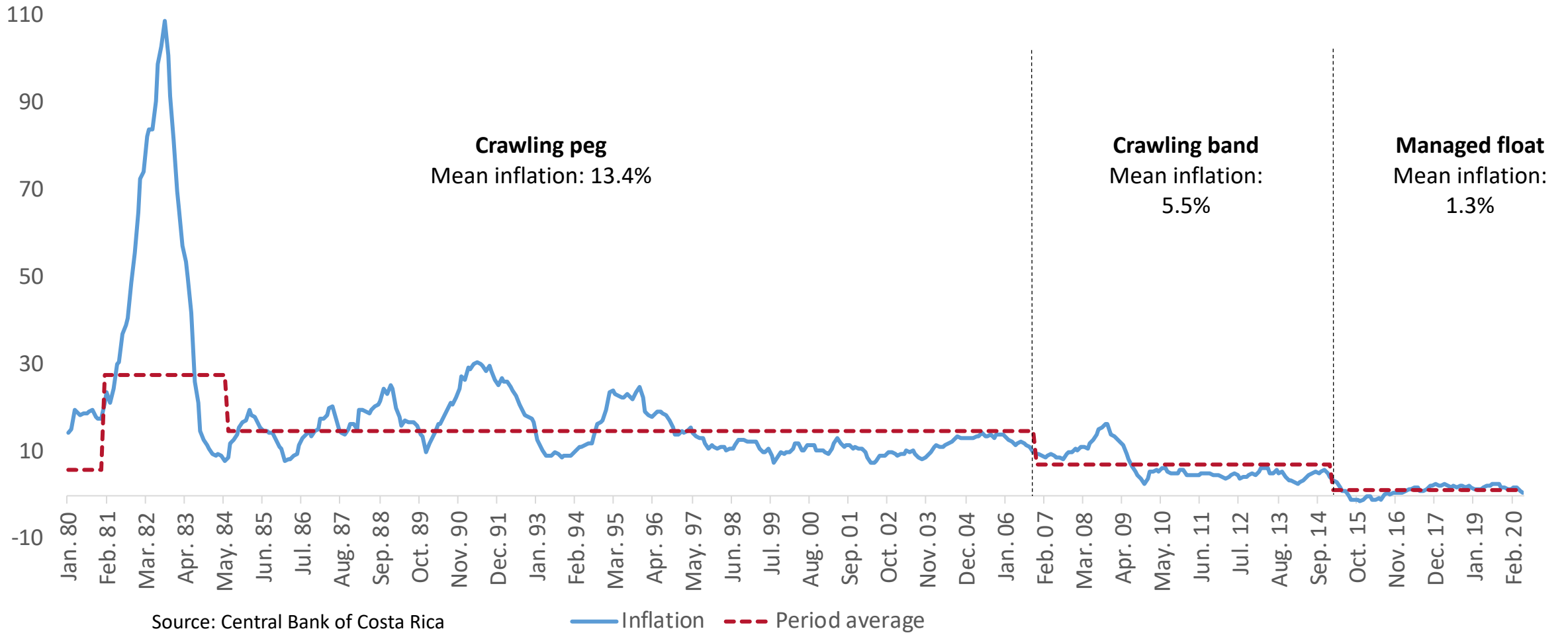
In order to

- Characterize the relationship between the effectiveness of monetary policy and fiscal policy coordination, in accordance to the literature (Sargent and Wallace, 1981), and

- define the tradeoffs between the degree of independence of the policies and their effectiveness (Aiyagari and Gertler, 1985).

- This is specially relevant for Costa Rica where the central government's debt level has reached levels over 50% of its GDP and the Central Bank has made remarkable efforts to strenghten its independence.

Empirical evidence is diverse

- For developing countries, some evidence suggests that the scope for monetary policy has been contingent on fiscal policy
  - Catao and Terrones (2005)
  - De Resende(2007)
  - Jevđović and Milenković (2018)

- Monetary policy rate reacts to fiscal variables:
  - Negatively in developed countries (Wyplots (1999), Ahmed et al. (2019))
  - Positively in developing or emerging economies (Kuncoro and Sebayang (2013), Ahmed et al. (2019))
  - Not significantly in ARG, BRA, CHL, COL, MEX, POL, ZAF, THA (Zoli, 2005) and EU28 (Afondo et al. 2019)
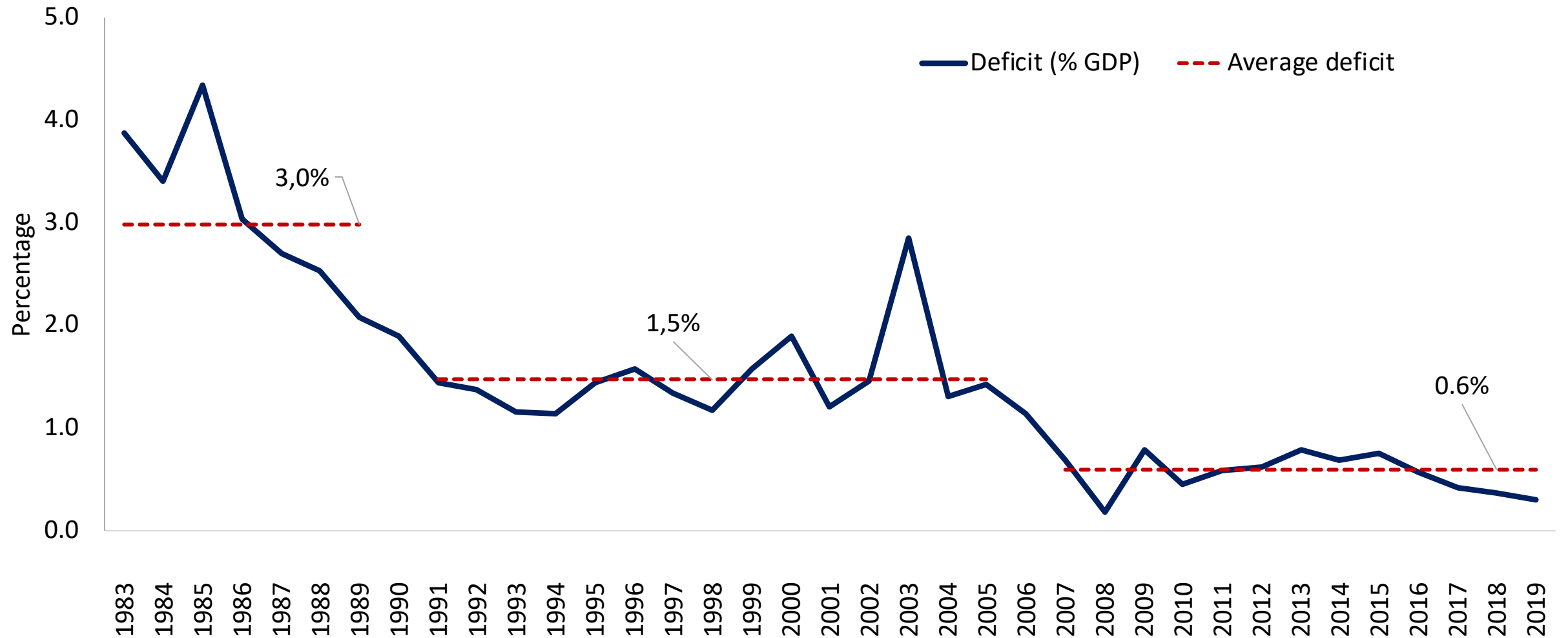
Inflation and exchange rate regime

Central Bank's monetary policy: inflation target

Crawling peg
Mean inflation: 13.4%

Crawling band
Mean inflation:
5.5%

Managed float
Mean inflation:
1.3%

Source: Central Bank of Costa Rica

Inflation — — Period average

Deficit of the Central Bank (% of GDP), 1983 - 2019
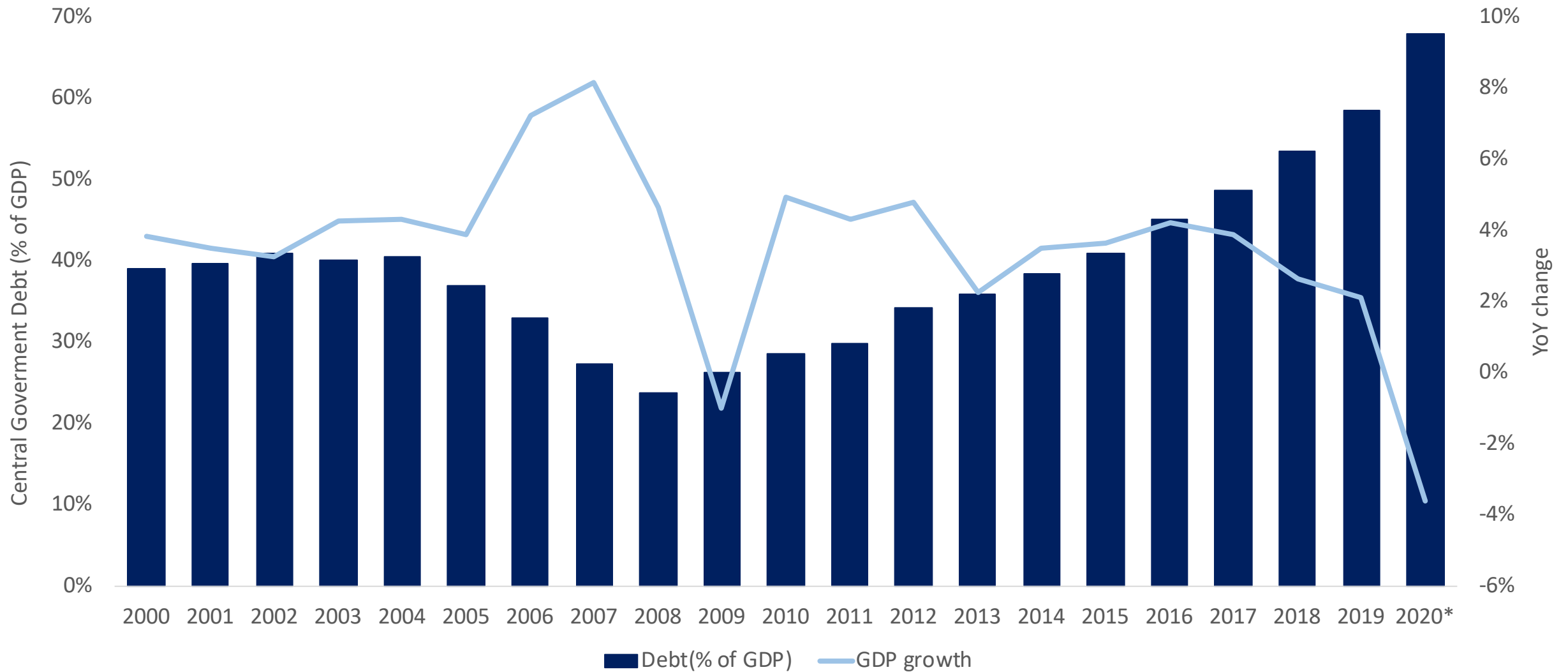
BCCR's deficit (crisis of the 80's) has decreased over time

Source: Central Bank of Costa Rica

Central Government Debt, 2000-2020*

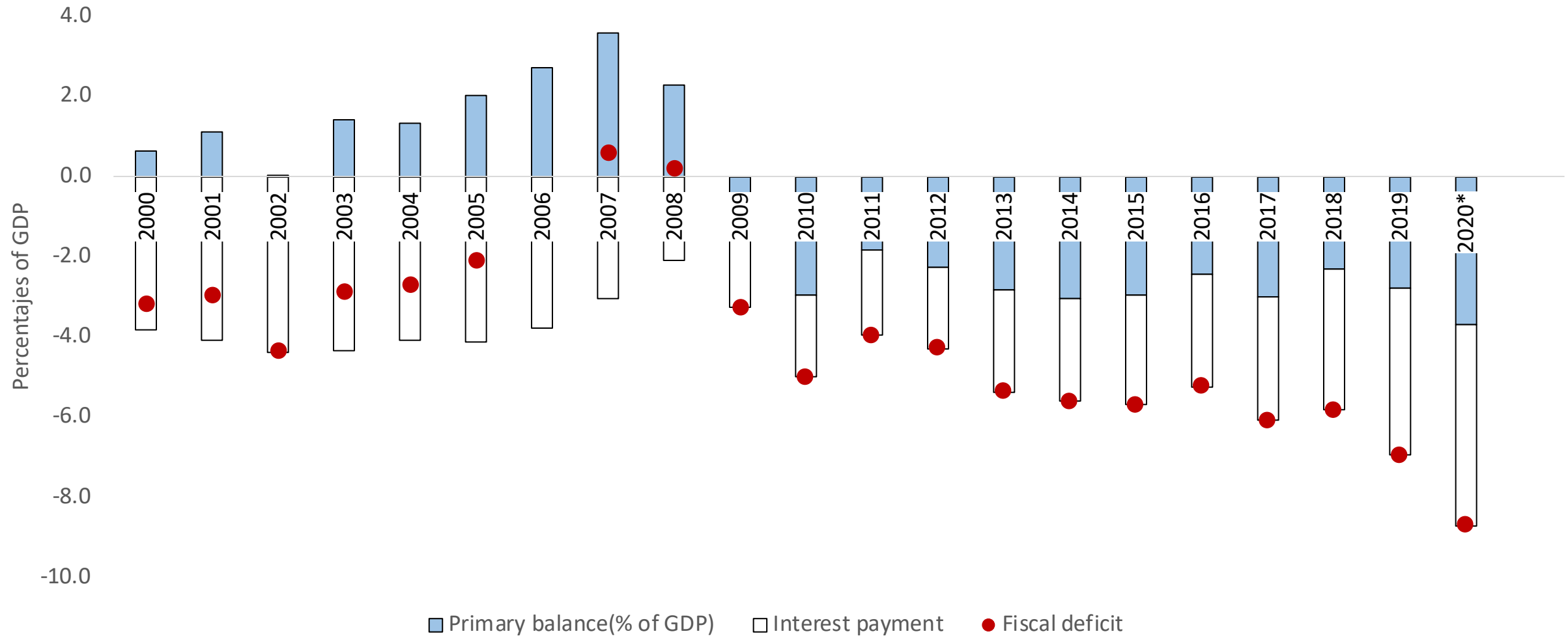## Fiscal policy, structural break in 2009

Note: *IMF projection
Source: Central Bank of Costa Rica

Fiscal and primary balance of the Central Government (% of GDP), 2000-2020*

The country has reached a critical fiscal situation
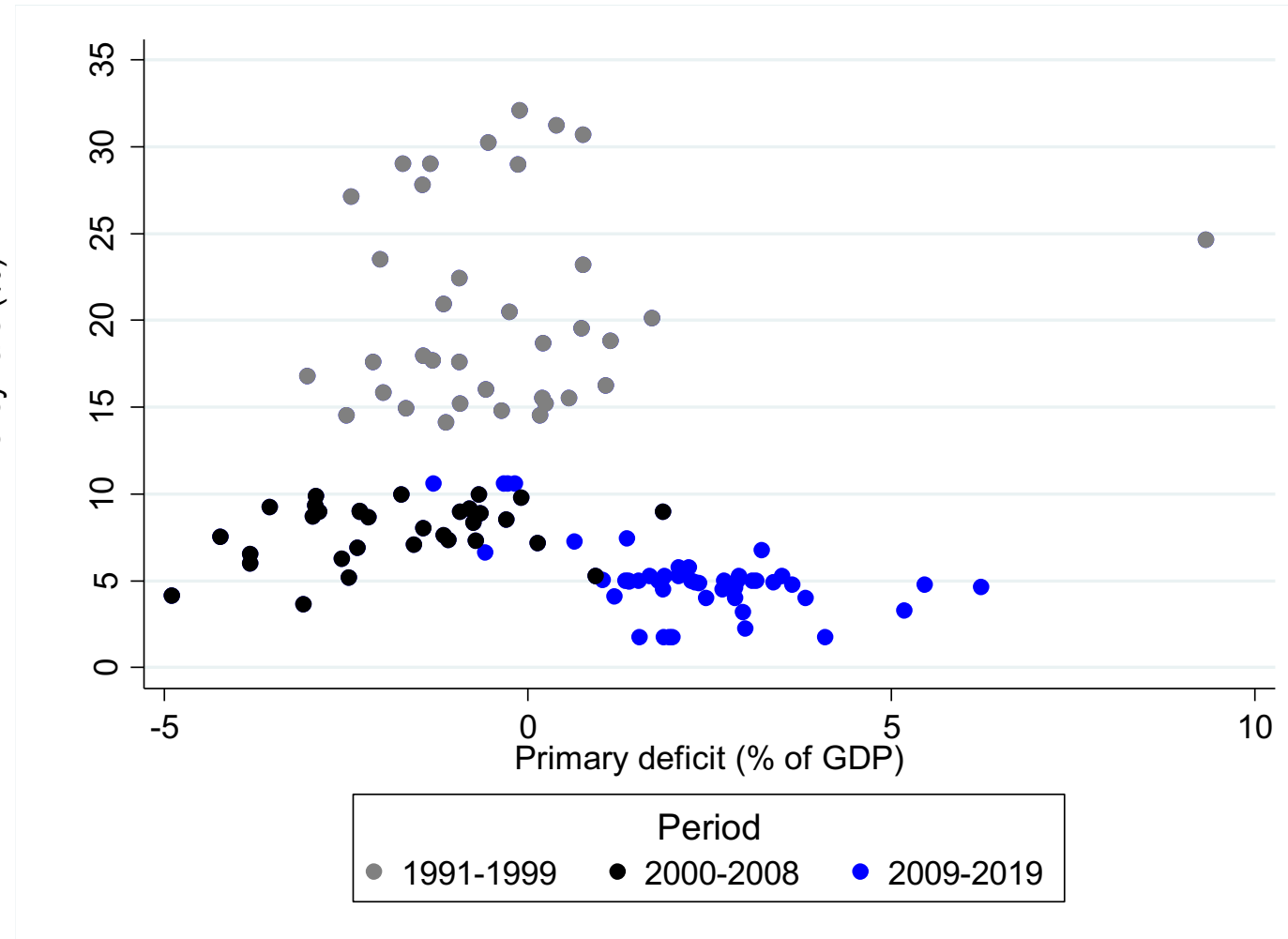

Percentajes of GDP

Legend: Primary balance(% of GDP) · Interest payment · Fiscal deficit

Note: *IMF Projection
Source: Central Bank of Costa Rica

Data suggests a different relationships through time

Source: Central Bank of Costa Rica.

Reaction function of the Central Bank

General approach: considering the fiscal space

$$i_t = \beta_0 + \beta_1 i_{t-1} + \beta_2(\pi - \pi^*)_{t-1} + \beta_3(y - y^*)_{t-1} + \beta_4 e_{t-1} + \boldsymbol{\beta_5} fiscal_{t-1} + u_t$$

- i_t policy interest rate and i_{t-1} is its value the previous period

- $(\pi - \pi^*)_{t-1}$ inflation rate , π, deviation from target, π^*

- $(y - y^*)_{t-1}$ difference between the observed output, y, and potential output, y^*

- e_t real exchange rate

- $fiscal_{t-1}$ variable from the fiscal authority (primary deficit or debt, over GDP)

- u_t error term

- β_1 to β_5 parameters to be estimated

Muñoz and Sáenz (2003) found a positive and significant coefficient for internal debt in their estimation of BCCR's reaction function.

Data from 1991 until 2002, and the basic passive interest rate was the DV.

Data and descriptive statistics

Quarterly data,
1991q1 – 2019q4

Sources:
BCCR
INEC
MH
Bloomberg

Variables	Mean	Std. Dev.	Observations
DV: Monetary policy interest rate (%)[1]	10.71	7.76	116
Inflation target[2] (%) π^*	8.43	3.86	116
π (annual variation)			
Consumer price index (CPI) (%)	9.35	5.98	112
Core indicator, average (%)	7.33	4.22	96
Truncated media (%)	7.41	3.99	96
$\pi - \pi^*$			
Consumer price index	1.05	3.16	112
Core indicator, average	-0.07	2.15	96
Truncated media	0.02	1.80	96
$\pi^e - \pi^*$			
Estimates from secondary market	-0.90	0.97	44
Median (survey)	1.14	0.85	56
Average (survey)	1.25	0.85	69

Notes: 1/ Indicador of MPR before May 2011 Chaverri y Castro.
2/Data from monetary and macroeconomic programs.

Source: Central Bank of Costa Rica

Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Output gap	0.00	1.13	-2.3	3.3
Real exchange rate index (ITCERPM)	96.65	10.08	77.9	115.0
Real exchange rate growth (%)	-0.004	1.13	-7.5	5.2
International reserves (deviation from trend mill. USD)	0.00	390.51	-970.0	1440.4
Trade openness (% GDP)	77.51	10.10	61.4	96.5
Current account balance (% of GDP)[1]	-4.25	2.62	-10.7	1.4
BCCR's deficit (% GDP)	0.95	0.49	-0.1	2.2
Primary deficit (% of GDP)	0.08	0.61	-1.19	2.51
Primary deficit (% of MB)	0.50	9.39	-19.62	30.85
Debt (% of GDP)	37.23	7.75	22.54	58.36
Monetary base, MB (% of GDP)	6.14	0.97	4.04	8.12
Liabilities (% of GDP)	43.37	7.94	28.58	65.61
WTI oil price (annual growth)[2]	8.64	32.18	-53.53	112.45
N° of observations	116			

Note: 1/ N = 84. 2/N = 112
Source: Central Bank of Costa Rica

Unit root tests

Variables in levels (non-stationary variables included according to tests)

Variable	ADF	P-value	PP	P-value	Lags*
Monetary policy rate	-2.645	0.084	-2.260	0.185	3
CPI variation	-2.309	0.169	-2.798	0.059	2
Core Index var.	-2.156	0.222	-2.191	0.209	2
Truncated Media var.	-1.945	0.311	-2.227	0.197	2
Prim def (% GDP)	-1.559	0.504	-5.565	0.000	4
Debt (% GDP)	-0.249	0.991	-1.215	0.907	4
Trade openness	-0.944	0.773	-2.244	0.191	4
Def bccr (% GDP)	-1.704	0.429	-2.628	0.087	4

Notes: Quaterly data. After apply first difference all variables stationary, I(1).
*Number of lags according to AIC information criteria.

Source: Central Bank of Costa Rica

Estimated relationship between policy rate and primary deficit

Regression results using full sample

Dependent variable	Levels		First differences	
	(1)	(2)	(3)	(4)
	MPR	MPR	DMPR	DMPR
Primary deficit$_{t-1}$	0.358***	0.223**	0.347**	0.245**
	[0.089]	[0.106]	[0.102]	[0.114]
Inflation measure	CPI	Core Index	CPI	Core Index
Lagged DV	Yes	Yes	No	No
Trend	Yes	Yes	No	No
Observations	112	96	112	96
R^2	0.97	0.97	0.52	0.48

Notes: MPR: Monetary policy rate.
Quarterly data.
Newey-west standard errors in brackets.
Controls for seasonality effects and crisis and fiscal events.
Source: Central Bank of Costa Rica.

Estimated relationship between policy rate and primary deficit

VARIABLES	(1) MPR	(2) MPR	(3) DMPR	(4) DMPR
	Levels		First differences	
i_{t-1}	0.862***	0.851***		
	[0.048]	[0.058]		
$\pi_t - \pi_t^*$	-0.034	-0.054	-0.117	-0.112
	[0.073]	[0.071]	[0.081]	[0.097]
$y_{t-1} - y_{t-1}^*$	0.690***	0.405***	0.754***	0.516***
	[0.179]	[0.146]	[0.196]	[0.163]
e_{t-1}	0.189**	0.097**	0.156*	0.077
	[0.085]	[0.042]	[0.087]	[0.050]
Reserves dev$_{t-1}$ (before 2007)	-0.007***	-0.004**	-0.007***	-0.005***
	[0.002]	[0.002]	[0.002]	[0.001]
Reserves dev$_{t-1}$ (after 2007)	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000
Primary deficit$_{t-1}$	0.358***	0.223**	0.348***	0.245**
	[0.089]	[0.102]	[0.106]	[0.114]
Trend	-0.048*	-0.044**		
	[0.025]	[0.020]		
Constant	2.850*	2.902**	-0.676**	-0.765***
	[1.448]	[1.399]	[0.295]	[0.234]
Inflation measure	CPI	Core Index	CPI	Core Index
Observations	111	96	110	96
R^2	0.97	0.97	0.52	0.48

Notes: Quaterly data. Newey-west standard errors in brackets. Controls for seasonality effects and crisis and fiscal events.
Source: Central Bank of Costa Rica.

Estimated relationship between policy rate and primary deficit

Regression results using sub-sample and including interaction with period from the financial crisis

	Levels		First differences	
Equation	(1)	(2)	(3)	(4)
Sample	1991-2019	2000-2019	1991-2019	2000-2019
Dependent variable	MPR	MPR	DMPR	DMPR
Primary deficit$_{t-1}$ (after 2008)	0.166*	0.114	0.138+	0.117*
	[0.095]	[0.067]	[0.106]	[0.066]
Primary deficit$_{t-1}$ (before 2008)	0.430***	0.144	0.437***	0.204
	[0.112]	[0.170]	[0.121]	[0.178]
Lagged DV	Yes	Yes		
Trend	Yes	Yes	No	No
Observations	111	84	111	84
R^2	0.97	0.94	0.53	0.45

Notes: Quaterly data. Newey-west standard errors in brackets. Controls for seasonality effects and crisis and fiscal events.
Significance levels: *** p<0.01, ** p<0.05, * p<0.1.
/ + Indicates a significant difference.
Source: Central Bank of Costa Rica.

Robustness checks

- **Inflation measure:** truncated media is used as another core inflation measure; the results are similar to those of the core measure. Inflation was also included only as variation, results were supported.

- **External variables:** the inclusion of openness, current account or nominal exchange rate variables supports the results.

- **Central Bank deficit:** has no significant coefficient.

- **Fiscal variable:** primary deficit scaled by MB has a smaller coefficient, but it is still significant.

  - Debt was used instead of primary balance, estimates have a significant impact on full ssmple, but only in the regression excluding the lagged dependent variable.

  - There was no evidence of non-linear effects on full sample, and few evidence of non-linear effects from 2008.

- **Sub-samples**: 2000-2019: the core results were supported. Non-linear effects.

  2009-2019: there was no evidence of a relationship. Additionally, deviation of inflation expectations from target does not have a significant relationship.

Fiscal deficit and inflation

Is a persistent fiscal deficit inflationary in Costa Rica?

- The fiscal theory of price level (FTPL) proposes that in order to maintain stable prices, the government's deficit must be sustainable ; the inter temporal budget constraint must be balanced (Leeper, 1991; Sims, 1994).

- Commonly in developing countries, fiscal authorities finance their deficits by printing money through the central bank. Hence, there is a low degree of independence of the central banks to define their monetary policy (Jalil, Tariq and Bibi, 2011).

- As a consequence, government finances may affect the price level of the economy.

Fiscal deficit and inflation in Costa Rica, 1991Q1-2019Q4
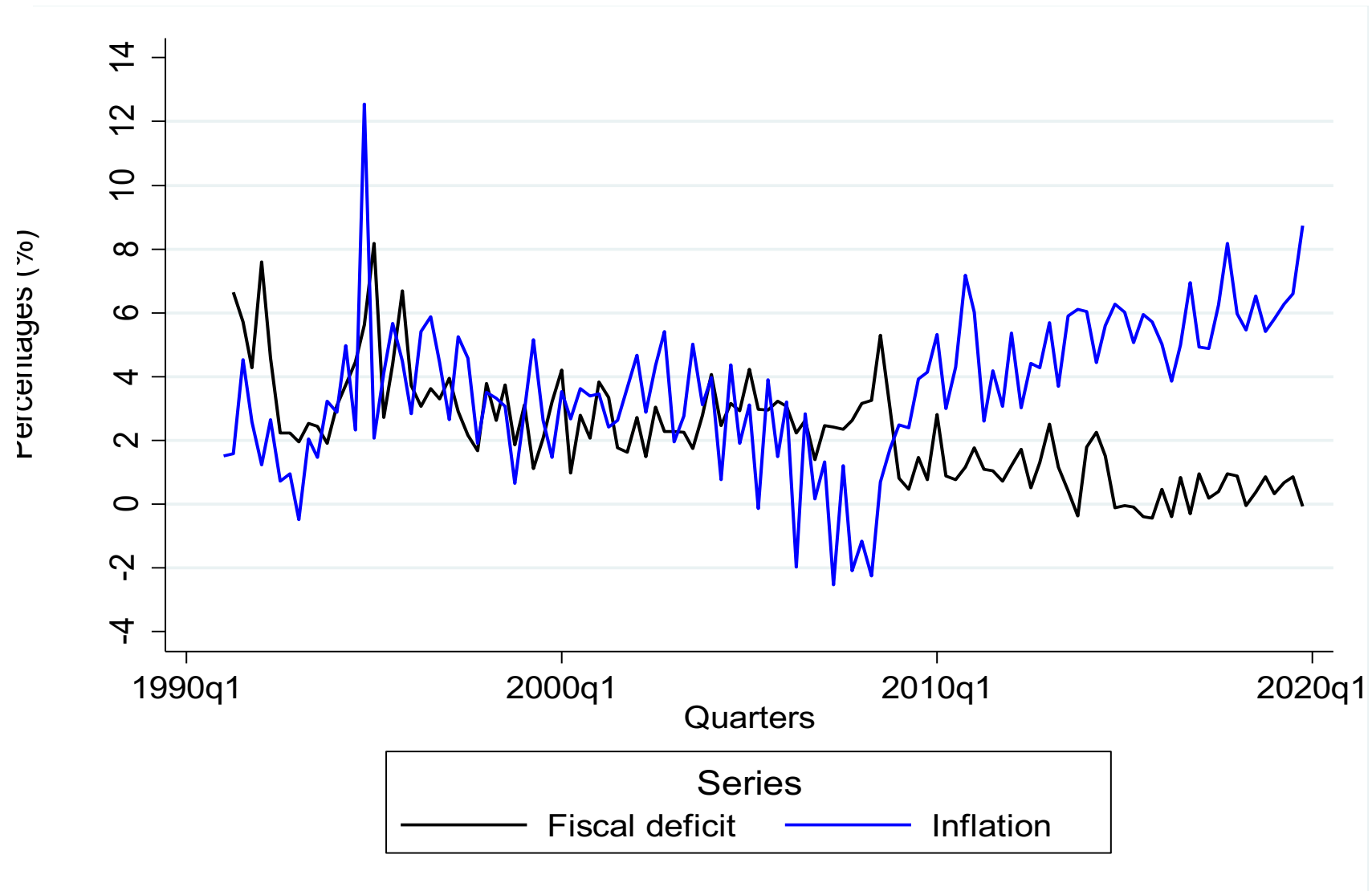
Source: Central Bank of Costa Rica.

Is persistent fiscal deficit inflationary?

- Catao and Terrones (2005) analyze this question for a panel of countries between 1960 and 2001.
- Jalil, Tariq, Bib (2014) study this question for Pakistan, from 1972 until 2012.

They estimate short- and long-run effects of fiscal deficit by using an autoregressive distributed lag model (ARDL) as the following:

$$\boldsymbol{\pi}_t = \alpha_0 + \sum_{j=1}^{p} \lambda_j \, \boldsymbol{\pi}_{t-j} + \sum_{i=1}^{q} \beta'_i \, \boldsymbol{x}_{t-i} + \varepsilon_t$$

Where:

$\boldsymbol{\pi}_t$ is the inflation rate

$\boldsymbol{x}_t$ is a vector of explanatory variables that includes fiscal deficit, monetary base, oil price growth, an openness index, real exchange rate, and the Central Bank's deficit.

Is persistent fiscal deficit inflationary?

Error Correction Model

$$\Delta\boldsymbol{\pi}_t = \alpha_0 + \phi[\boldsymbol{\pi}_{t-1} - \boldsymbol{\theta}'\boldsymbol{x}_t] + \sum_{j=1}^{p-1} \lambda_j \,\Delta\boldsymbol{\pi}_{t-j} + \sum_{i=1}^{q-1} \beta'_i \,\Delta\boldsymbol{x}_{t-i} + \varepsilon_t$$

where:

$\boldsymbol{\pi_t}$ is the inflation rate

$\boldsymbol{x}_t$ is a vector of explanatory variables that includes fiscal deficit, monetary base, oil prices growth, an openness index and real exchange rate, and Central Bank's deficit.

$\boldsymbol{\phi}$ is the speed of adjusment to the long-run value of a change in $\boldsymbol{x}_t$

$\boldsymbol{\theta}$ represents the equilibrium relationship between the explantory variables included in $\boldsymbol{x}_t$ and $\boldsymbol{\pi}_t$

Results from the Error Correction Model

Estimates of fiscal deficit on inflation (scaled by GDP or MB), 1991-2019

	(1)	(2)	(3)	(4)	(5)	(6)
Long Run elasticities (θ):						
Fiscal deficit (% of GDP)	-0.066	0.276**	0.252**			
	[0.157]	[0.115]	[0.113]			
Fiscal deficit (% of MB)				0.012	0.075**	0.069**
				[0.045]	[0.030]	[0.030]
EC coefficient (ϕ)	-0.306***	-0.763***	-0.817***	-0.289***	-0.747***	-0.810***
	[0.079]	[0.082]	[0.096]	[0.076]	[0.082]	[0.097]
Control variables	No	Yes	Yes	No	Yes	Yes
Other LR effects	No	No	Yes	No	No	Yes
Observations	111	111	108	111	111	108
R^2	0.250	0.63	0.60	0.25	0.62	0.61

Notes: Quarterly data. Standard error in brackets.
Controls for seasonality effects, financial crisis and fiscal events.
Source: Central Bank of Costa Rica.

Robustness checks

- **Inflation measure**: annual variation of CPI has a larger coefficient and its relationship is positive and significant. Other inflation measures (core index or truncated media) did not have a significant relationship.

- **Control variables**: the results were supported with the inclusion of annual or quarterly oil price variation and central bank deficit.

- **Fiscal deficit measures:** different measures of fiscal deficit showed a robust significant impact, but there were changes in magnitudes.

- **Sub-samples**:

  - 2000-2019: no evidence of a significant relationship.

  - 2008-2019: weak evidence of a significant relationship.

Passive or active policy?

- Fiscal policy is active or passive depending on its responsiveness to government debt shocks (Leeper, 1991) :

    - Active fiscal policy (non-Ricardian) does not consider goverment debt for its decisions
    - Passive fiscal policy (Ricardian) responds to goverment debt shocks

- Bohn (1998) and others have regressed the surplus on the debt and have found a significantly positive correlation. However, non-Ricardian policy will also imply a positive correlation (Cochrane, 1998).

- There may be Ricardian and non-Ricardian explanations for any particular aspect of the data, which generates an identification problem.

- A new approach is to ask which explanation seems more plausible (Canzoneri, Cumby and Diba, 2011).

- The relationship between government balance and public liabilities can be represented using a Vector Autoregression model as:

$$primbal_t = \alpha_0 + \sum_{j=1} \alpha_j \, primbal_{t-j} + \sum_{j=1} \beta_j \, \Delta liab_{t-j} + \varepsilon_t$$

$$\Delta liab_t = \gamma_0 + \sum_{j=1} \delta_j \, primbal_{t-j} + \sum_{j=1} \gamma_j \, \Delta liab_{t-j} + \omega_t$$

where:
- $primbal$ is the primary balance scaled by GDP
- $\Delta liab$ is the change in public liabilities (Central Government debt and Monetary base) scaled by GDP
- ε_t and ω_t are the error terms

Passive or active policy?

- Granger causality tests (Jevđović & Milenković , 2018)

  - **Fiscal dominance:** unidirectional causality running from primary surplus to government debt
  - **Monetary dominance:** unidirectional causality running from government debt to primary surplus

- Impulse Response Functions:

  - **Fiscal dominance:** positive relationship between primary deficit and future debt. A positive or null relationship rejects monetary dominance hypothesis.
  - **Monetary dominance**: negative relationship suggests that the government adjusts its fiscal deficit to debt. Two conditions need to be satisfied (Lozano and Herrera, 2008):
    - The liability response in period 1 has to be significantly negative in the face of a positive shock to the primary balance in period 0.
    - Primary balance response to positive primary balance shocks has to be significantly positive.

Empirical considerations

- Quarterly data

- Number of lags: 4 according to HQIC and SBIC information criteria

- Controls for seasonality effects including dummies

- Cycle-adjusted series

- Controls for Anglo Bank's bankruptcy in 1994, international financial crisis in 2008 and 2009 fiscal events

The rejection of the null hypothesis that PB does not Granger cause liabilities suggests Fiscal Dominance
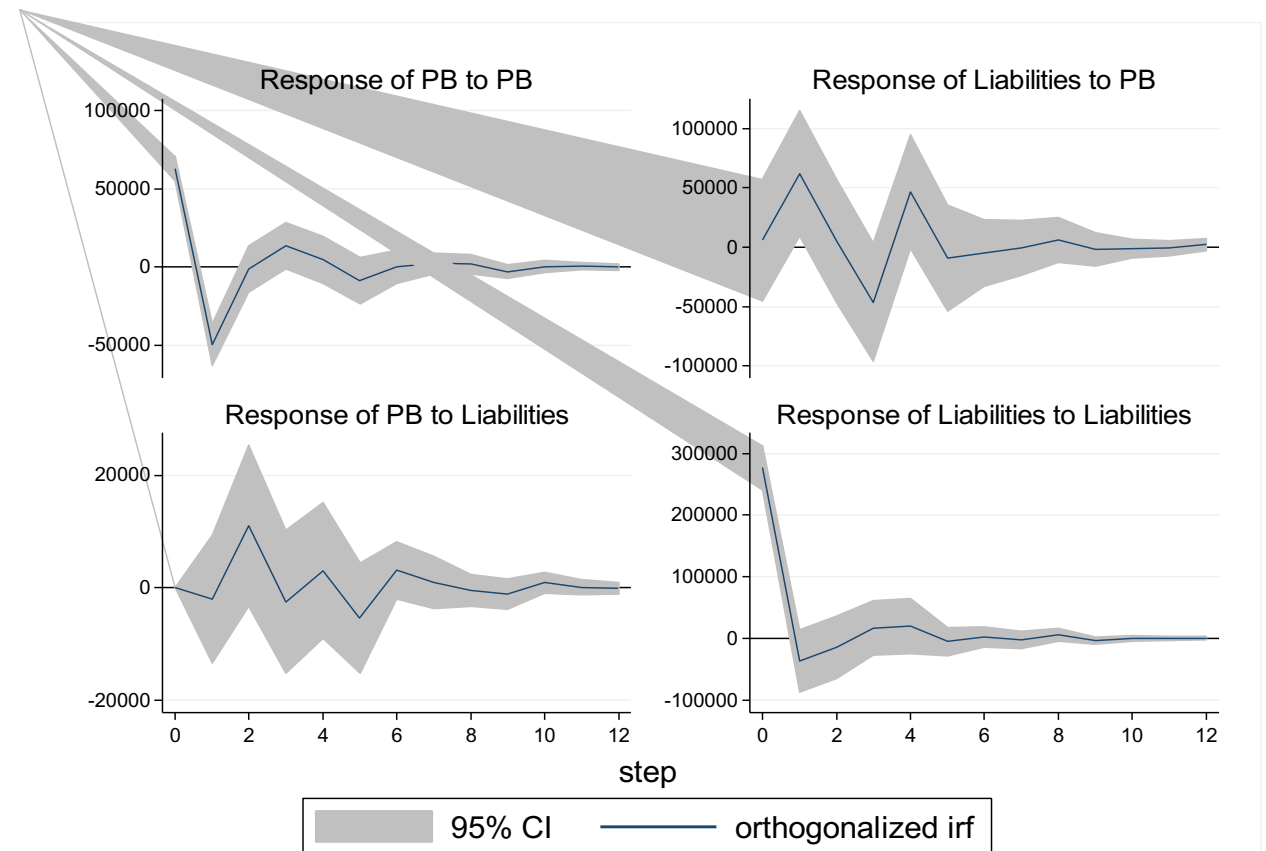
Granger causality test

| Null hypothesis	Chi-square	df	p-value
Liabilities does not Granger cause PB	6.05	4	0.20
PB does not Granger cause Liabilities	10.37	4	0.03

Notes:
VAR satisfices stability condition.
Source: Central Bank of Costa Rica.

Impulse-Response Functions

Source: Central Bank of Costa Rica.

Passive or active policy?

Granger causality test

Null hypothesis	Chi-square	df	p-value
Liabilities does not Granger cause PB	1.18	4	0.88
PB does not Granger cause Liabilities	8.05	4	0.09

Notes:
VAR satisfices stability condition.
Source: Central Bank of Costa Rica.

Impulse-Response Functions
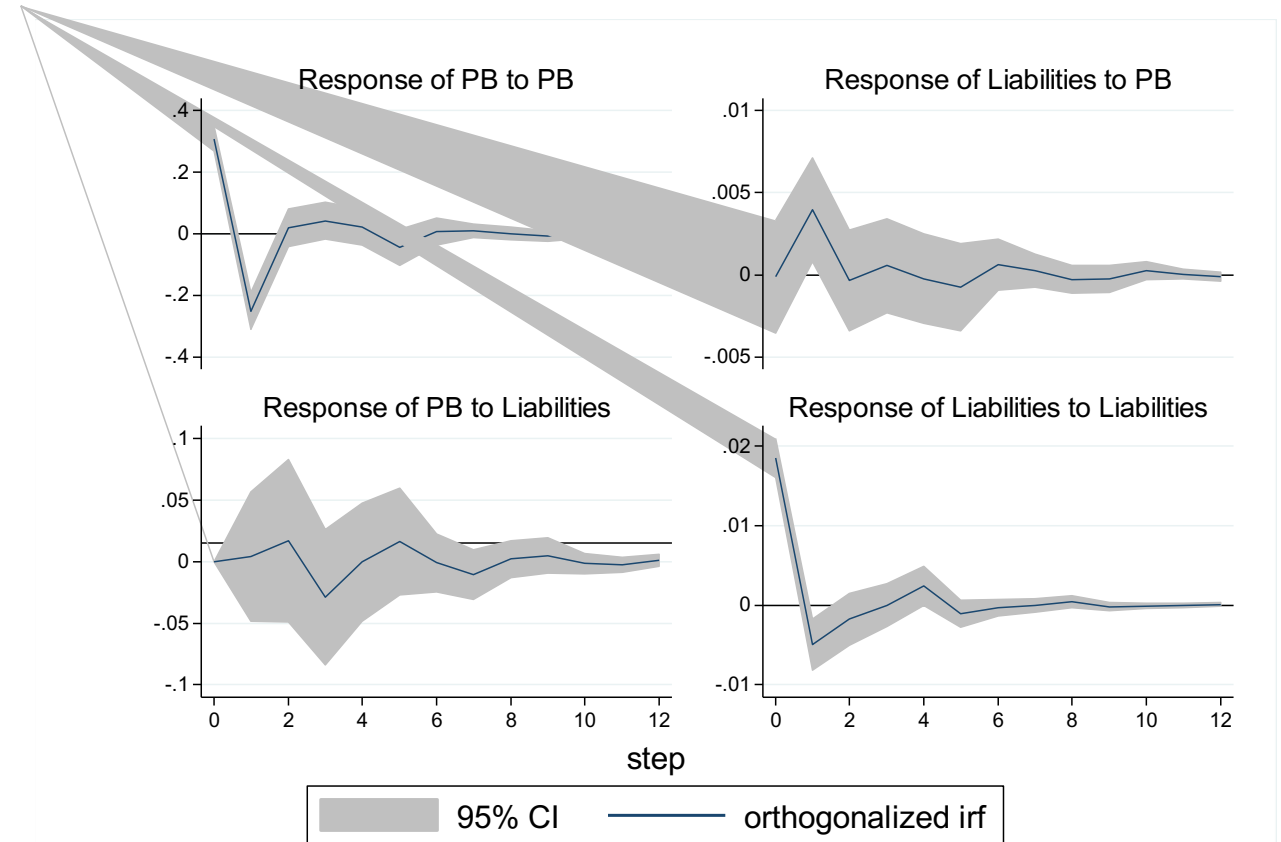
Graphs by irfname, impulse variable, and response variable

Source: Central Bank of Costa Rica.

Robustness checks

VAR analisys

- The results of using debt instead of liabilities supported the results.

- The results of using variables adjusted by the cycle component are ambiguous: the Granger causality tests suggested Fiscal Dominance, while IRF indicated Monetary Dominance.

- Subsample: results of causality are confirmed when using the sample 1991-2007, but not after 2008 where the null hypothesis was not rejected.

Final remarks

- Primary deficit seems to affect positively the policy rate.

- This suggests that the Central Bank considers fiscal results for its monetary policy decisions.

- Results are robust to different specifications: including openness measures as the current account variable and nominal exchange rate variation.

- Fiscal deficit seems to have a significant log-run effect on inflation.

- From the VAR analysis, primary balance seems to be exogenously determined.

- Liabilities seem to be affected by the primary balance for the period 1991-2005.