The Safety Net: Central Bank Balance Sheets and Financial Crises, 1587-2020

Niall Ferguson   Martin Kornejew

Paul Schmelzing   Moritz Schularick

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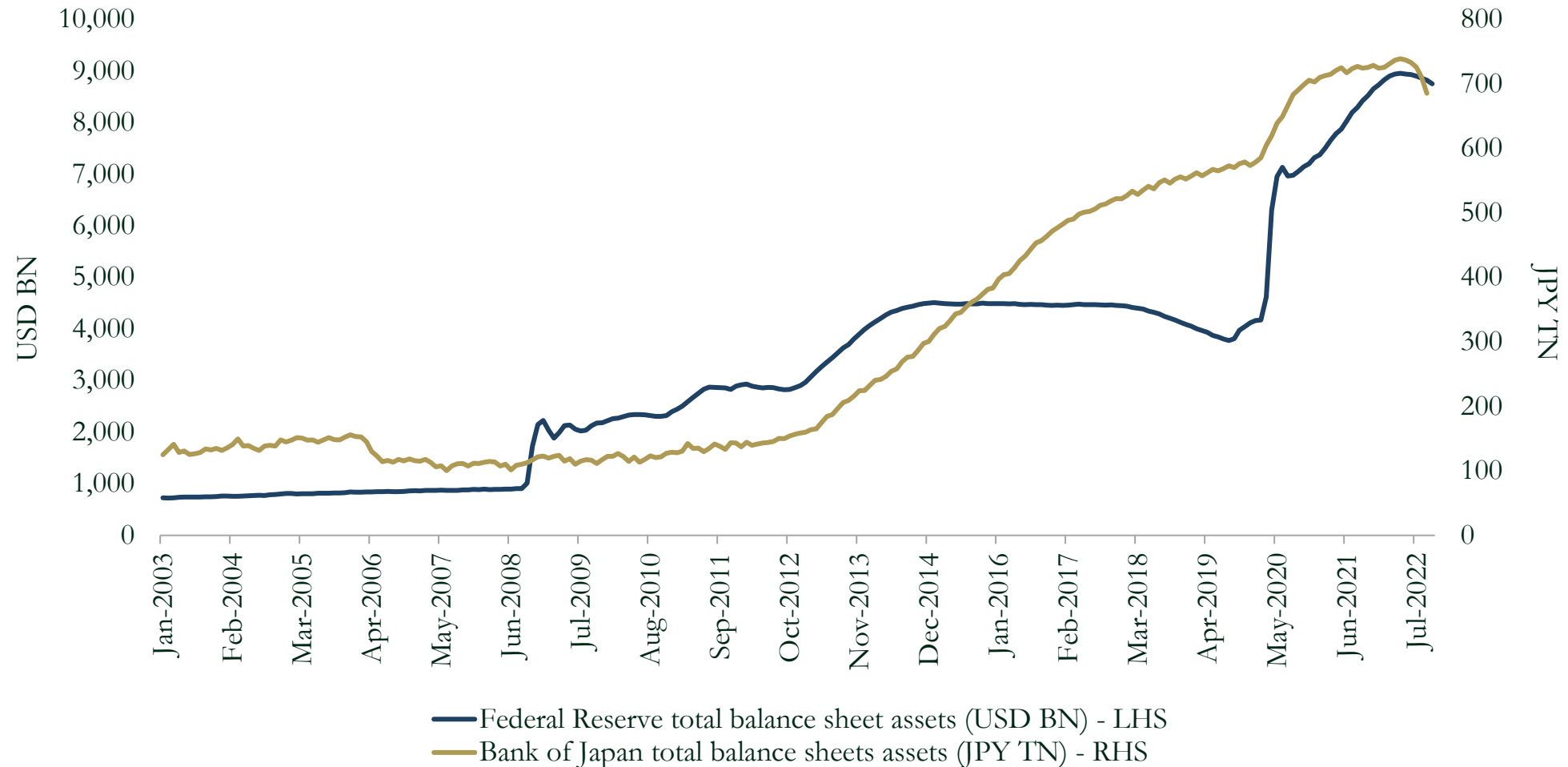# MOTIVATION: DEMISE OF A TRADITIONAL POLICY TOOL

- Traditional 4-5% policy rate instrument used by monetary policymakers during recessions, other tail events – the crucial tool of Taylor's rule – becomes less effective at ZLB.

Legend: NBER recession date — Fed Funds rate (%)
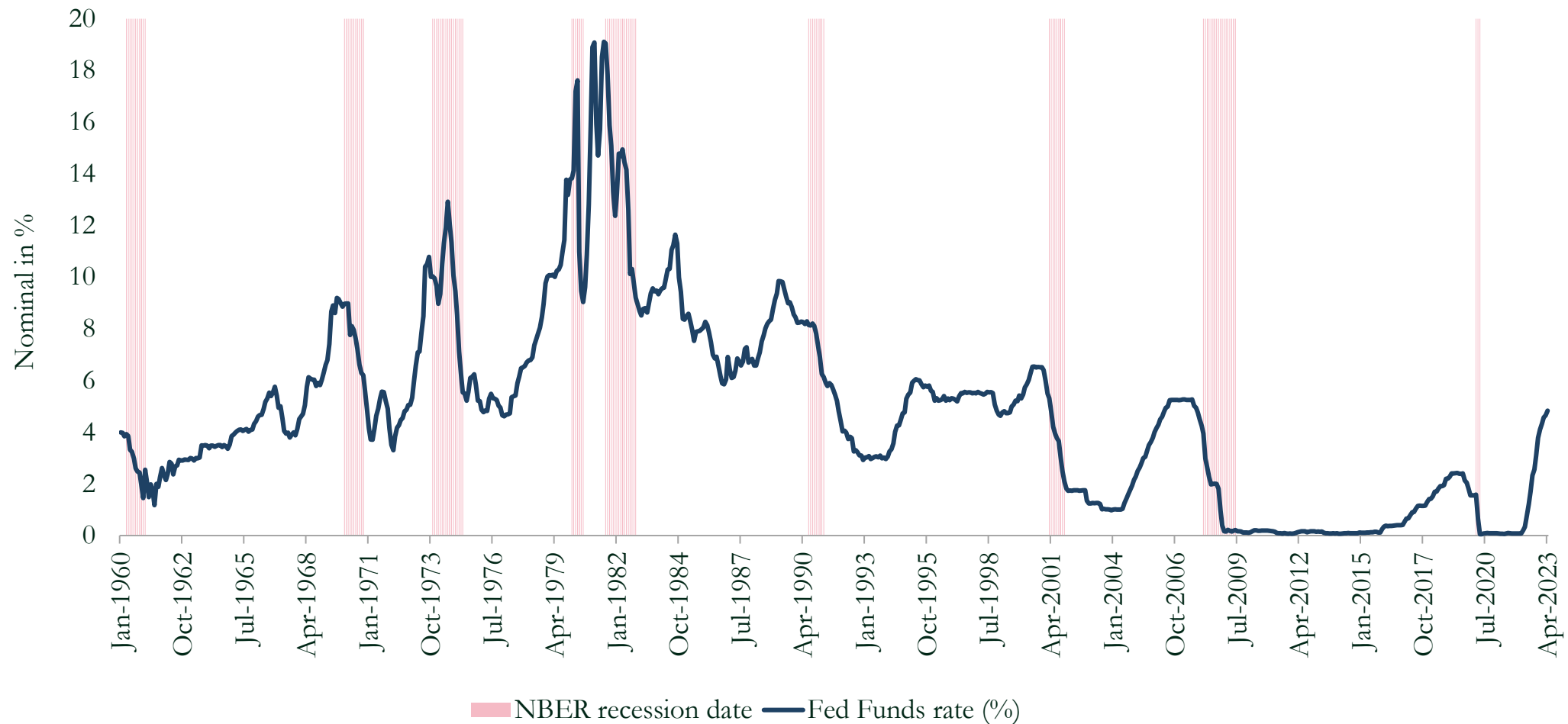
Notes: monthly averaged fed funds rate OECD basis via FRED, series IRSTFR01USM156N as of October 2022. Shaded areas indicate NBER recession dates.

MOTIVATION: POST-2008 CB BALANCE SHEET SURGE

- A recently-embraced "unconventional" policy alternative: central bank balance sheets (others include negative policy rates, forward guidance).

Federal Reserve total balance sheet assets (USD BN) - LHS
Bank of Japan total balance sheets assets (JPY TN) - RHS

Notes: via FRED and Bank of Japan, series WALCL, JPNASSETS, as of October 2022.

PS

MOTIVATION, EXISTING LITERATURE

- Literature on macro effects of post-2008 balance sheet expansions
  - Joyce et al. (2011) – analyzed BoE's QE, confirming announcement, portfolio balancing effects on fixed income equity, macro.
  - Engen, Laubach, Reifschneider (2015) – used survey data to estimate private sector perception changes after U.S. QE, positive.
  - Sims and Wu (2020) – found QE to be most efficient tool vis-à-vis NIRP, forward guidance (FG), DSGE approach.
  - Bernanke (2020) – confirmed "unconventional" tools as here to stay.
  - Range of QE impact on 10-year yields from **15bps** (Christensen and Rudebusch 2016) to **240bps** (D'Amico and King 2013).

- Micro/banking literature on OMT/TLTRO, emergency lending: e.g., Drechsler et al. (2016), Crosignani et al. (2020).

- Literature on LLR during crises
  - More critical, despite favorable case studies (Richardson and Troost 2009).
  - Bordo et al. (2001) – banking crises since 1880 more costly when open-ended liquidity support granted.
  - Honohan and Klingebiel (2003) – accommodative policy, incl. open-ended liquidity support, significantly raised cost of crises.

- What we are trying to do
  - Provide first long-run historical investigation of central bank balance sheet dynamics, identifying trends, contextualizing the post-2008 deployment.
  - Study the macroeconomic effects of central bank balance sheet expansions, via causal analysis during banking crises.
  - Capture LLR "at the source" – the central bank balance sheet – using new identification methodology.

NEW DATA: PRIMARY, SECONDARY BALANCE SHEETS

Peruzzi, S.L., *Storia del commercio e dei banchieri di Firenze in tutto il mondo* (1868).

- Coverage of nine "early central banks", typically privately-owned and endowed with note issuance monopoly or other de facto monopolies (e.g., Goodhart 1988; Bindseil 2020).

- 1913 Fed as historical latecomer: *Banco San Giorgio* (1407), *Casa dell Annunziata* (1587), Wisselbank (1609), Sienese *Monte* (1625), Riksbank (1668), BoE (1694), Bank of the United States (1791).

- Explicit early mandates: currency stabilization, note issuance monopoly, government financing, financial stability (de facto).

Nationaal Archief – De Nederlandsche Bank N.V.: Jaarverslagen, F1100212/2013, 457697.

DATA COVERAGE AND EXPANSION EVENTS, 17 COUNTRIES

- 742 country-year expansion events, defined as changes ≥15% y-o-y total assets.
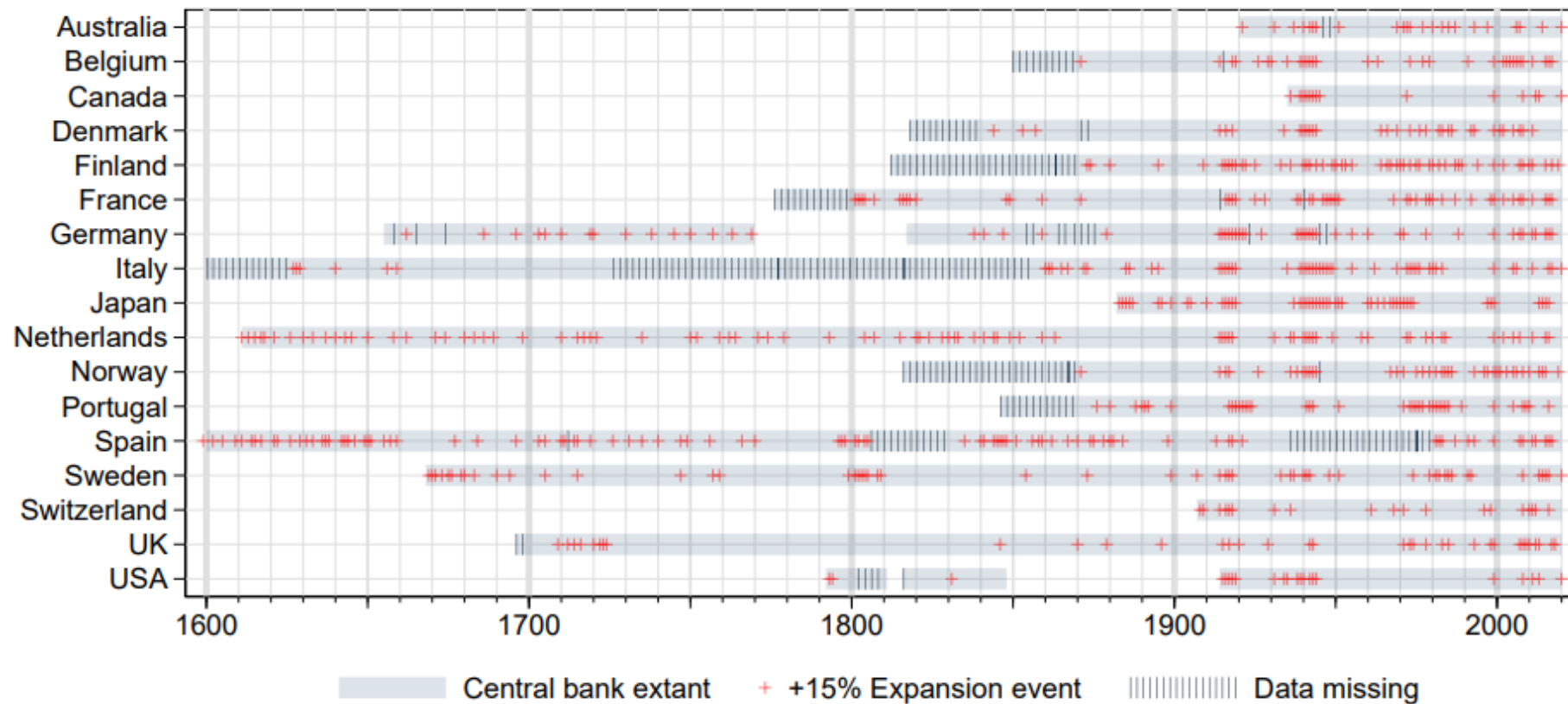

Notes: pre-1870 sample features following de facto central banks: Bank of Amsterdam (1611-1809), Sienese Banco Santo Spirito (1605-1815), Bank of Hamburg (1655-1770), Riksbank (1668-1869), the Public Banks of Naples (1611-1805), Bank of England (1701-1869), the Banks of the United States (1792-1848), Bank of Finland (1811-1869), Bank of Netherlands (1815-1864), Royal Bank of Prussia (1817-1869), Danish Nationalbanken (1835-1869), Banque Belge (1850-1869), Banco de San Fernando/Banco de España (1830-1869), and the Banque de France (1800-1869).

TOTAL CB ASSETS/GDP, 1611-2021

- CB balance sheets have reached all-time record levels relative to output since 2008, now far outstripping WWII peak.

Figure 1: Central bank assets relative to GDP, 1611-2020
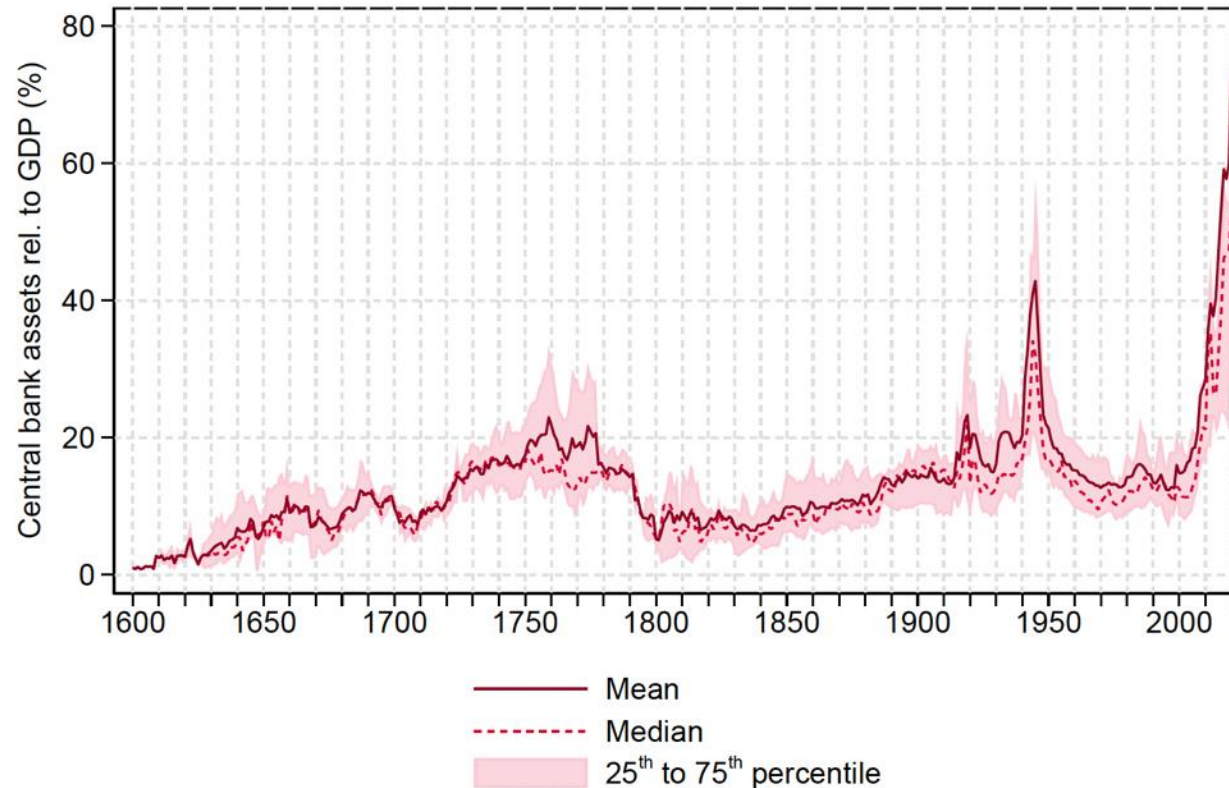
Notes: Arithmetic average for advanced economy sample. Current GDP pre-1870 is based on Smits et al. (2000) and van Zanden and van Leeuwen (2012) for Holland, Malanima (2011) for Italy, Johnston and Willamson (2020) for the United States, Edvinsson (2014) for Sweden, Broadberry et al. (2015) for the U.K., Mitchell (2013) for Denmark, Pfister (2022) for Prussia and Hamburg, Alvarez-Nogal and de la Escosura (2013) for Spain, and Ridolfi and Nuvolari (2021) for France.

TOTAL CB PUBLIC DEBT ASSETS/TOTAL ASSETS, 1650-2021

- Public debt concentration in central bank balance sheets traditionally in 25-60% range, currently upper end of range.

Figure 3 (b) Government debt held by central banks as a share of total central bank assets, 1652-2020
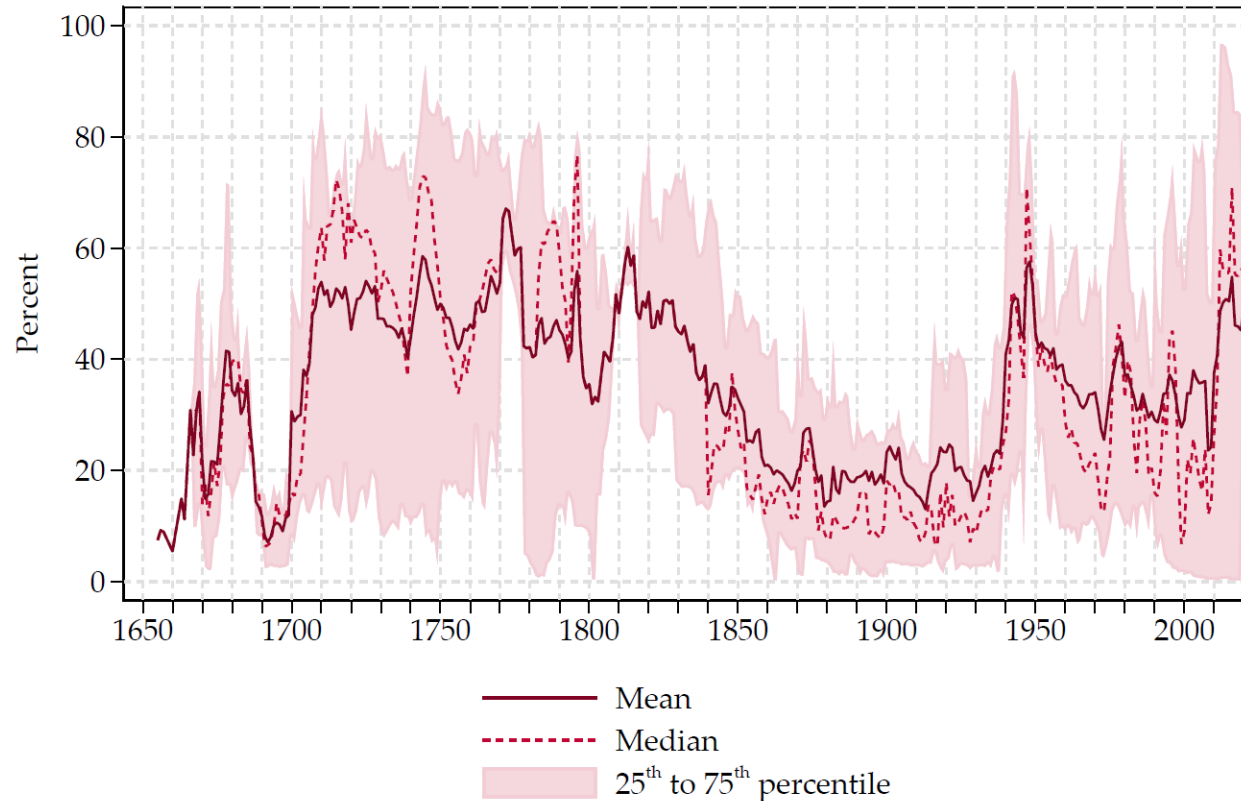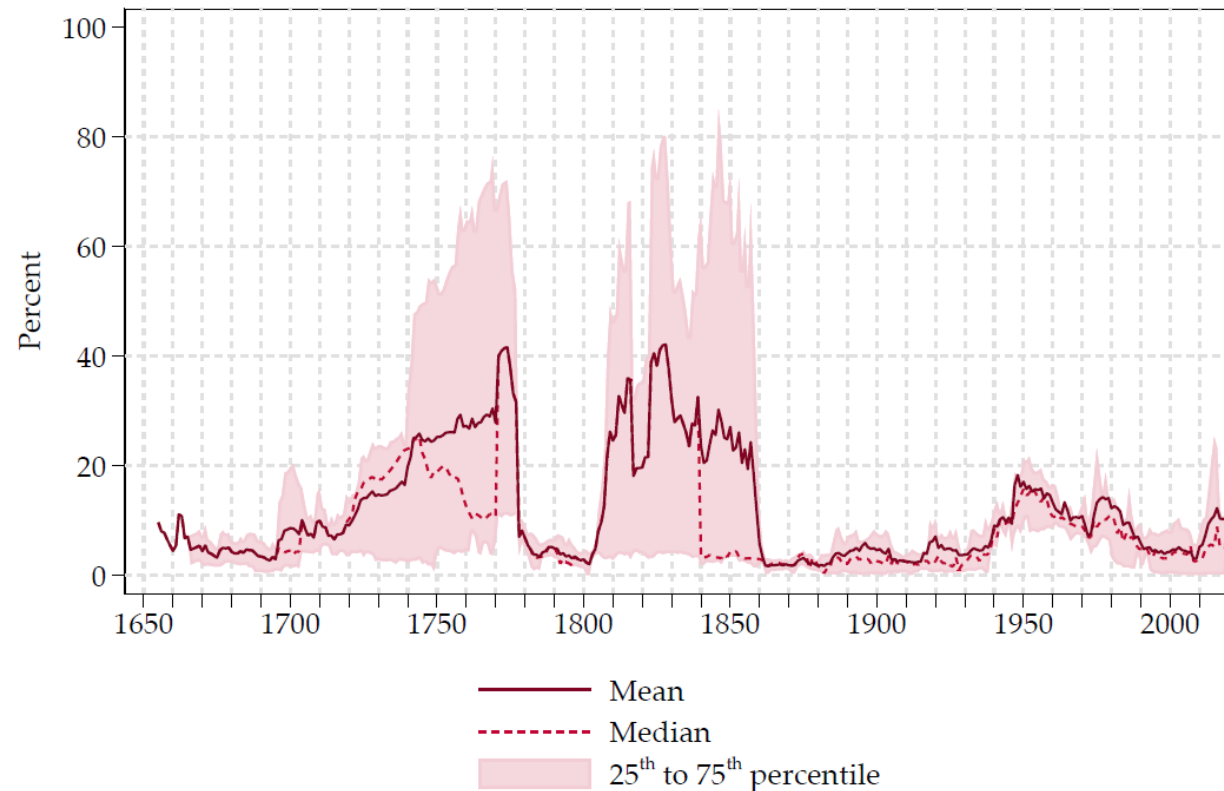

Notes: Arithmetic average for advanced economy sample. 1650-1869: sample including Bank of Amsterdam (1650-1809), Bank of Hamburg (1655-1770), Riksbank (1668-1869), Bank of England (1701-1869), the Banks of the United States (1792-1848), Bank of Netherlands (1815-1864), Royal Bank of Prussia (1817-1869), Danish Nationalbanken (1835-1869), Banco de San Fernando/Banco de España (1830-1869), and the Banque de France (1800-1869).

CB PUBLIC DEBT ASSETS/TOTAL PUBLIC DEBT, 1655-2021

- Classic debt monetization dynamics in 18th and 19th centuries (Anglo-French wars) – 2021 levels (comparatively) subdued.

Figure 3 (a) Government debt held by central banks as a share of government debt outstanding, 1652-2020
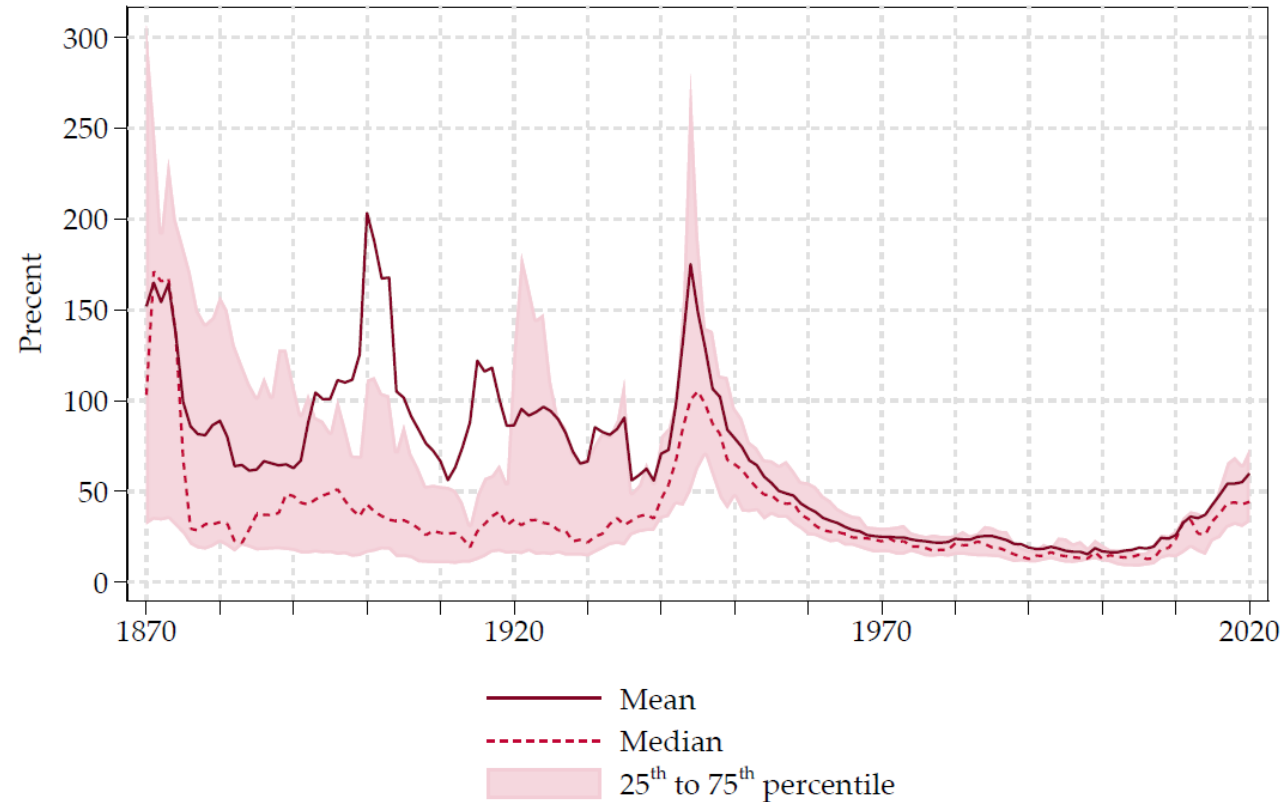

Notes: Arithmetic average for advanced economy sample. 1655-1869: sample including Bank of Amsterdam (1655-1809), Bank of Hamburg (1655-1770), Riksbank (1668-1869), the Public Banks of Naples (1655-1805), Bank of England (1701-1869), the Banks of the United States (1792-1848), Bank of Netherlands (1815-1864), Royal Bank of Prussia (1817-1869), Danish Nationalbanken (1835-1869), Banco de San Fernando/Banco de España (1830-1869), and the Banque de France (1800-1869). Post-1870, 17 CBs included.

TOTAL CB ASSETS/PRIVATE LOAN STOCK, 1870-2021

- While CB asset growth outstripped output growth, financial sector growth far outstripped CB asset growth, 1945-2020.

Figure 2: Central bank assets as a share of total bank lending to the non-financial private sector, 1870-2021

Notes: Basis is arithmetic average for full 17 advanced economy sample, excluding early pre-1870 central banks.

CENTRAL BANK BALANCE SHEET DRIVERS, SENSITIVITY

- Geopolitical conflict traditionally the most prominent driver, with banking crises taking the lead post-1945.

- Major expansion probability during post-1945 banking crisis (>50%) reduced if explicit deposit insurance scheme in place (20%).
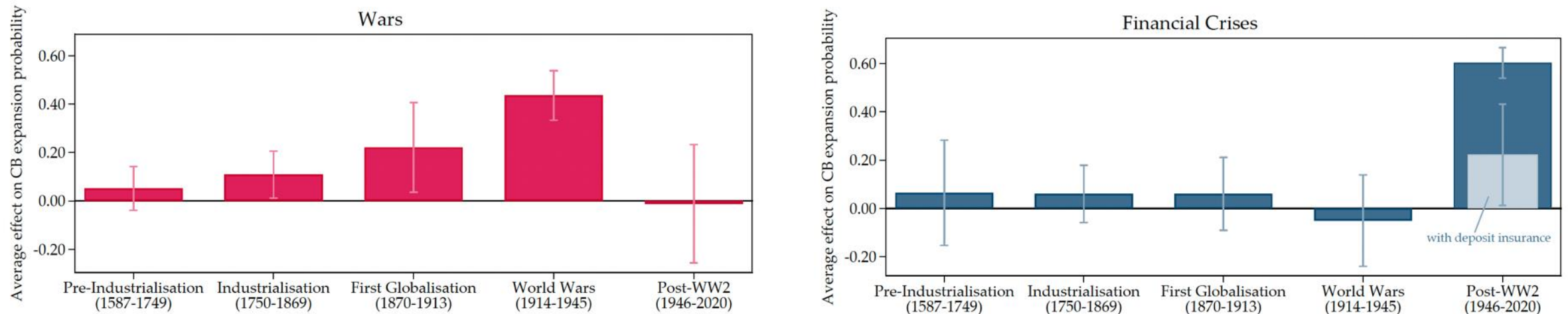
Figure 6: Central bank balance sheet drivers, 1587-2020

Notes: Average effects on the probability of a central bank balance sheet expansion of +15% or more during the current or the next year. Estimates based on a single probit model with episode-specific country fixed effects as well as episode-specific coefficients for a war event and a financial crisis. Whiskers mark the 95% confidence interval. The chronology of wars comes from Clodfelter (2017) and we restrict attention to war-years with at least 50 casualties per million population. Financial crises are dated following Metrick and Schmelzing (2021) for the period until 1870 and Baron et al. (2021) for the period 1870-2020. The coefficient on financial crisis during the post-WW2 episode is indexed by the presence of a mandatory explicit deposit insurance system as coded by Demirguc-Kunt and Detragiache (2002).

IDENTIFICATION STRATEGY

1. Policy bias of central bank governor.
   - Two-way or three-way schemes to classify legislative/executive political policymakers (classic: Hibbs 1977).
   - Expressed as relative ranking of macroeconomic and financial policy variables.

2. Growing understanding of biographical and professional biases, and their effects on economics, economic policymaking.
   - Gohlmann and Vaubel (2007) – panel study on occupational/educational past, political background with higher inflation preferences.
   - Kuttner and Posen (2010) – markets "classify" central bank governors upon announcement.
   - Malmendier and Nagel (2011) – link between personal inflation and macro crises experience, and risk taking.
   - Monnet and Puy (2020) – evidence of "institutional path dependence" inside central banks.

- We extensively survey "governor attributes" over time – policy career, # of crises experienced, age at crisis, party membership.
- We do not assume that nominating government succeeds in appointing "devoted governors," with few exceptions (Nazi Germany).
- We do not assume a simplistic "freshwater/saltwater" educational divide.

RELATIVE POLICYMAKER PREFERENCES

- Policymakers continuously have to rank relative preferences, publicly and internally – in 1870 as in 2020.
- Hawks/Doves do not neatly mirror Republican/Democrat legislative divide, but debates feature similar fault-lines (e.g., bimetallism, "real bills").

Policy preferences of central bank governors regarding key macroeconomic goals.

	Dove	Pragmatist	Hawk
	Full employment		Price stability
	Income equality	Price stability	Moral hazard
	Economic expansion	Economic expansion	FX stability
		Full employment	
	Price stability	FX stability	Economic expansion
	FX stability	Income equality	Full employment

Decreasing order of preference (vertical axis label, top to bottom)

Notes: Adopted from Hibbs (1977), Chang (2003), and others.

Governor sources: speeches, op-eds, (auto-)biographies

"The President … is a fierce defender of the gold standard … often loathed by the bimetallists … he refuses to let the Reichsbank be a cheap source of long-term liquidity … cleansing the [Reichsbank] portfolio of bills unrelated to trade."—Editorial on Reichsbank governor Richard Koch in *Berliner Börsen-Zeitung*, Oct. 31, 1903.

It is "inexcusable [for the Chirac government] not to reduce the fiscal deficits, which … are threatening to upset price stability. The expansion should not be prolonged … by way of higher prices."—Interview with BdF governor Jean-Claude Trichet in *Le Monde*, June 25, 1997.

1. DOVES ARE MORE LIKELY TO UNDERTAKE LARGE BS EXPANSIONS

- We operate with 78 identified "BVX" banking crises for which all associated variables are available over 1870-2020.
- Hawks are 36% less likely to undertake major BS expansions during banking crisis over $t - t+1$.
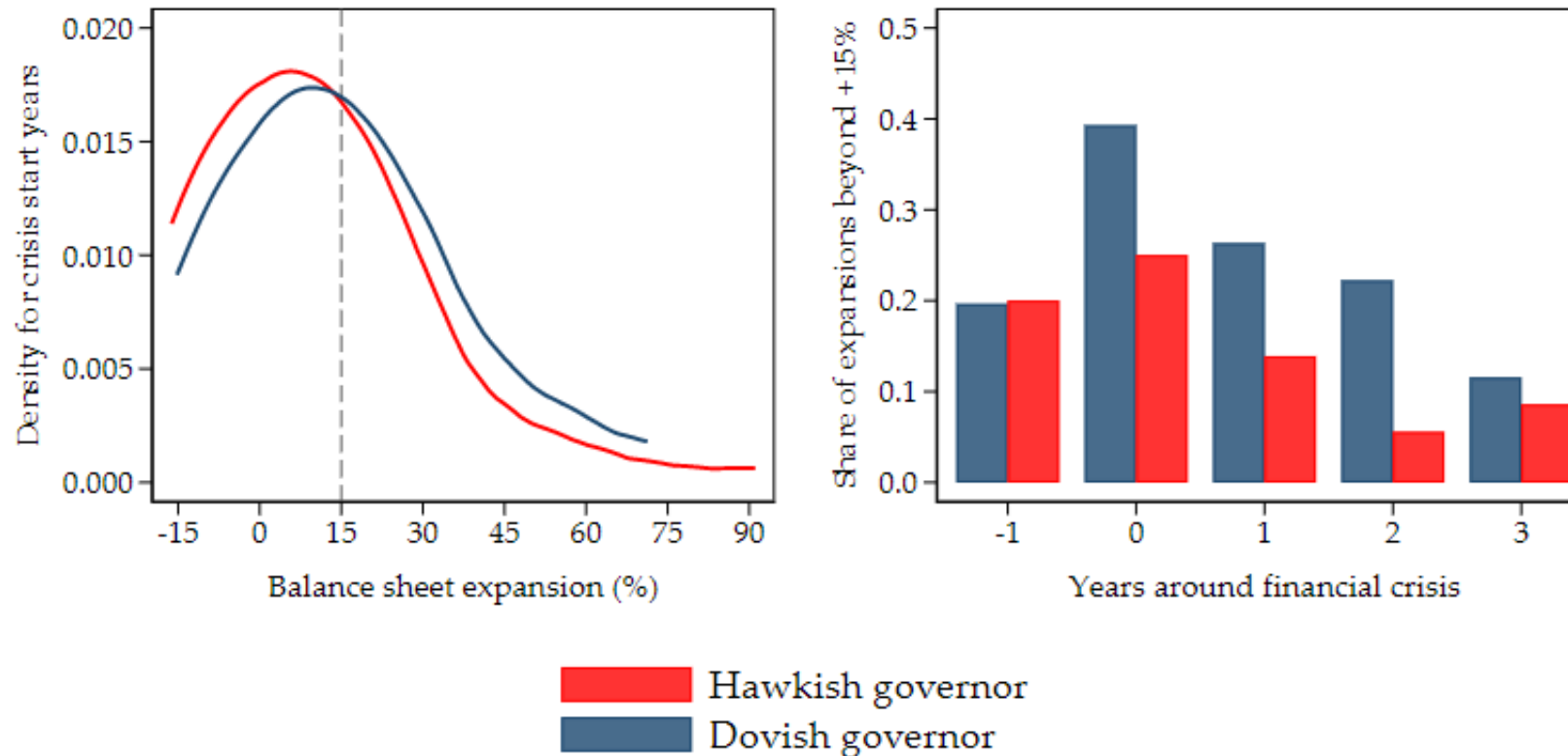
Notes: using banking crisis chronology in Baron, Verner, and Xiong (2021), and defining balance sheet expansion via ≥15% y-o-y total asset growth during B/V/X crisis start year. The left panel plots kernel density estimates of the maximal annual CB balance sheet expansion during the initial year of a banking crisis. The right panel shows the sample share of balance sheet expansions exceeding 15% annually, for individual horizons around financial crises. Data from 78 crises dated by Baron et al. (2021) occurring between 1870 and 2020 in our sample of 17 advanced economies with an operating central bank, excluding 1914-1918, 1939-1945, the German hyperinflation and the Spanish civil war.

CLASSIFICATION OF GOVERNORS DURING BANKING CRISES, 1870-2020

- Hawks and Doves systematically differ over time: professional backdrop (finance vs. public service), age at financial crisis (58 vs. 61), lifetime crises experience (2.2 vs. 1.6).
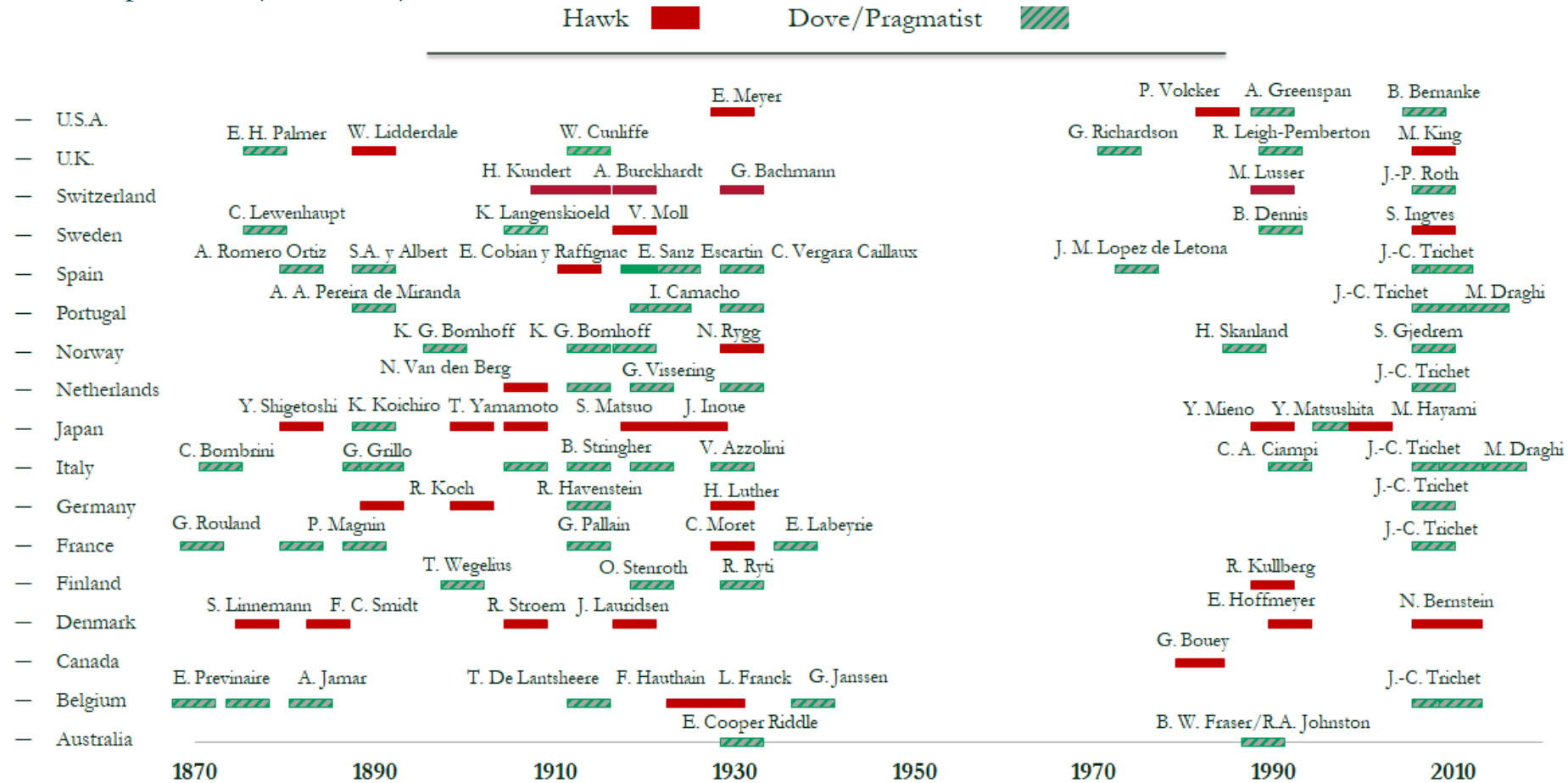
Notes: Figure displays policy orientation of central bank governors in charge of respective central banks during each identified banking crisis as defined in Baron, Verner, and Xiong (2021). Policy classification methodology detailed in FKSS (2023) appendix section 1.

2. BS EXPANSIONS HAVE ROBUST MACRO EFFECTS DURING CRISES

- Results are unambiguous: balance sheet expansions boost both real and nominal variables over medium-term, e.g., cumulative 15% gap on Log CPI.
- We do not estimate role of specific channels: announcement effect / portfolio rebalancing / market liquidity.
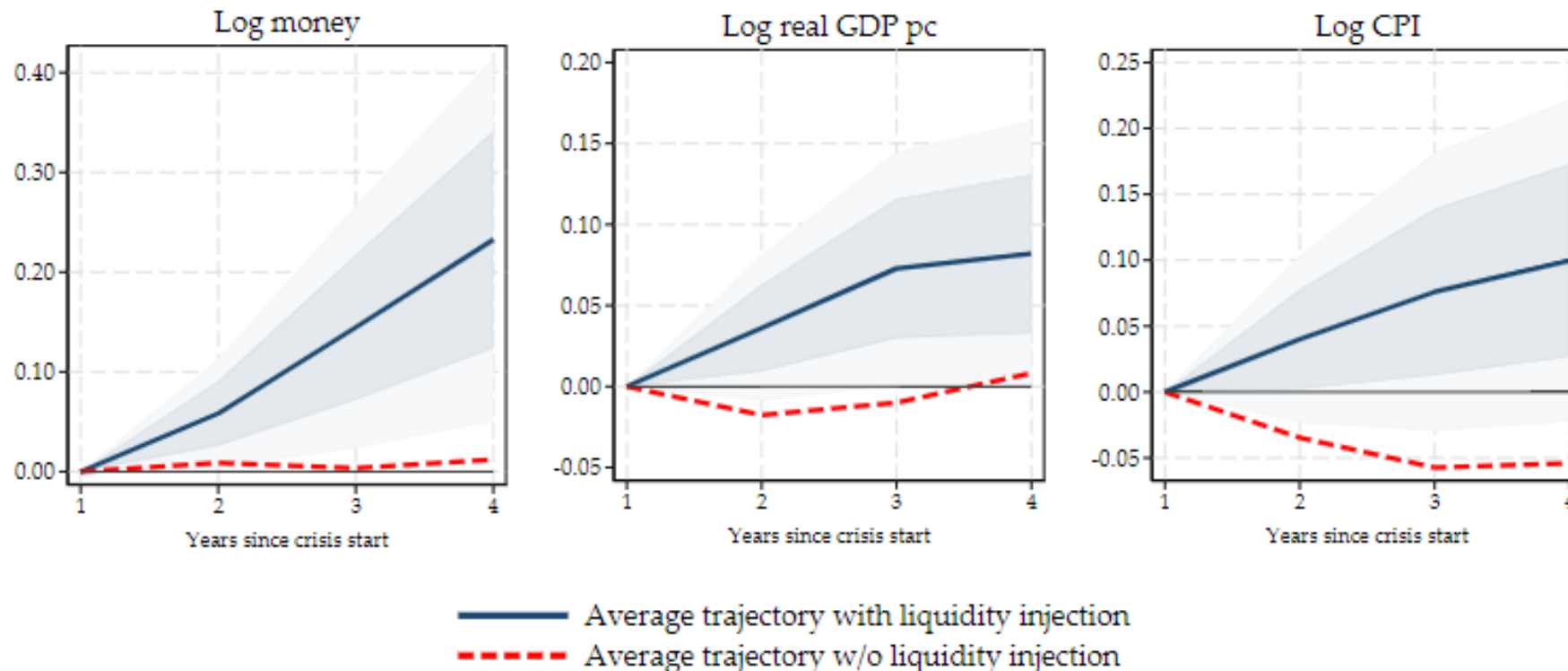
Notes: Plots show the trajectory of macroeconomic aggregates after financial crises depending on central bank liquidity policy. Uncertainty about trajectory of liquidity expansions induced by estimation uncertainty in ˆβh is represented by lightly shaded areas marking its 90% confidence interval; ± one standard error is marked in dark. Country fixed effects and dynamic macro-financial controls included (see text). Standard errors clustered on the country level.

BUT DOVES MAY DIRECTLY INDUCE MORAL HAZARD EFFECTS

- We define "credit boom episodes" as country-years with >10% total credit/GDP ratio growth over past three years.
- Almost double the probability (8.4%) that credit boom-bust will occur after liquidity injection over 20-year post-crisis horizon.
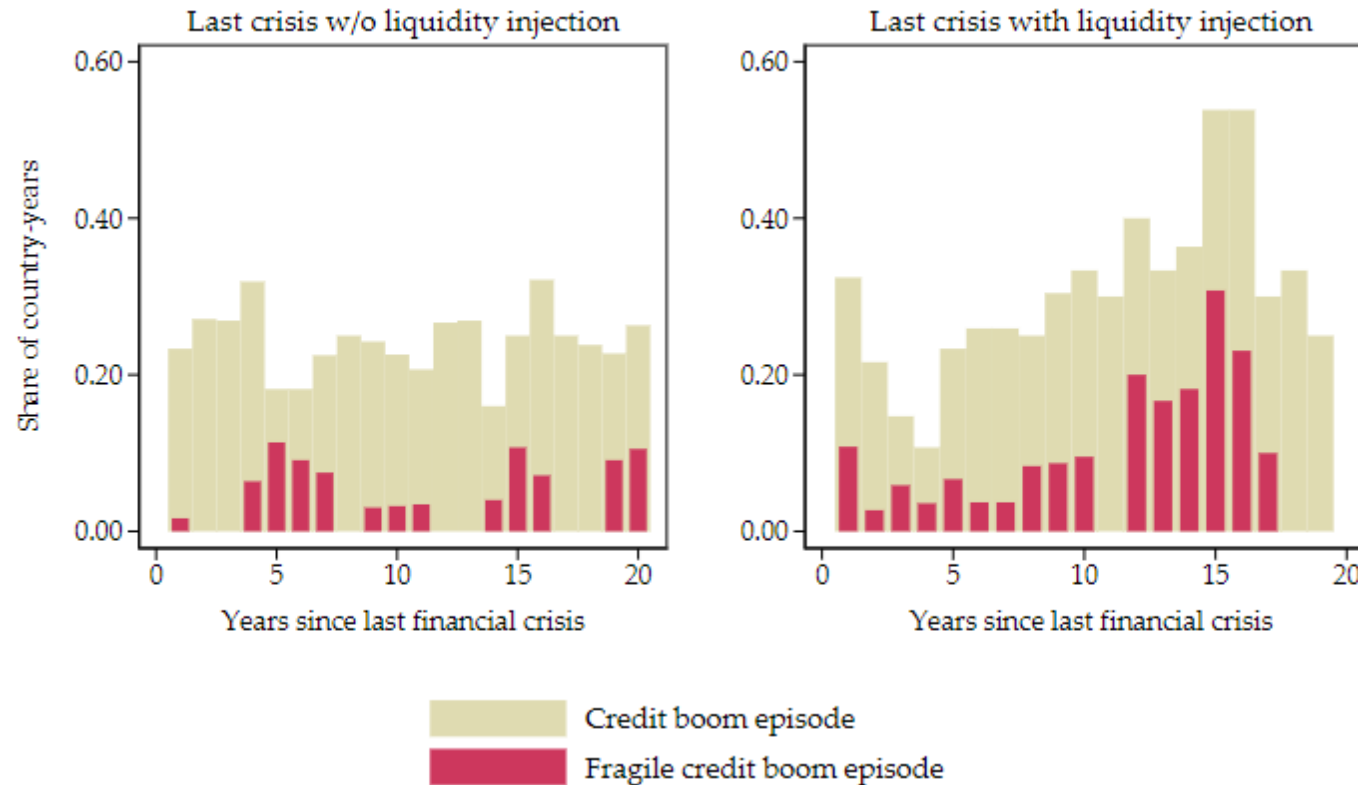
Notes: Share of country-years experiencing a credit boom episode, binned by the number of years since last financial crisis and respective central bank liquidity policy (mit+1 = 1). We define a country-year to belong to a credit boom episode if the credit-to-GDP ratio increased beyond +0.10 over the past three years. We label a country-year to be part of a fragile credit boom episode if in addition a financial crisis (JST basis) ensues during any of the three subsequent years.

CONCLUSIONS

- We have provided the first long-run reconstruction of central bank balance sheet trends over c. four centuries.
- Balance sheets have not been static, inelastic, or small per se over time: only on some measures are post-2008 levels are unprecedented.
- In fact, central bank balance sheets have been a go-to safety net during tail events for centuries.

- But what about the efficiency of the balance sheet as a tool?

- Causal analysis of balance sheet expansions during banking crises over 1870-2020 suggests they generally achieved the desired macro effects of their deployment.
- Over medium-term (t – t+4), we see a significant response for loan growth, inflation, output growth, and financial variables.
- Once the causal approach is employed, it appears that the skeptical view of LLR operations over time does not hold.

- However, the longer-run adverse effects of balance sheet expansions are real. Credit booms and busts are more frequent subsequent to monetary interventions.
- We therefore also provide support for the hawks' moral hazard concerns, contextualizing the credit boom literature (e.g., Greenwood et al. 2022).

APPENDIX MATERIAL

# POLICY ORIENTATION BEATS ALTERNATIVE ATTRIBUTES

- Governors at times of crisis are between 58 and 60.6 years and have experienced on average 3.03–4.71% lifetime inflation rates.
- The only other significant attribute appears to be professional Treasury background (Doves: 44.4%), but policy stance is stronger.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hawk ($g_{it+1} = 1$)	-0.363***	-0.339***	-0.321***	-0.333***	-0.320***	-0.340***	-0.331***	-0.329***
	(0.083)	(0.081)	(0.086)	(0.082)	(0.087)	(0.088)	(0.079)	(0.097)
Crises		0.009						-0.011
		(0.020)						(0.019)
Inflation			0.012**					0.013
			(0.005)					(0.009)
Financial sector				-0.022				-0.029
				(0.135)				(0.147)
Treasury/cabinett					0.151**			0.153*
					(0.070)			(0.083)
Party member						-0.024		-0.103
						(0.141)		(0.158)
Age							0.002	-0.005
							(0.008)	(0.011)
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F	18.91	17.68	14.07	16.56	13.69	15.00	17.77	11.45
R^2	0.33	0.39	0.41	0.39	0.41	0.39	0.39	0.42
Crises	78	77	77	77	77	77	77	77

Notes: Variables measure the pre-appointment biographies of governors: the number of crises experiences, life-time average annual inflation, whether his career included positions in the financial sector, in the treasury or the cabinet, whether the governor has been affiliated to a political party and his age. Macroeconomic controls as described in the main text. Country fixed effects absorbed by within-estimator. Standard errors clustered on countries in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

ROBUSTNESS I

- Main causal results hold for large variety of robustness set-ups.
- Controlling for policy rate changes during banking crises (hawks associated with tighter rates).
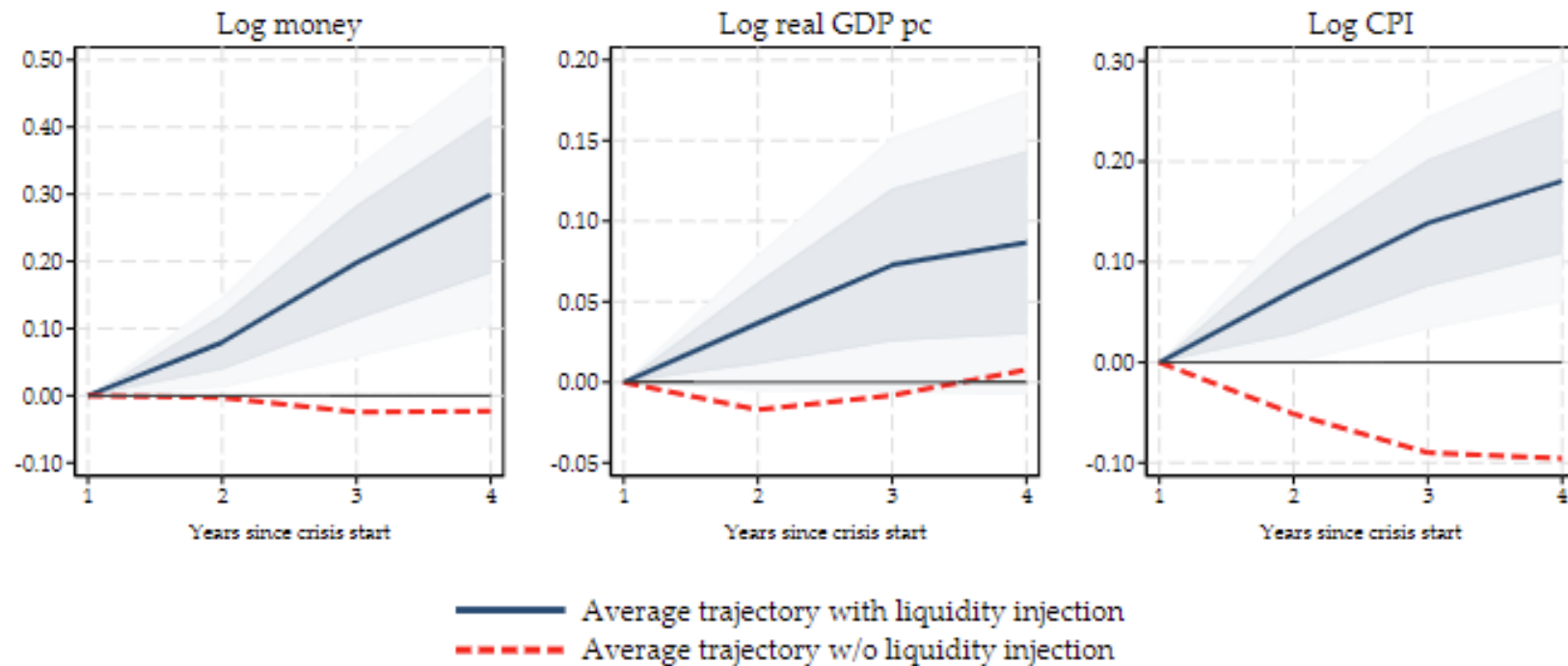

Notes: Baseline controls extended by policy rate changes with the same lag structure as for GDP growth and inflation.
Lightly shaded areas mark 90% confidence intervals; ± one standard error in dark. Country fixed effects included; standard errors clustered on countries.

ROBUSTNESS II

- Main causal results hold for large variety of robustness set-ups.
- Controlling for central bank independence, using CBI index in Garriga (2016), replacing governor with government stance when CBI <.5.

Average trajectory with liquidity injection
Average trajectory w/o liquidity injection
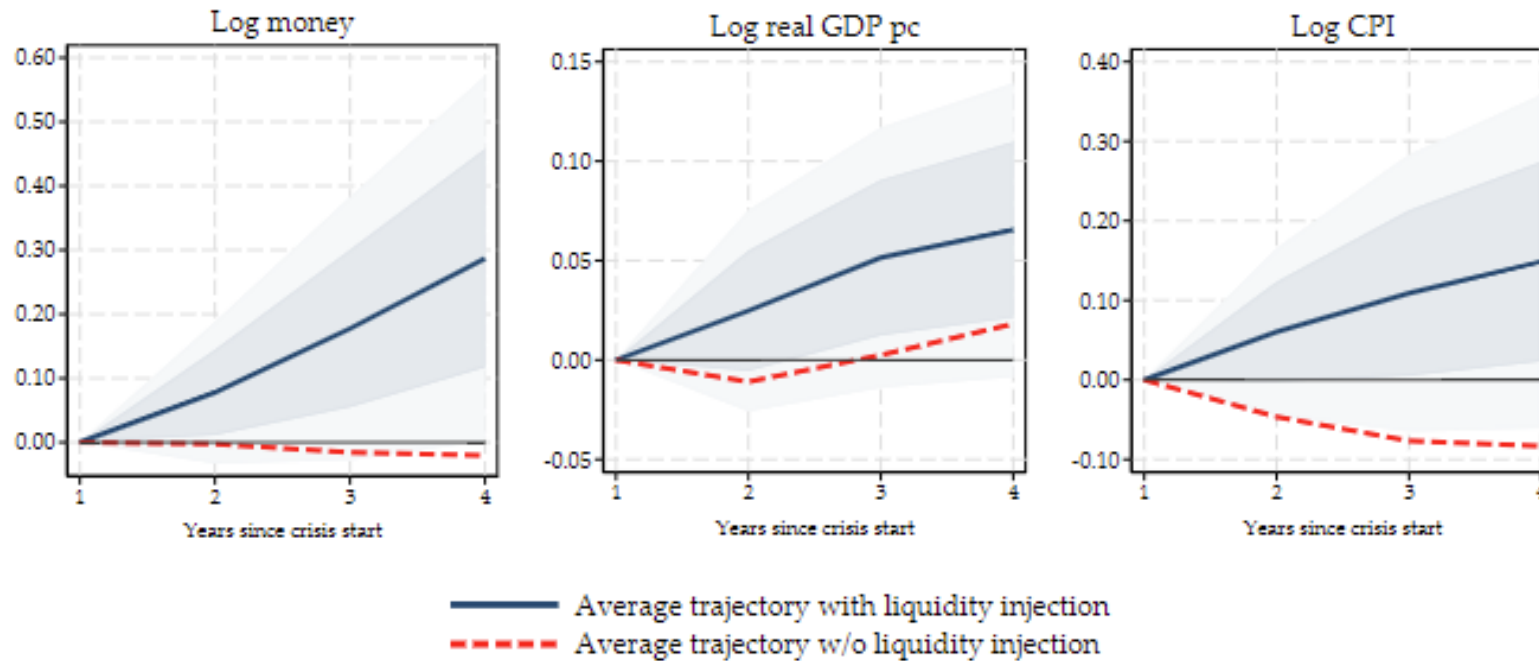
Notes: Replace the governor coding by a coding of government ideology instead for central banks that rank low on indices of central bank independence as measured by Garriga (2016): we impute the government policy stance for all central bank country-years in which the central bank index is recorded as less than 0.5, for our banking crisis years, we count 19 such instances. In these cases, we impute center-right/conservative-led government = hawk ; centrist/center-left/left-led government = dove/pragmatist. Lightly shaded areas mark 90% confidence intervals; ± one standard error in dark. Baseline controls and country fixed effects included; standard errors clustered on counties.

QE versus LLR: Are they different animals?

- Specific implementation of post-2008 BE expansions is deemed unique in some literature, esp. IOER.
- We do not deem the liabilities side of CB sheets to be decisive when assessing overall expansion events.
- Post-2008 implementation continues to center on liquidity and the lending channel regardless of operational details.

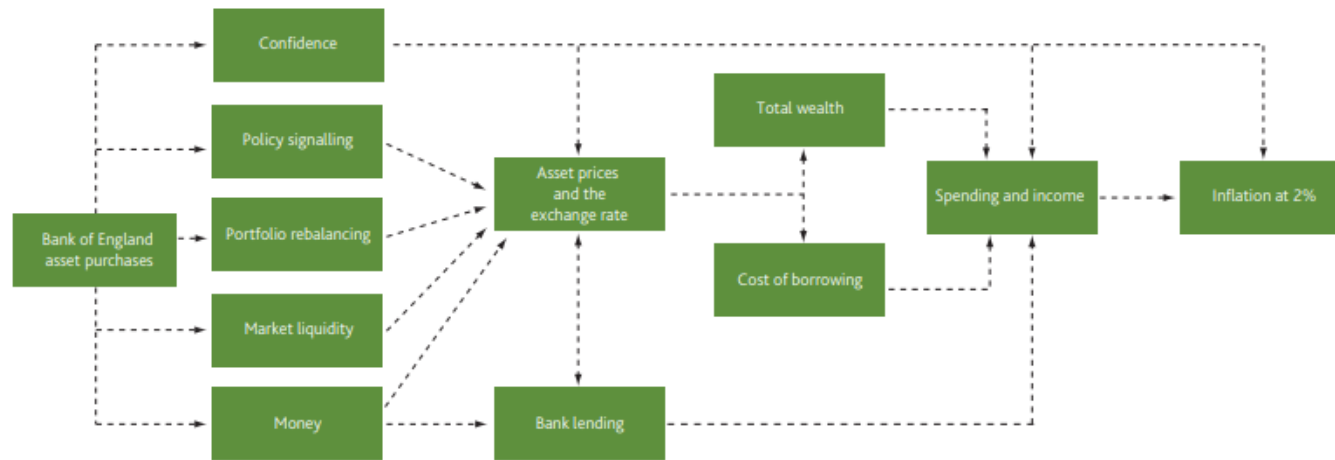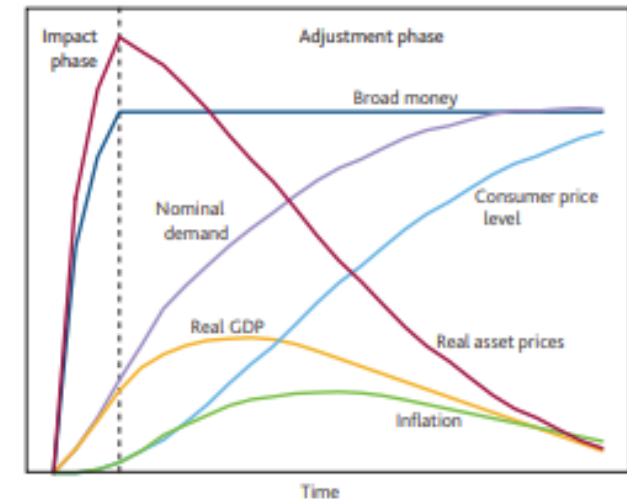### Figure 1 QE transmission channels

Chart 1 The qualitative economic impact of QE

Joyce et al. (2011): "The aim of undertaking asset purchases was the same as a cut in Bank Rate, to stimulate nominal spending and thereby domestically generated inflation, so as to meet the MPC's 2% inflation target in the medium term. (1) As discussed in a previous Quarterly Bulletin article by Benford et al (2009), there are a number of potential channels through which asset purchases might affect spending and inflation. (2) Purchases of financial assets financed by central bank money should initially increase broad money holdings, push up asset prices and stimulate expenditure by lowering borrowing costs and increasing wealth. Asset purchases may also have a stimulatory impact through their broader effects on expectations and by influencing bank lending, though this channel would not be expected to be material during times of financial crisis. These channels are considered in more detail below with Figure 1 providing a simple pictorial representation."