



Rise of the central bank digital currencies: drivers, approaches, and technologies

Raphael Auer, Giulio Cornelli and Jon Frost*

AEA session on advances in global cryptocurrencies and central bank digital currencies, 8 January 2022

*The views are those of the authors and not necessarily the Bank for International Settlements

The rise of CBDC: drivers, approaches, and technologies

- Global interest in CBDCs is mounting
- But substantial heterogeneity across countries
 - some central banks are looking into CBDC development, others see no need
 - among those researching and developing CBDCs, both approaches and designs differ
- **In this paper, we:**
 - **construct a database of CBDC projects, speeches and search interest***
 - **discuss how and why central banks' approaches and technologies differ**
 - **assess the economic and institutional factors behind these differences**

*see <https://www.bis.org/publ/work880.htm>, updated as of October 2021.

Our findings in a nutshell

- Central banks' speech stance toward CBDCs has turned more positive in the past two years, ever more are embarking on projects and three central banks have issued live retail CBDCs
- CBDC projects are more likely:
 - in countries with higher mobile use and innovation capacity
 - (for retail CBDCs) where the informal economy is larger
- Heterogeneity in approaches and designs across countries (architecture, infrastructure, access, interlinkages of retail CBDC projects)
- Common elements: central banks generally see CBDCs as a complement to cash, and many are exploring designs where the private sector handles all customer-facing activity
- Growing discussion on the role of CBDCs in cross-border payments

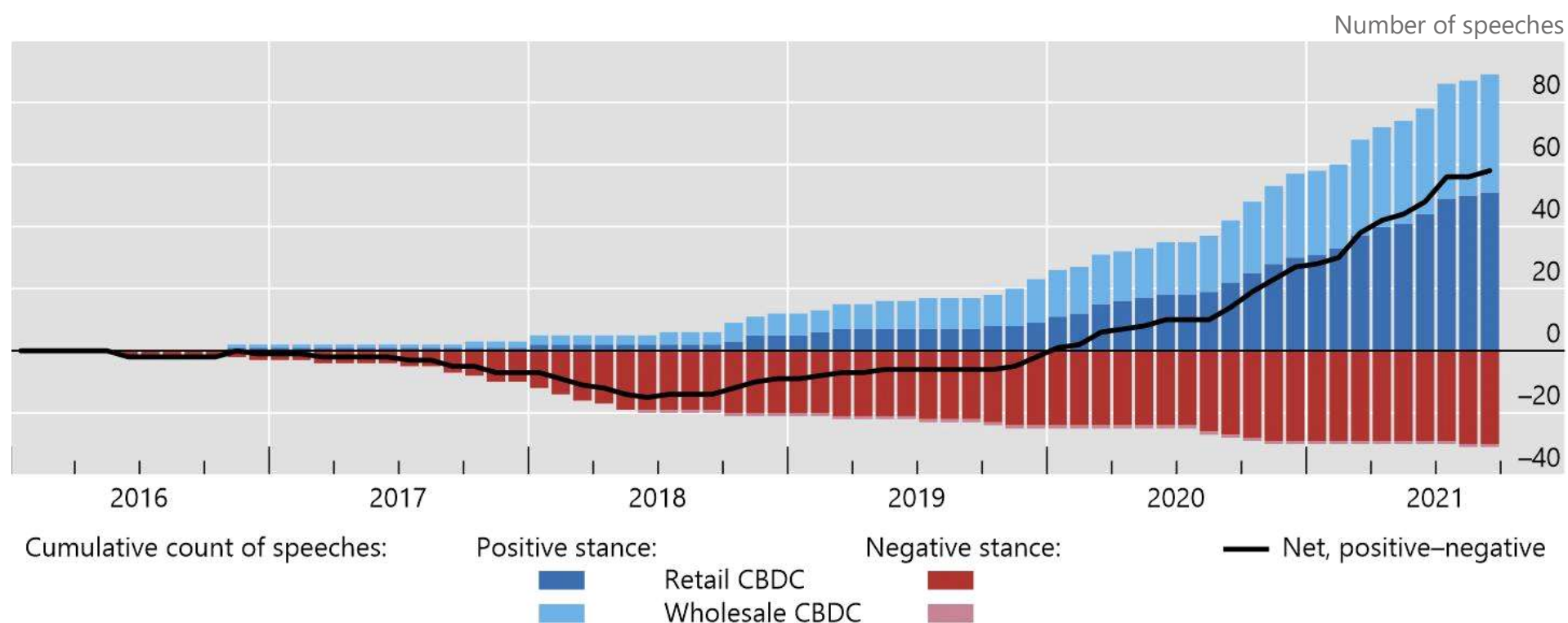


I. A new database on CBDCs

Three sources of information on CBDCs by country

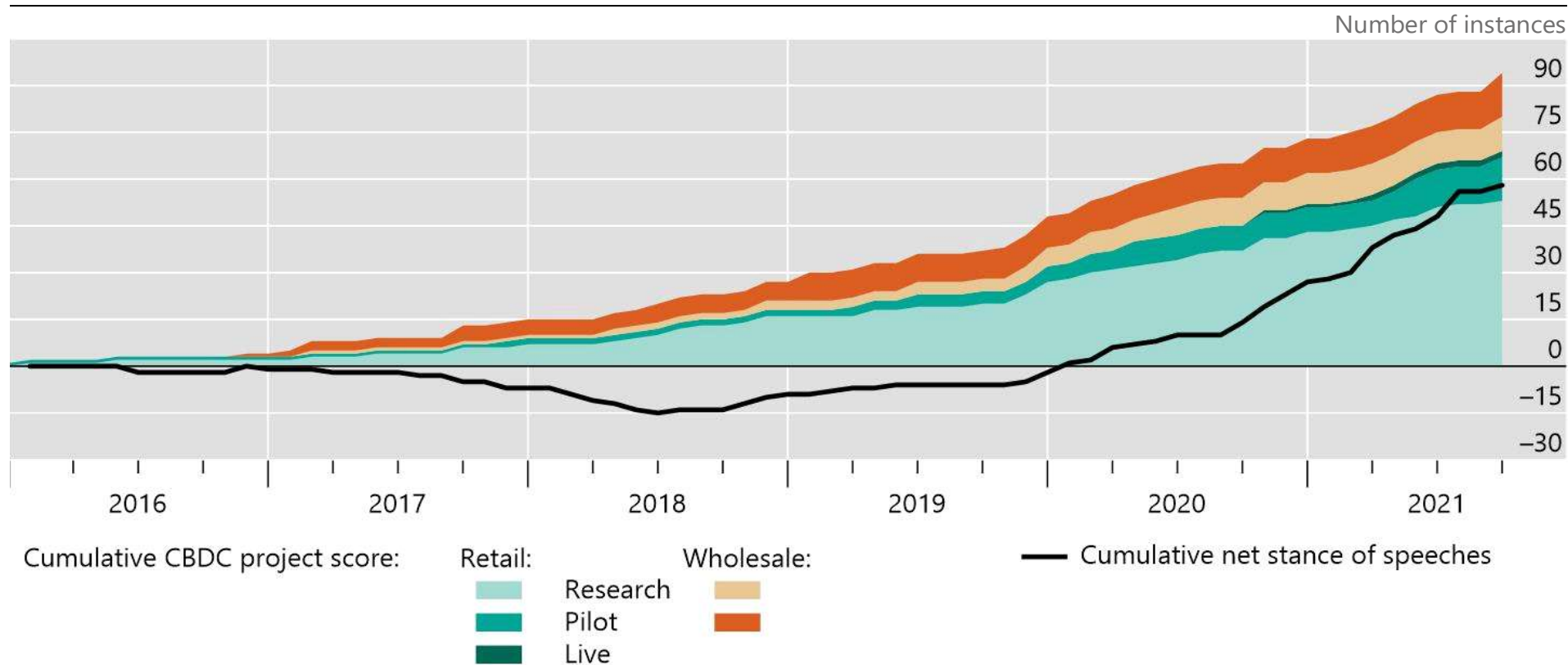
- Projects and design approaches (cross-section)
 - Reports by central banks on retail and wholesale CBDC research and pilots
 - Only official reports, not rumours
 - (For retail) technical characteristics: architecture, infrastructure, access, and interlinkages
- Central bank speeches (2013-2021)
 - Universe of BIS speeches
 - Search for keywords related to CBDCs / digital currencies
 - Measure stance – positive or negative
- General search interest, as measured by Google Trends and Baidu Trends (2013-2021)

Speeches on CBDCs have turned more positive since early 2020



Source: R Auer, G Cornelli and J Frost (2020), "Rise of the central bank digital currencies: drivers, approaches and technologies", *BIS working papers*, No 880, August, updated as of October 2021.

A growing number of retail and wholesale CBDC projects



Source: R Auer, G Cornelli and J Frost (2020), "Rise of the central bank digital currencies: drivers, approaches and technologies", *BIS working papers*, No 880, August, updated as of October 2021.

Project phase:

- Live retail CBDC
- Retail pilot ongoing
- Retail pilot completed
- Retail research
- Retail research and wholesale project
- Wholesale project
- N/A

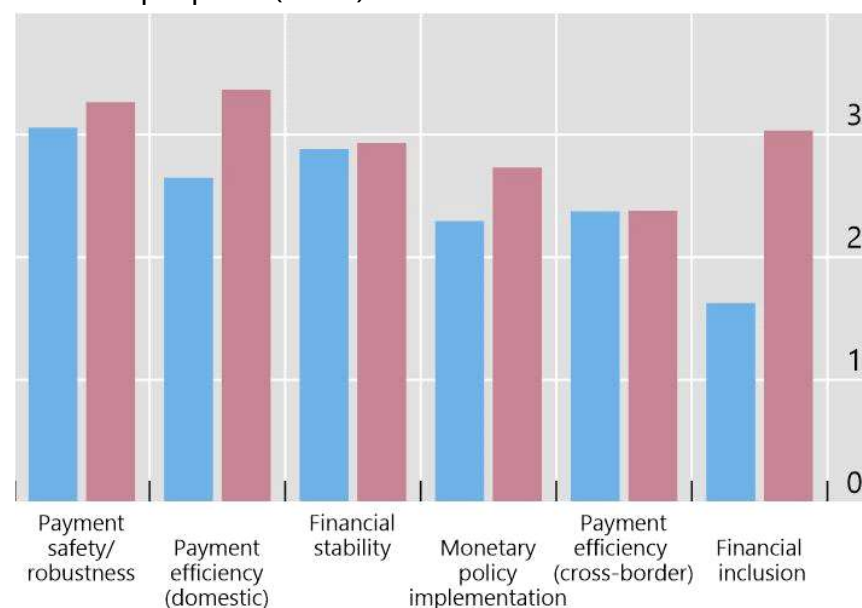
Source: Auer et al (2020), updated as of November 2021.



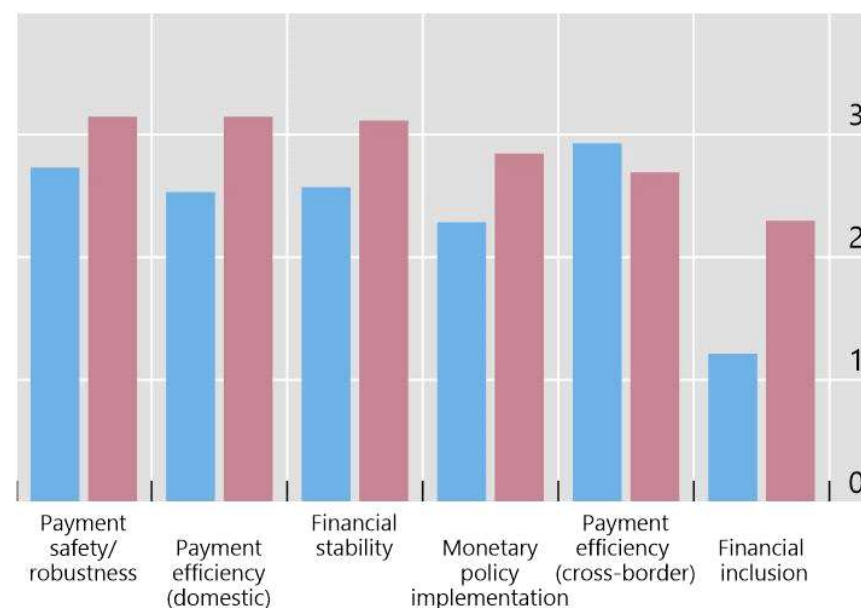
II. The drivers of CBDC projects

Motivations for issuing a CBDC

General purpose (retail) CBDC



Wholesale CBDC



Average importance: ■ AEs ■ EMEs

1 = not so important; 2 = somewhat important; 3 = important; and 4 = very important.

Source: CPMI survey of central banks; Boar et al (2020).

CBDC project index

- To gauge the status of CBDCs, we generate a CBDC project index
- Three breakdowns:
 - **Overall project index:** 0=no announced project, 1=research, 2=pilot, 3=live CBDC
 - **Retail project index:** 0=no announced retail project, 1=research on retail CBDC, 2=retail CBDC pilot, 3=live retail CBDC
 - **Wholesale project index:** 0=no announced retail project, 1=research on wholesale CBDC, 2=wholesale CBDC pilot, 3=live wholesale CBDC
- The overall project scores takes the maximum value of retail and wholesale CBDC projects

Which variables could explain CBDC research and development?

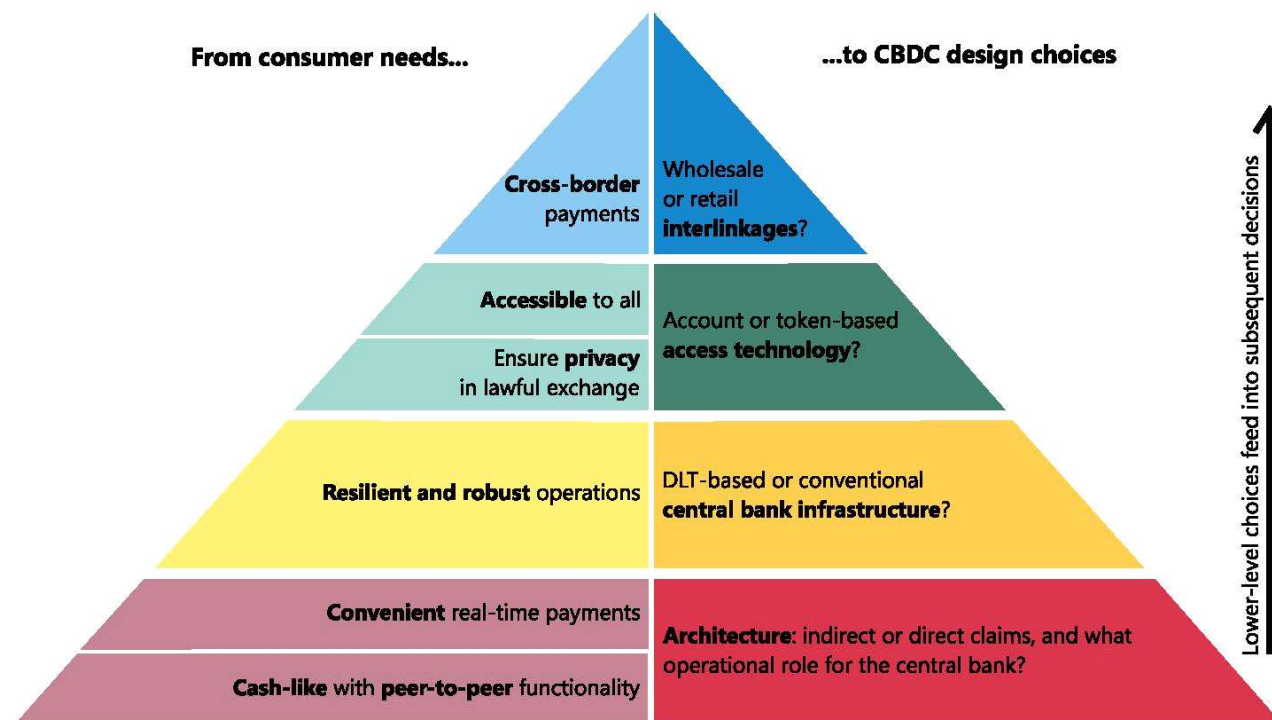
	Observations	Mean	Standard deviation	Min	Max
Dependent variables					
Overall CBDC project index	175	0.31	0.66	0	2
Retail CBDC project index	175	0.22	0.53	0	2
Wholesale CBDC project index	175	0.13	0.48	0	2
Independent variables					
Mobile cellular subscriptions (per 100 people)	169	109.24	39.54	12.60	320.55
Broadband subscriptions (fixed line, per 100 people)	167	13.60	13.38	0	47.16
Innovation output score (WIPO)	118	29.67	12.69	7.90	67.13
Fast payment system dummy	175	0.37	0.48	0	1
Government effectiveness	175	0.08	0.99	-2.24	2.19
Informal economy (% of GDP)	122	26.08	11.62	5.43	55.78
GDP per capita (USD)	168	16,652	21,423	301	110,344
Account ownership (% age 15+)	135	60.39	27.96	6.45	99.96
Financial development index ²	158	0.36	0.22	0.06	0.93
Search interest index (Google/Baidu) ³	175	0.11	1.13	-0.34	8.18
Remittances ⁴ to GDP	110	5.89	7.86	0.19	41.18
Trade openness ⁵	134	80.05	48.87	0	345.69
Central bankers' speech stance index ⁷	175	0.02	0.47	-0.13	1.68

Multivariate ordered probit regressions on CBDC project indices

	Overall CBDC project index		Retail CBDC project index		Wholesale CBDC project index	
Mobile cellular subscriptions (per 100 people)	0.013** (0.005)	0.015*** (0.006)	0.011** (0.005)		0.022** (0.010)	
Innovation output score (WIPO)	0.045*** (0.010)		0.067*** (0.017)	0.082*** (0.019)		
Informal economy (% of GDP)		0.027* (0.015)	0.033* (0.018)	0.042*** (0.016)	-0.009 (0.026)	
Financial development Index ²		3.909*** (0.867)			3.303*** (0.775)	4.287*** (1.299)
Trade openness ³		-0.003 (0.004)		-0.016** (0.007)	0.004* (0.003)	-0.001 (0.004)
Number of observations	118	105	110	100	132	105
Pseudo R ²	0.167	0.241	0.144	0.244	0.263	0.352

III. Comparing technical designs

The CBDC pyramid

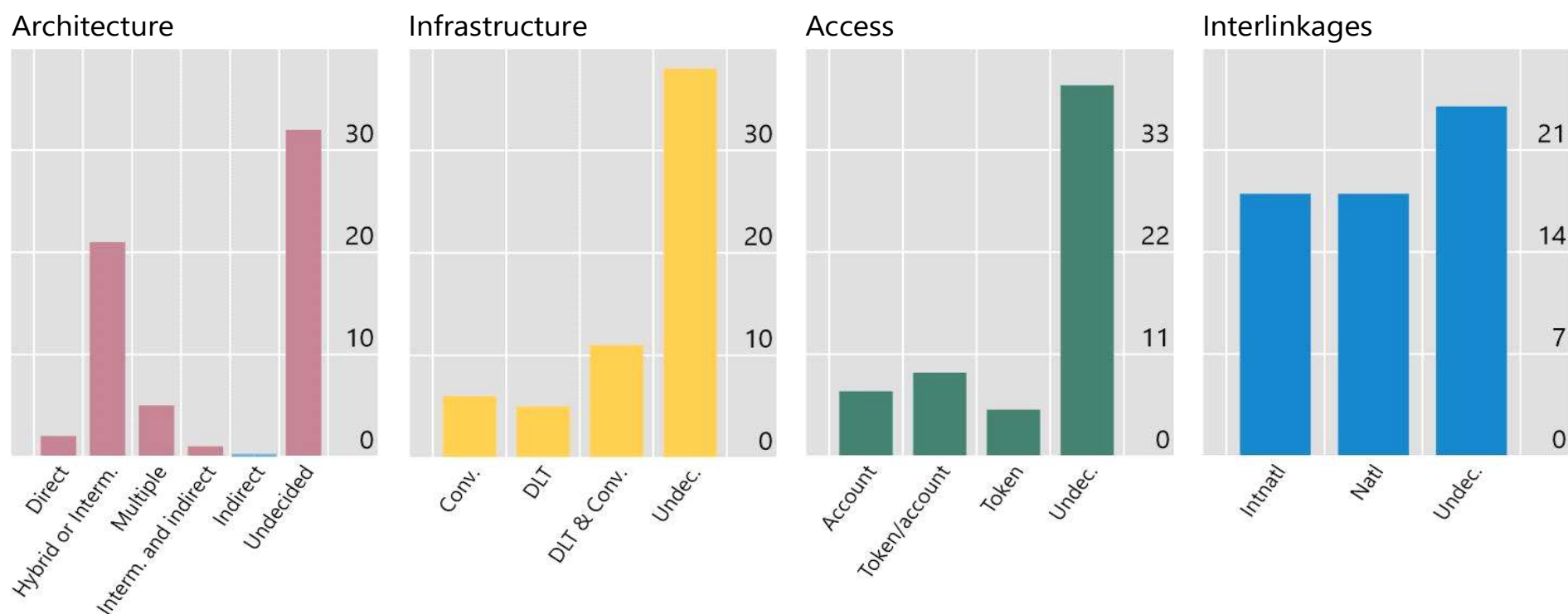


The CBDC pyramid maps consumer needs onto the associated design choices for the central bank. The left-hand side of the CBDC pyramid sets out such consumer needs and associated features that would make a CBDC useful. The pyramid's right-hand side lays out the associated trade-off – forming a hierarchy in which the lower layers represent design choices that feed into subsequent, higher-level decisions.

Source: R Auer and R Boehme (2020), "The technology of retail central bank digital currency", *BIS Quarterly Review*, March, p. 85-100.

Attributes of retail CBDC projects

Number of retail CBDC projects investigating each design option



Source: R Auer, G Cornelli and J Frost (2020), "Rise of the central bank digital currencies: drivers, approaches and technologies", *BIS working papers*, No 880, August.

IV. Conclusion

Conclusion

- Interest in CBDCs is rising, three retail CBDCs are live, issuance imminent in other countries
- Novel CBDC project index and speech, search interest scores provided with the paper as a public good for researchers, policy makers and the general public
- CBDCs more likely in countries with higher mobile use and innovation capacity
- Retail CBDCs more likely where the informal economy is larger, ceteris paribus
- Heterogeneity in approaches and designs across countries (architecture, infrastructure, access, interlinkages)
- Many central banks are considering CBDCs as a direct cash-like claim on the central bank, but where the private sector handles all customer-facing activity
- International use of CBDCs is likely to be a major issue going forward



Thank you