A New Test of Fiscal Dominance & Central Bank Independence

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Inflation is always and everywhere a monetary phenomenon.
– Milton Friedman

Inflation is always and everywhere a monetary phenomenon.
– Milton Friedman

Inflation is always and everywhere a fiscal phenomenon.
– Thomas Sargent

Our framework: take both Friedman and Sargent seriously.

Utilize the *consolidated* government budget balance, incorporating **both** monetary and fiscal policy, to estimate the degree of fiscal dominance across countries.

What We Do

Derive a tractable test for fiscal dominance from a micro-founded monetary model.

Long-run policy rule indexed by $\kappa \in [0, 1]$ characterizes the degree of fiscal dominance.

1. κ
   - Fraction of government debt, including interest payments, backed by the present discounted value of current and future primary surpluses.
2. $1 - \kappa$
   - Fraction of outstanding debt backed by the present discounted value of current and future seigniorage revenue.

What We Do

Policy regimes indexed by $\kappa \in [0, 1]$

- Higher $\kappa \Rightarrow$ weaker fiscal dominance/stronger CBI

Static estimates of κ

- $\kappa \approx 1$ in economies with low average inflation (US, Canada)
- $\kappa \in$ (0.5, 0.9) in countries with higher average inflation (Greece, Iceland, Italy, Portugal, Spain)

Time varying estimates of κ

- κ declines post-2008 for economies engaged in Large-Scale Asset Purchase (LSAP) programs

What is fiscal dominance?

Interaction between fiscal and monetary authority
Fiscal policy moves first $\rightarrow$ sequence of primary surpluses, $\{s_t^\tau\}_{t=0}^{\infty}$, set independently of the central bank

Fiscal dominance imposes contraints on monetary policy. Strong fiscal dominance forces the central bank to accommodate large deficits through money creation, leading to high inflation.

Sargent and Wallace (Minn FED 1981) introduced the concept of "fiscal dominance" to characterize fiscal regimes

1. "Non-ricardian fiscal regime" (Sargent, AER 1982)
2. "Active fiscal policy" (Leeper, JME 1991)

Why is fiscal dominance important?

Under fiscal dominance, fiscal policy *directly* affects the price level.

- This is Sargent & Wallace's "Unpleasant Monetarist Arithmetic".

How does it affect the price level?

- Gov't intertemporal budget constraint links fiscal and monetary authority's behaviour
- Given a sequence primary surpluses/deficits, $\{s_t^\tau\}_{t=0}^{\infty}$, monetary authority must adjust seigniorage, $\left\{s_t^M\right\}_{t=0}^{\infty}$, to avoid explosive debt path
- Debt (eventually monetized) acts as money itself today

Why is fiscal dominance bad?

Unpleasant Monetarist Arithmetic.

- Tight monetary policy to fight inflation can make things worse
  - $\uparrow i$, $\uparrow$ debt services today, which means loose monetary policy in the future to pay off larger debt
- Agents anticipate future increase in money creation and bid the price level up today

Why is fiscal dominance bad?

In our framework, p_t is determined by money market clearing.

- Policy rule $\Longrightarrow$ money supply
- Consumer's first-order condition $\Longrightarrow$ money demand

p_t depends not only on M_t, but also on $(1-\kappa)B_t$:

$$p_t = \frac{(1-\beta)[M_t + (1-\kappa)B_t]}{\gamma c_t}$$

Connection to Central Bank Independence literature

Most estimates of CBI are partly or wholly based on *de jure* features:

- Cuckierman (1992, 2008)
- Alesina & Summers (1993)
- Eijffinger & Schaling (1993)
- Banaian (2008)
- Arnone & Romelli (2013)
- Dincer & Eichengreen (2014)
- Masciandro et al. (2020)
- Romelli (2018, 2022, 2024)
- Adrian, Khan & Menand (2024)

De jure indices may miss behavioral aspects of CBI.

Our estimates of κ can be viewed as a measure of de facto CBI.

Benefits of our Fiscal Dominance/CBI Index

Model-based

- Not ad hoc, but derived from a micro-founded model

Tractable

- End up with an intuitive, testable equation
- Straightforward to implement and estimate empirically

Data availability

- Widely accessible public data on money, consumption, and government debt position all that is needed to calculate estimates of κ

De facto

- Captures monetary-fiscal interactions and behavior rather than only legal & institutional framework

The Model

Model Overview

- Identical, infinitely-lived consumers with perfect foresight
- Money-in-utility (MIU)
- Government finances spending through a combination of tax revenue, seigniorage revenue and debt issuance

Government

Flow budget constraint period-by-period

$$G_t + (i_{t-1} - 1)\frac{B_{t-1}}{p_t} = \tau_t + \frac{(M_t - M_{t-1})}{p_t} + \frac{(B_t - B_{t-1})}{p_t}$$

No Ponzi condition

$$\lim_{j \to \infty} \left(M_{t+j} + B_{t+j}\right) / p_{t+j} R_t^{(j)} = 0$$

where $R_t^{(j)} = \prod_{h=1}^{j} r_{t+h}$ is the j-periods-ahead market discount factor

Government

Intertemporal budget constraint after forward iteration

$$\begin{aligned} i_{t-1}\frac{B_{t-1}}{p_t} &= \sum_{j=0}^{\infty}\frac{\tau_{t+j}}{R_t^{(j)}} + \sum_{j=0}^{\infty}\frac{M_{t+j}-M_{t+j-1}}{p_{t+j}R_t^{(j)}} - \sum_{j=0}^{\infty}\frac{G_{t+j}}{R_t^{(j)}} \\ &= \mathcal{T}_t + \mathcal{S}_t - \mathcal{G}_t \end{aligned}$$

- $\mathcal{T}_t \equiv$ present value of tax receipts
- $\mathcal{S}_t \equiv$ present value of seigniorage revenue
- $\mathcal{G}_t \equiv$ present value of government expenditure

The κ-backing Fiscal Policy

Given a sequence of prices $\{i_{t+j-1}, p_{t+j}\}_{j=0}^{\infty}$ *and an initial stock of nominal debt* B_{-1}*, a* κ*-backing fiscal policy is a sequence of fiscal variables* $\{G_{t+j}, \tau_{t+j}, B_{t+j}\}_{j=0}^{\infty}$ *such that, for all* t*:*

$$\mathcal{T}_t - \mathcal{G}_t = \kappa i_{t-1} \frac{B_{t-1}}{p_t} \quad \text{and} \quad \mathcal{S}_t = (1-\kappa) i_{t-1} \frac{B_{t-1}}{p_t}$$

where $\kappa \in [0, 1]$.

- Consistent with multiple sequences of fiscal variables, $\{g_t, \tau_t, B_t\}_{t=0}^{\infty}$, and monetary variables $\{M_t, i_t\}_{t=0}^{\infty}$
- Policy regimes indexed by $\kappa \in [0, 1] \rightarrow$ **two polar cases**

Two Polar Cases for κ

1. **Zero fiscal dominance:** $\kappa = 1 \Rightarrow \mathcal{T}_t - \mathcal{G}_t = i_{t-1}\frac{B_{t-1}}{p_t}$
   - Complete accommodation of fiscal policy to any increase in debt $\Rightarrow$ FA adjusts $\mathcal{T}_t - \mathcal{G}_t$ to back all bond obligations.
   - MA does not respond.

2. **Complete fiscal dominance:** $\kappa = 0 \Rightarrow \mathcal{S}_t = i_{t-1}\frac{B_{t-1}}{p_t}$
   - MA fully accommodates FA's behaviour $\Rightarrow$ MA adjusts current/future money creation to back all bond obligations.
   - Primary surplus $(\mathcal{T}_t - \mathcal{G}_t)$ does not react to changes in debt

Empirical Estimation of Fiscal Dominance Across Countries

Data

Annual data (IMF/IFS) on nominal macro variables from 1948-2016 for 24 OECD countries.

- $C_t \equiv$ consumption
- $M_t \equiv$ reserve money (*i.e.* base money)
- $B_t \equiv$ government debt

Table: Cross-Country Sample

Australia	1950 – 2016
Austria	1950 – 1997
Belgium	1953 – 1998
Canada	1948 – 2016
Denmark	1950 – 2015
Finland	1950 – 1998
France	1949 – 1998
Germany	1950 – 1998
Greece	1953 – 2000
Iceland	1950 – 2016
Ireland	1950 – 1998
Italy	1962 – 1997
Japan	1955 – 2016
Korea	1958 – 2016
Netherlands	1950 – 1998
New Zealand	1950 – 2016
Norway	1950 – 2016
Portugal	1965 – 1998
Singapore	1963 – 2016
Spain	1954 – 1998
Sweden	1950 – 2016
Switzerland	1948 – 2016
UK	1948 – 2016
USA	1950 – 2016

We are working on a related paper focused on developing & emerging markets (an additional 100 countries).

Empirical Estimation Strategy

DOLS (Stock and Watson, 1993)

$$M_t = \alpha_0 + \alpha_1 C_t - (1-\kappa)B_t + \sum_{n=-p}^{q} \xi_{c,n} \Delta C_{t-n} + \sum_{n=-p}^{q} \xi_{b,n} \Delta B_{t-n} + e_t$$

Empirical model estimated as a cointegrating system. For DOLS to be valid, need to conduct:

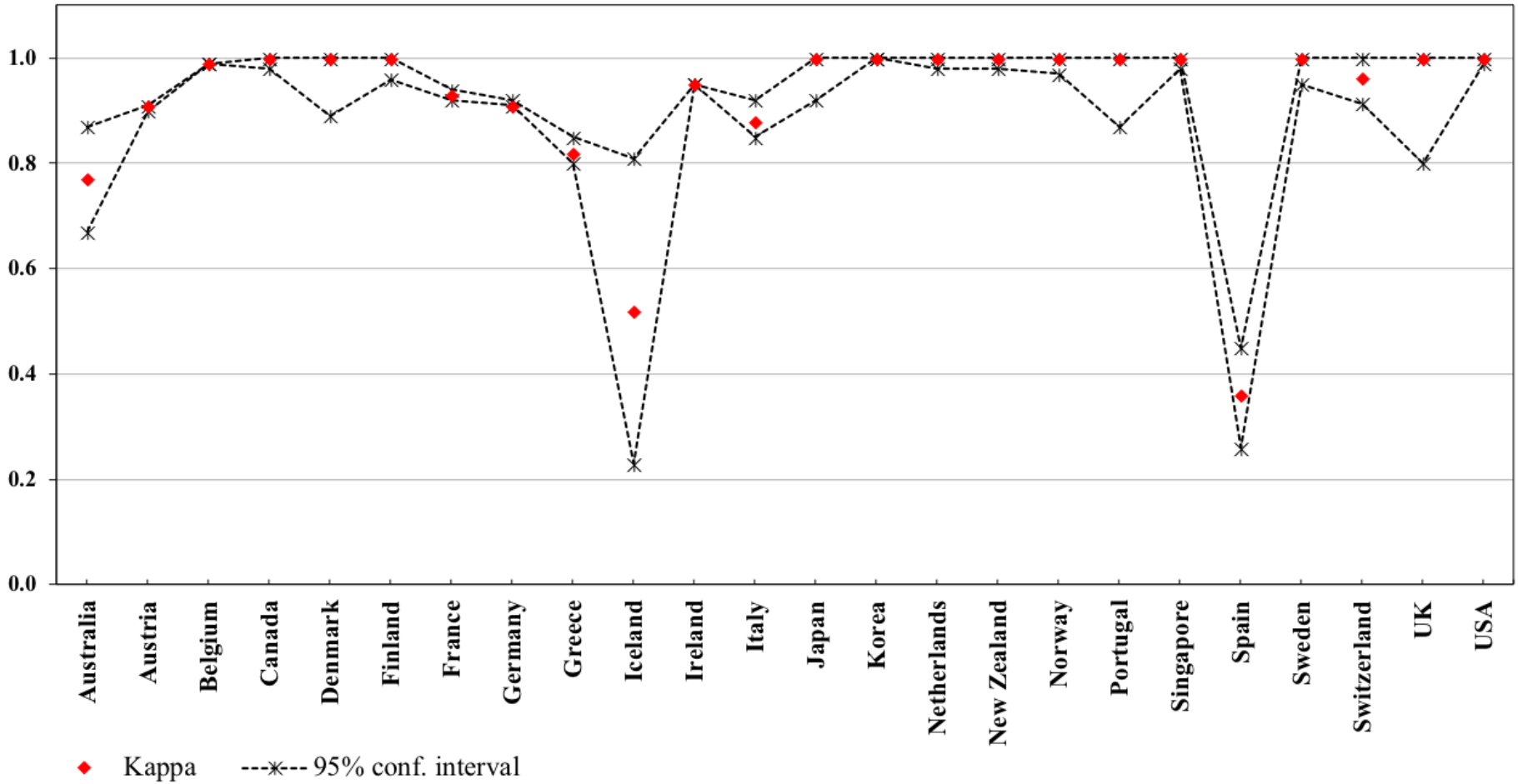
- ADF tests: all variables are I(1) ✓
- Engle-Granger cointegration tests: null (no cointegration) typically rejected ✓rejected

Table: DOLS Estimation of Structural Parameters

	leads	lags	α_1		κ			Valid Sample		
	p	q	estimate	p-val	estimate	p-val	95% conf. int.	start	end	obs
Australia	6	7	0.19	0.01	0.77	0.00	[0.67 , 0.87]	1957	2010	54
Austria	4	0	0.29	0.00	0.91	0.00	[0.90 , 0.91]	1951	1994	44
Belgium	3	2	0.09	0.00	0.99	0.00	[0.99 , 0.99]	1956	1995	40
Canada	8	2	0.05	0.35	1.00	0.00	[0.98 , 1.00]	1951	2008	58
Denmark	7	6	0.27	0.53	1.00	0.00	[0.89 , 1.00]	1957	2009	53
Finland	2	3	0.27	0.00	1.00	0.00	[0.96 , 1.00]	1954	1996	43
France	3	1	1.14	0.00	0.93	0.00	[0.92 , 0.94]	1952	1995	44
Germany	4	2	0.23	0.00	0.91	0.00	[0.91 , 0.92]	1953	1994	42
Greece	4	1	0.49	0.00	0.82	0.00	[0.80 , 0.85]	1954	1996	43
Iceland	7	7	0.48	0.38	0.52	0.38	[0.23 , 0.81]	1971	2009	39
Ireland	4	3	0.14	0.00	0.95	0.00	[0.95 , 0.95]	1954	1994	41
Italy	2	2	0.45	0.03	0.88	0.00	[0.85 , 0.92]	1962	1995	34
Japan	0	6	0.46	0.45	1.00	0.00	[0.92 , 1.00]	1962	2016	55
Korea	3	6	0.30	0.00	1.00	0.00	[1.00 , 1.00]	1965	2013	49
Netherlands	4	4	0.22	0.05	1.00	0.00	[0.98 , 1.00]	1955	1994	40
New Zealand	7	4	0.10	0.00	1.00	0.00	[0.98 , 1.00]	1955	2009	55
Norway	4	7	0.13	0.04	1.00	0.00	[0.97 , 1.00]	1957	2012	56
Portugal	2	2	-0.03	0.91	1.00	0.00	[0.87 , 1.00]	1968	1998	31
Singapore	5	5	0.16	0.03	1.00	0.00	[0.98 , 1.00]	1969	2011	43
Spain	3	4	0.62	0.02	0.36	0.06	[0.26 , 0.45]	1959	1995	37
Sweden	6	7	0.26	0.01	1.00	0.00	[0.95 , 1.00]	1958	2010	53
Switzerland	2	6	0.17	0.05	0.96	0.06	[0.91 , 1.00]	1955	2006	60
UK	8	8	0.03	0.89	1.00	0.02	[0.80 , 1.00]	1957	2008	52
USA	7	7	0.01	0.79	1.00	0.00	[0.99 , 1.00]	1956	2009	54

Optimal leads and lags chosen to minimize the Modified Schwarz Information Criterion (MSIC).

95% Confidence Interval for Estimates of κ



Some intuition: price level determination

p_t is determined by money market clearing

- Policy rule $\Longrightarrow$ money supply
- Consumer's first-order condition $\Longrightarrow$ money demand

p_t depends not only on M_t, but also on $(1-\kappa)B_t$:

$$p_t = \frac{(1-\beta)[M_t + (1-\kappa)B_t]}{\gamma c_t}$$

Model vs data inflation comparison

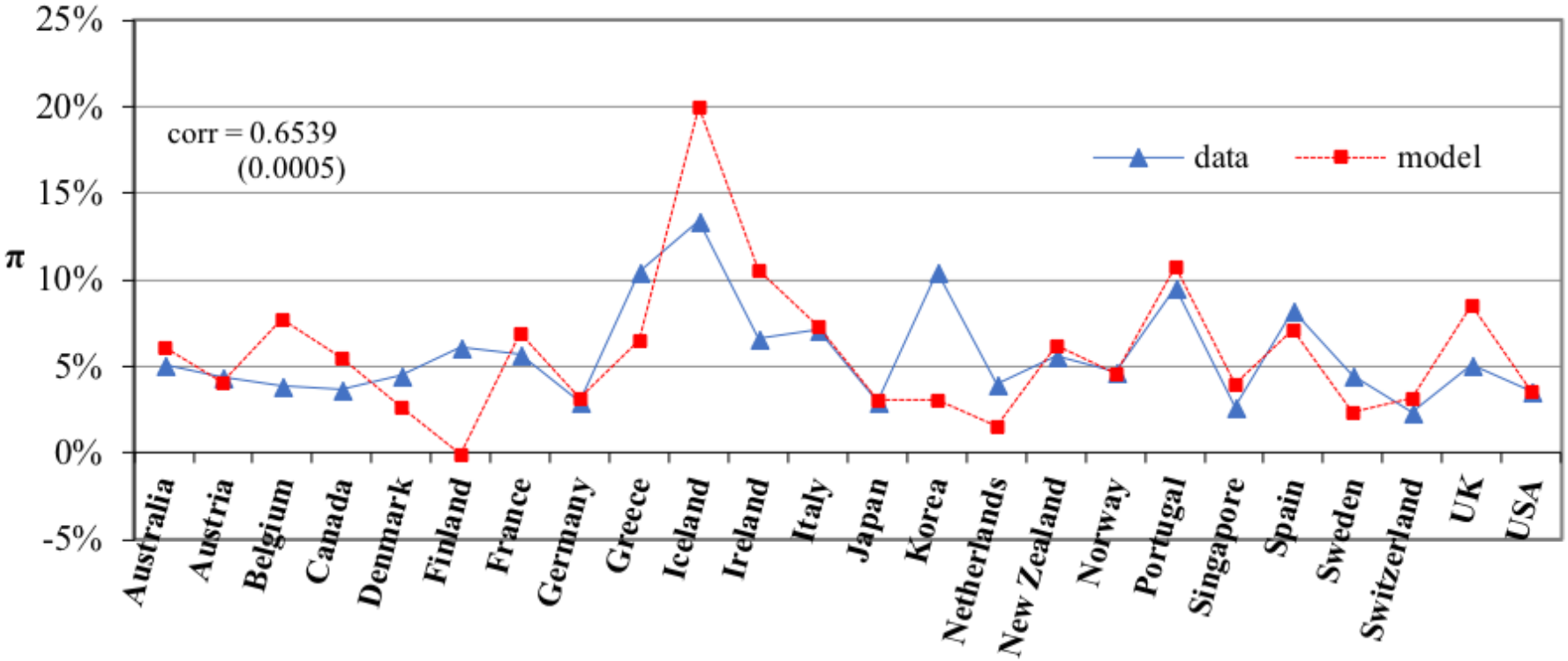


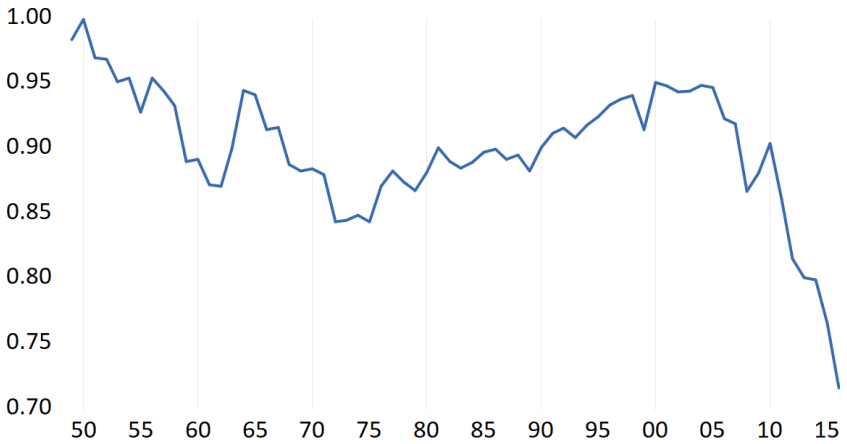
Table: DOLS Estimation of Structural Parameters with Breaks

	α_1		κ			breaks
	est.	p-val	est.	p-val	95% conf. interval	period
Australia	0.15	0.00	0.89	0.00	[0.86 , 0.93]	$<$ 2005
			0.88	0.00	[0.85 , 0.91]	$>$ 2005
Austria	0.28	0.00	1.00	0.00	[0.98 , 1.00]	$<$ 1969
			0.91	0.00	[0.91 , 0.91]	$>$ 1969
Belgium	0.08	0.00	0.95	0.00	[0.94 , 0.95]	$<$ 1963
			0.99	0.00	[0.99 , 0.99]	$>$ 1963
Canada	0.09	0.00	1.00	0.00	[1.00 , 1.00]	$<$ 1983
			0.98	0.00	[0.98 , 0.98]	$>$ 1983
Denmark	-3.51	0.01	0.86	0.00	[0.83 , 0.88]	$<$ 1988
			0.97	0.00	[0.95 , 0.99]	1988 – 2005
			0.82	0.00	[0.79 , 0.85]	$>$ 2005
Finland	0.28	0.00	0.47	0.02	[0.36 , 0.59]	$<$ 1971
			1.00	0.00	[0.95 , 1.00]	$>$ 1971
France	1.20	0.00	1.00	0.00	[1.00 , 1.00]	$<$ 1976
			0.91	0.00	[0.91 , 0.92]	$>$ 1976
Germany	0.23	0.00	0.91	0.00	[0.91 , 0.92]	$<$ 1970
			0.92	0.00	[0.91 , 0.92]	$>$ 1970
Greece	0.39	0.00	0.85	0.00	[0.84 , 0.86]	$<$ 1980
			0.88	0.00	[0.86 , 0.90]	$>$ 1980
Iceland	-2.14	0.00	1.00	0.00	[0.99 , 1.00]	$<$ 1987
			0.76	0.00	[0.74 , 0.79]	1987 – 1998
			0.54	0.00	[0.50 , 0.58]	$>$ 1998
Ireland	0.15	0.00	0.95	0.00	[0.94 , 0.96]	$<$ 1969
			0.95	0.00	[0.94 , 0.95]	$>$ 1969
Italy	0.14	0.00	0.86	0.00	[0.85 , 0.86]	$<$ 1984
			1.00	0.00	[0.99 , 1.00]	$>$ 1984

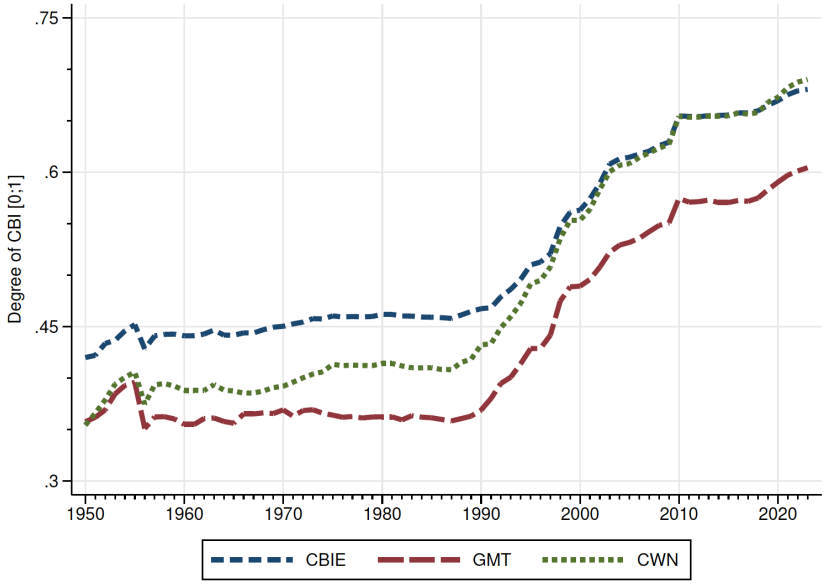
Table: DOLS Estimation of Structural Parameters with Breaks

	α_1		κ			breaks
	est.	p-val	est.	p-val	95% conf. interval	period
Japan	0.48	0.07	0.91	0.00	[0.89 , 0.92]	$<$ 2001
			1.00	0.00	[0.99 , 1.00]	$>$ 2001
Korea	-1.55	0.01	0.87	0.00	[0.81 , 0.93]	$<$ 1995
			0.82	0.00	[0.80 , 0.85]	1995 – 2002
			1.00	0.00	[0.99 , 1.00]	$>$ 2002
Netherlands	0.17	0.00	0.91	0.00	[0.90 , 0.92]	$<$ 1976
			1.00	0.00	[0.99 , 1.00]	$>$ 1976
New Zealand	0.14	0.00	0.97	0.00	[0.96 , 0.99]	$<$ 2005
			0.91	0.00	[0.89 , 0.93]	$>$ 2005
Norway	0.21	0.00	0.89	0.00	[0.86 , 0.92]	$<$ 1999
			0.90	0.00	[0.87 , 0.93]	$>$ 1999
Portugal	-6.09	0.68	0.78	0.00	[0.77 , 0.80]	$<$ 1989
			1.00	0.00	[0.98 , 1.00]	1989 – 1994
			0.95	0.00	[0.95 , 0.96]	$>$ 1994
Singapore	0.15	0.00	0.88	0.00	[0.86 , 0.90]	$<$ 1979
			0.99	0.00	[0.98 , 1.00]	$>$ 1979
Spain	0.26	0.11	1.00	0.00	[0.95 , 1.00]	$<$ 1992
			0.84	0.00	[0.79 , 0.89]	$>$ 1992
Sweden	-1.92	0.00	0.74	0.00	[0.62 , 0.85]	$<$ 1992
			0.87	0.00	[0.81 , 0.93]	1992 – 2007
			1.00	0.00	[0.94 , 1.00]	$>$ 2007
Switzerland	1.56	0.15	1.00	0.02	[0.89 , 1.00]	$<$ 1982
			0.98	0.01	[0.96 , 0.99]	$>$ 1982
UK	0.00	0.66	0.95	0.00	[0.95 , 0.96]	$<$ 1986
			0.99	0.00	[0.98 , 0.99]	$>$ 1986
USA	0.02	0.00	1.00	0.00	[1.00 , 1.00]	$<$ 1985
			0.99	0.00	[0.99 , 0.99]	$>$ 1985

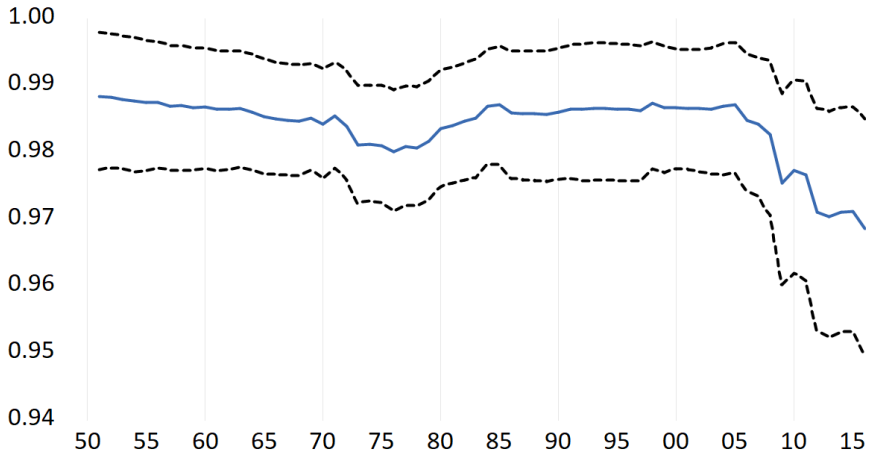
De Facto Central Bank Independence
Average κ Point Estimate for OECD Sample



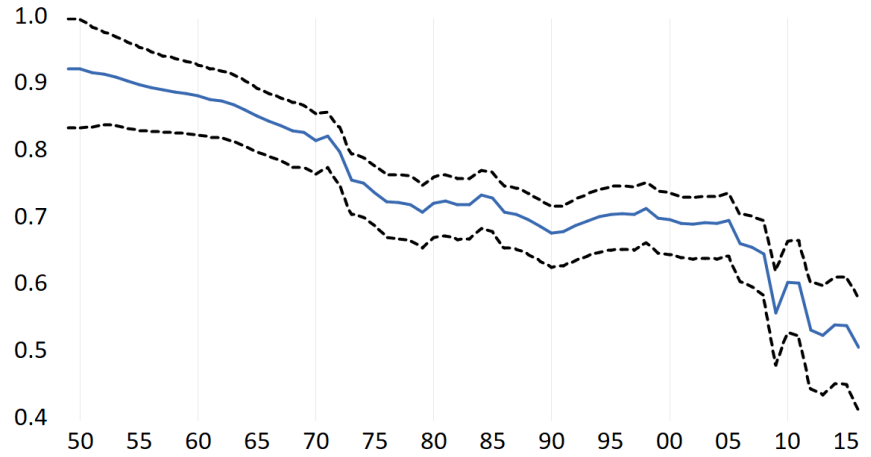
De Jure Central Bank Independence Indices



Time varying κ, USA



Time varying κ, UK



Conclusion

Fiscal dominance is associated with higher steady state inflation.

Model estimates of inflation and data fairly well correlated.

Static estimates of κ

- $\kappa \approx 1$ in economies with low average inflation (US, Canada)
- $\kappa \in (0.5, 0.9)$ in countries with higher average inflation (Greece, Iceland, Italy, Portugal, Spain)

Time varying estimates of κ

- κ declines post-2008 for economies engaged in Large-Scale Asset Purchase (LSAP) programs
- Disconnect post-2008: falling *de facto* CBI, rising *de jure* CBI

Research agenda

1. **A New Test of Fiscal Dominance & Central Bank Independence**
   – today's paper
   – extending dataset to 2023 to include pandemic monetary and fiscal stimulus
   –working on model estimate of inflation for whole sample using time-varying κ
2. **Fiscal Dominance in Developing & Emerging Market Countries**
   – More heterogeneity and higher degree of FD in non-OECD countries
3. **Fiscal Dominance in the Euro Area: Credibility or Crisis?**
   –in progress

Appendix

Households

$$\max_{\{c_t, n_t, m_t, b_t, k_t\}} \sum_{t=0}^{\infty} \beta^t u\left(c_t, m_t/p_t, 1 - n_t\right)$$

s.t.

$$c_t + \frac{m_t}{p_t} + \frac{b_t}{p_t} + k_t = w_t n_t + r_t k_{t-1} + \frac{m_{t-1}}{\pi_t p_{t-1}} + i_{t-1} \frac{b_{t-1}}{\pi_t p_{t-1}} - \tau_t$$

- $\pi_t \equiv p_t/p_{t-1}$: gross inflation rate
- $i_{t-1} \equiv$ gross nominal interest rate
- $w_t \equiv$ wage rate
- $r_t \equiv$ gross return on capital

Household FOCs

The functional form for household utility is:

$$\ln(c_t) + \gamma \ln(m_t/p_t) + \theta \ln(1 - n_t)$$

FOCs

$$\begin{aligned} \text{Euler Equation } \frac{1}{c_t} &= \beta \frac{i_t}{\pi_{t+1}} \frac{1}{c_{t+1}} \\ \text{Money Demand } \frac{m_t}{p_t} &= \gamma c_t \frac{i_t}{i_t - 1} \end{aligned}$$

Equilibrium

Competitive equilibrium corresponds to a (i) price system, (ii) allocations for the representative consumer and the representative firm, and (iii) a government policy, such that:

1. the representative consumer and the representative firm optimize given the government policy and the price system;
2. the government policy is budget-feasible given the price system and the choices of consumers and firms;
3. markets clear.

Empirical specification of κ

Rewrite the previous equation for the price level:

$$M_t = \frac{\gamma}{(1-\beta)} C_t - (1-\kappa) B_t,$$

Consider the empirical counterpart to this relation:

$$M_t = \alpha_0 + \alpha_1 C_t + \alpha_2 B_t + e_t$$

- α_0 is an intercept
- $\alpha_1 = \gamma/(1-\beta)$
- $\alpha_2 = -(1-\kappa)$
- e_t is a disturbance term that captures specification error

Empirical Specification

$$M_t = \alpha_0 + \alpha_1 C_t + \alpha_2 B_t + e_t$$

We can run dynamic OLS (DOLS) (Stock & Watson (1993)) and get superconsistent parameter estimates (Phillips and Durlauf 1986) if M_t, B_t, C_t are nonstationary and there is a cointegrating relationship between them.

DOLS regression specification

$$M_t = \alpha_0 + \alpha_1 C_t + \alpha_2 B_t + \sum_{n=-p}^{q} \xi_{c,n} \Delta C_{t-n} + \sum_{n=-p}^{q} \xi_{b,n} \Delta B_{t-n} + e_t$$

where $\alpha_2 \equiv -(1 - \kappa)$.

Table: DOLS Estimation of Structural Parameters, Emerging Market and Developing Countries

	κ			Sample	
	est.	p-val	95% conf. interval	start	end
Albania	1.00	0.00	[0.92 , 1.00]	1997	2016
Algeria	0.48	0.00	[0.42 , 0.54]	1975	2011
Armenia	1.00	0.00	[0.93 , 1.00]	1994	2016
Azerbaijan	0.28	0.36	[0.08 , 0.48]	1997	2015
Bahamas	1.00	0.00	[0.95 , 1.00]	1976	2014
Bahrain	1.00	0.00	[0.98 , 1.00]	1976	2010
Bangladesh	0.66	0.00	[0.65 , 0.67]	1978	2012
Barbados	0.98	0.00	[0.96 , 1.00]	1974	2011
Belize	1.00	0.00	[0.93 , 1.00]	1977	2015
Benin	0.95	0.00	[0.93 , 0.97]	1971	2014
Bhutan	1.00	0.00	[0.91 , 1.00]	1983	2013
Bolivia	0.02	0.88	[0.00 , 0.09]	1975	2012
Botswana	0.00	1.00	[0.00 , 0.24]	1976	2013
Brazil	0.00	1.00	[0.00 , 0.89]	1971	2011
Bulgaria	0.95	0.00	[0.88 , 1.00]	1991	2016
Burkina Faso	1.00	0.00	[0.97 , 1.00]	1977	2014
Burundi	1.00	0.00	[1.00 , 1.00]	1967	2011
Cameroon	0.94	0.00	[0.94 , 0.95]	1972	2011
CAR	0.06	0.88	[0.00 , 0.30]	1974	2006
Chad	0.79	0.00	[0.74 , 0.84]	1971	2008
Chile	0.62	0.00	[0.59 , 0.65]	1961	2011
China	1.00	0.00	[0.80 , 1.00]	1980	2014
Colombia	1.00	0.00	[0.98 , 1.00]	1958	2009
Costa Rica	1.00	0.00	[0.86 , 1.00]	1958	2011
...					