Baltic Central Banks' Invited Lecture Series Lecture 2: Fiscal support and central bank independence

Ricardo Reis
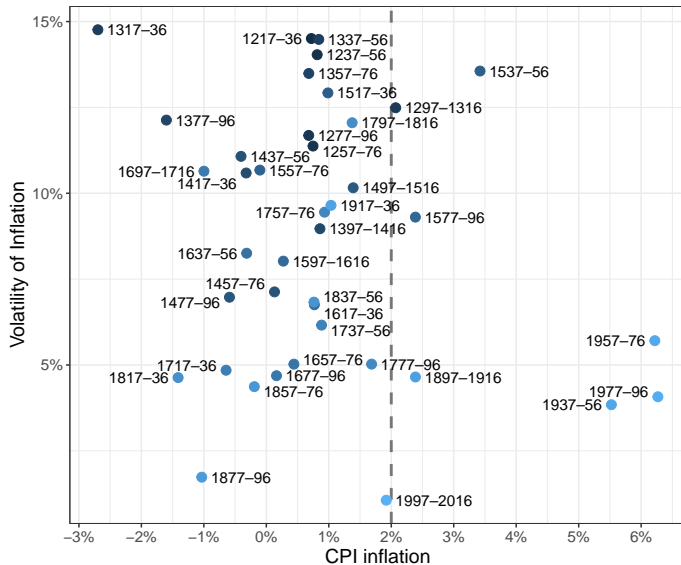
London School of Economics

April 2024

TABLE OF CONTENTS I

UK after Bank of England became independent

QUESTION: HOW DO CENTRAL BANKS CONTROL INFLATION?

1) Inflation control three pillars
   - Inflation targeting central bank, clear goal and mandate
   - Interest rates as the main tool, transparent rules
   - Escape clause based on threats or monetary targets.

2) One missing pillar: central bank independence
   - What does it mean?
   - What happens when it fails
   - Revisit last three years

The central bank in full

CENTRAL BANK PROFIT AND LOSS

- Issue reserves V_t, pay interest $I_t^v = I_t$

- Issue banknotes, collect seignorage S_t^H

- Expenses E_t

- Portfolio of assets with current real value A_t and a risky return $(1 + R_{t+1}^a)$.

- Dividends paid to Treasury D_t

- Total net surplus S_t ends up being:

$$S_t = S_t^H - D_t - E_t + (1 + R_t^a - (1 + I_{t-1})P_{t-1}/P_t)A_{t-1}.$$

CENTRAL BANK BUDGET CONSTRAINT

- The central bank's net worth is the difference between its assets and its liabilities:

$$W_t = A_t - V_t/P_t$$

- The central bank cannot be running a Ponzi scheme, since on the other side are the private agents who would not want to give away their resources for free. Therefore, this net worth must equal the present value of its expected deficits:

$$\left(\frac{(1 + I_{t-1})P_{t-1}}{P_t} \right) W_{t-1} = - \mathbb{E}_t \left(\sum_{j=0}^{\infty} M_{t,t+j} S_{t+j} \right)$$

- Limit version:

$$\lim_{T \to \infty} \mathbb{E}_t \left[M_{t,T} W_T \right] = 0$$

Other side of a transversality condition for the private sector

CENTRAL BANK IN FULL

- Central bank is
    1) Manager of a spreadsheet of payments on reserves
    2) Seller of an infinitely-lived durable good in currency
    3) Borrower and lender from the private sector through its balance sheet.

- Central bank policy tools
    1) choose interest on reserves
    2) choose banknotes supply
    3) choose balance sheet: assets and dividends

- Already saw what happens when choose interest rate or money. Now, discuss balance sheet.

Central bank solvency

ECONOMIC SOLVENCY

- Net debts (or savings) of the central bank must equal the present value of its expected surpluses (or deficits).

$$\left(\frac{(1 + I_{t-1})P_{t-1}}{P_t} \right) W_{t-1} = - \mathbb{E}_t \left(\sum_{j=0}^{\infty} M_{t,t+j} S_{t+j} \right)$$

- These are solvency conditions in the economic sense of the word: solvent if it is not running a Ponzi scheme. Same for government or for a private agent, nothing special about central bank.

- What is an insolvent central bank? Its liabilities would be worthless, so $P_t = \infty$. Happens all the time, we call it hyperinflation.

CB LOSSES AND HYPERINFLATIONS

Table 1. Central Bank Loss Experiences in the 1990s

Country	Year of loss	Loss in millions of national currency	Loss as a percentage of prior year central bank net worth	Loss as a percentage of central government expenditures	Loss covered by
Brazil	1997	1,875 (real)	52	1.5	Government
Chile	1997	756,560 (peso)	570	11.3	Central bank
Czech Republic	1996	8,653 (koruna)	32	1.8	Central bank
Hungary	1996	51,600 (forint)	108	1.8	Government
Korea	1994	73,331 (won)	7	0.1	Central bank
Thailand	1997	67,613 (baht)	147	7.7	Central bank

Sources: Central bank annual reports and Internet sites; IMF, *International Financial Statistics*, various issues.

THE FISCAL THEORY OF THE PRICE LEVEL

- Some simplifying assumptions:
    1) S_t is an exogenous i.i.d. process with mean $\bar{S}$
    2) $I_t^v = X_t^i$ is an exogenous peg

- Re-write the intertemporal BC:

$$\frac{P_t}{P_{t-1}} = \frac{(1 + X_{t-1}^i)W_{t-1}}{S_t + \bar{S}(\sum_{j=1}^{\infty}(1 + R_{t,t+j})^{-1})}$$

- RHS is exogenous. W_{t-1} was set in $t-1$. Unique solution for P_t.

- Choice of X_t^i pins down expected risk-adjusted inflation. News on S_t pin down inflation shocks: larger S_t lower P_t. By controlling its surpluses, can target inflation.

INTUITION

- Economic force:
    1) When the surplus of the central bank falls, fewer real resources are available to back the value of its debt,
    2) Value of debt is therefore lower.
    3) Because reserves are default-free, they have a fixed value in nominal terms, and they are the unit of account
    4) Only way for real value of reserves to fall is for the price level to rise.
    5) The price level adjusts as banks choose to hold more or fewer reserves in response to them becoming a Ponzi scheme.
    6) They do so until the real value of reserves is again in line with the central bank's assets and surpluses

- Control S_t by choosing the composition of the assets it holds (and so the risk in their returns), or more directly by varying its expenses, or the dividends it pays out.

Fed starts to 'lose' money

The Fed could face rising losses as it raises interest rates, forcing it to pay out more in interest to the financial institutions that deposit funds at the U.S. central bank. It began reporting losses last month.

— Earnings remittances due to Treasury
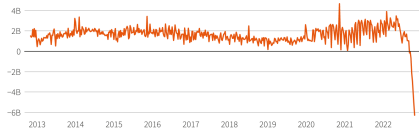
Note:
Source: U.S. Federal Reserve

Table 1. Assessing the Cost to Taxpayers of the Federal Reserve's Balance Sheet Policies			
CATEGORY	**SECURITY PURCHASE DATES**	**CHANGE IN MARKET VALUATION, DEC. 2021 TO SEPT. 2022 (BILLIONS OF DOLLARS)**	**PROJECTED IMPACT ON NET INTEREST INCOME, 2023 TO 2032 (BILLIONS OF DOLLARS)**
Prepandemic portfolio	Before Mar. 18, 2020	−341	−217
QE4	Mar. 18, 2020, to Sept. 2022	−736	−762
Market maker of last resort	Mar. 18, 2020, to Apr. 15, 2020	−134	−121
Core purchases	Apr. 16, 2020, to Sept. 28, 2022	−602	−641
Total	**All Dates**	**−1,077**	**−979**

Source: Andrew T. Levin, Brian L. Lu, and William R. Nelson, "Quantifying the Costs and Benefits of Quantitative Easing" (NBER Working Paper No. 30749, National Bureau of Economic Research, Cambridge, MA, December 2022), 33, table 8.

Non-Ricardian policies

POLICY RULES FOR SURPLUSES: NON-RICARDIAN POLICY

- Feedback rule:

$$S_{t+1} = -\phi W_t + X_{t+1}^s$$

  If the real value of reserves rises, or the net worth falls, the central bank may pay less dividends or cut spending to raise its surplus in which case $\phi > 0$.

- Combine this rule with the flow equation one period forward:

$$W_{t+1} = \left[\frac{(1 + I_t)P_t}{P_{t+1}}\right] W_t + S_{t+1}$$

- Multiple by M_{t+1}, and taking expectations as of date t gives a difference equation:

$$\left(1 - \phi(1 + R_t)^{-1}\right) W_t = \mathbb{E}_t(M_{t+1} W_{t+1}) - \mathbb{E}_t(M_{t+1} X_{t+1}^s).$$

THE NON-RICARDIAN CONDITION

- Iterate the difference equation forward. CB solvency gives terminal condition. If the stochastic discount factor converges to the constant β, then converge as long as:

$$\phi < \beta^{-1} - 1$$

- Recalling that $W_t = A_t - V_t/P_t$, by pinning down W_t equal to the present value of future exogenous surpluses, the central bank pins down the price level.

- Non-Ricardian policies. If net worth falls central bank pays <u>more</u> dividends or raises spending to lower its surplus. More accurate: irresponsible policy. Higher reserves must then lead the price level to rise, so that the real value of these reserves falls back into the equilibrium where the central bank remains solvent.

- Ricardian policies: ϕ is larger than $\beta^{-1} - 1$ so the CB's solvency is assured by CB raising its surpluses when net worth falls, no matter what the price level is. Then must control inflation some other way (Taylor rule).

EFFECTIVENESS OF THE FTPL

- Price level is the unique solution to the equation:

$$\frac{(1 + X_{t-1}^i)(V_{t-1} - P_{t-1}A_{t-1})}{P_t} - S_t = \sum_{j=0}^{\infty} \mathbb{E}_t \left[\left(\frac{M_{t,t+1+j}}{1 - \phi \prod_{j'=0}^{j}(1 + R_{t+j'})^{-1}} \right) X_{t+j}^s \right].$$

- Must vary both the interest rate peg X_{t-1}^i and the net income rule for X_{t+j}^s.

- Fluctuations in returns on assets will affect X_{t+j}^s and the central bank would have to adjust expenses to offset these. Insofar as it is hard to do so in real time, then a new source of error comes from the risks in the central bank's balance sheet.

- Central banks avoid risk on their assets.

PROJECTIONS AND REALITY

Remittances to Treasury

Billions of dollars

- **No Purchases in 2013** (solid black)
- **Higher IR No Purchases** (blue dashed)
- **Higher IR $500bn Purchases** (red dotted)
- **Higher IR $1trn Purchases** (long dashed)

Annual
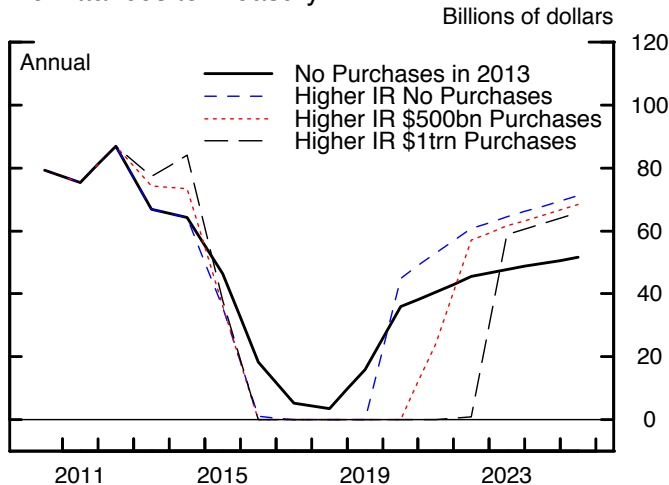
Table 1. Earnings Remittances and Longer-Run Size of the Balance Sheet (billions of $, unless otherwise noted)

	Longer-Run Level of Reserve Balances (billions of $)			
	$100	**$500**	**$1,000**	**$2,300**
Avg. Remittances				
Dollar Values				
2017–2030	66.8	67.2	67.3	63.8
2031–2035	111.8	113.7	115.6	118.2
Per Balance Sheet Dollar*				
2017–2030	2.2	2.0	1.8	1.3
2031–2035	3.1	2.9	2.6	2.0
Std. Dev. Remittances				
Dollar Values				
2017–2030	11.1	11.8	14.4	25.8
2031–2035	21.2	20.6	22.0	33.2
Per Balance Sheet Dollar*				
2017–2030	0.3	0.3	0.4	0.5
2031–2035	0.5	0.4	0.5	0.6
PDV of Remittances**				
Avg.	563.4	558.0	547.8	493.1
Std. Dev.	141.5	141.4	142.6	153.9
Deferred Asset				
Probability of Incurring*	3.9	4.1	4.6	30.8
95th Percentile of Size	0.0	0.0	0.0	30.6
Maximum Realized Spell***	14	14	15	29
5th Percentile of Market	817.0	820.7	826.7	841.6
Value of Assets Less Interest-Bearing Liabilities****				

* Expressed in percent
** PDV: present discounted value
*** Expressed in quarters
**** Minimum across periods

Fiscal interactions and the FTPL

DIVIDEND RULES

- S_t depends on fours terms:
    1) seignorage, but only through a money target, so not solvency
    2) assets returns, but too volatile
    3) expenses, but too small

- Central banks are linked to the Treasury by the dividend process $\{D_t\}_{t=0}^{\infty}$.

- Central bank independence: control over $\{D_t\}_{t=0}^{\infty}$, and through it control over the surplus S_t.

- Letter of law for many central banks, including Maastricht: pay out as a dividend all net income, $S_t = 0$, a Ricardian policy. In this case, inflation is not being pinned down by FTPL, central bank has <u>full fiscal support</u>.

- Other leg of current regime: full fiscal backing so rule out FTPL.

FISCAL DOMINANCE

- What is special about the central bank relative to other private agents? When it does insolvency-inducing things, the price level changes as opposed to actually going insolvent!

- Specialness: its liabilities are the unit of account. It can always honor the payment on reserves nominally by issuing more reserves.

- What may happen: the CB is no longer independent. Treasury imposes a dividend process, controls S_t, and thus determines inflation.

- But need more for Treasury to inherit that specialness

CLASSIC FTPL

- Treasury budget constraint, liabilities B_t, primary surpluses PS_t:

$$\frac{B_{t-1}(1+I_{t-1})}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} M_{t,t+j} PS_{t+j}$$

- Primary surpluses include the dividend of the central bank

- Makes three assumptions:
    1) The government does not default. (Dubious...) B and V are substitutes.
    2) Dividends can take any value, only consolidated budget of government constrains policies.
    3) Treasury chooses surplus, solvency of Treasury controls inflation.

- Fiscal dominance of the Treasury, FTPL applies but it is PS that drive inflation.

POST PANDEMIC FISCAL DOMINANCE?

Public Debt as a percentage of GDP — United States, Advanced economies, Emerging market and developing economies

IMF Forecasts for Public Debt as a percentage of GDP — United States, Advanced economies, Emerging market and developing economies
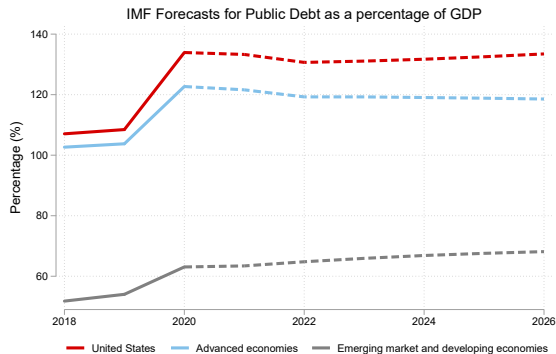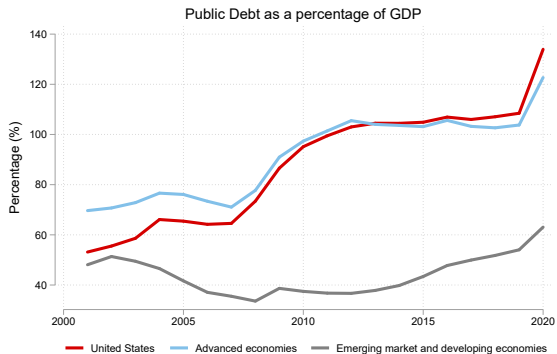
Quantitative easing

LARGE INCREASE IN RESERVES

Size of Fed and ECB's balance sheet
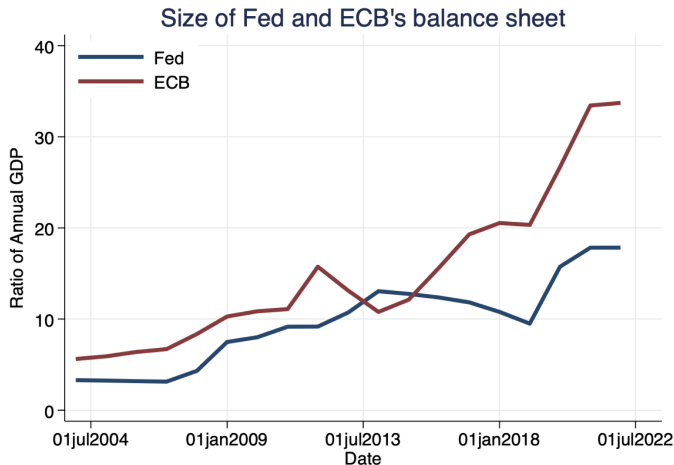
- Open market operations: reserves are infinite maturity, zero duration. A zero-coupon government bill instead has T-month maturity and duration.

- Monetary financing? Use infinite maturity of reserves to fight rollover risk, stop a debt crisis.

RESERVES AND THE PUBLIC DEBT

- Friedman's program for monetary stability argued for primacy of open market operations view that dominates today.

- *Open market operations and debt management are different names for the same monetary tool, wielded in one case by the Federal Reserve system, in the other, by the Treasury.* (Friedman, 1959, page 52)

- Back to the resource constraint, integrated between the two. By itself, issuing reserves does not relax the budget constraint. It changes its composition from a liability of the Treasury (bonds) to a liability of the central bank

$$\frac{(B_{t-1} + \hat{V}_{t-1})(1 + I_{t-1})}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} M_{t,t+j}(PS_{t+j} + S_{t+j})$$

- Should we count reserves as public debt? Yes, but then deduct public debt held by central bank. Approximately nets out.

DURATION OF THE DEBT: BOUGHT LONG

Fed's securities by maturity in %
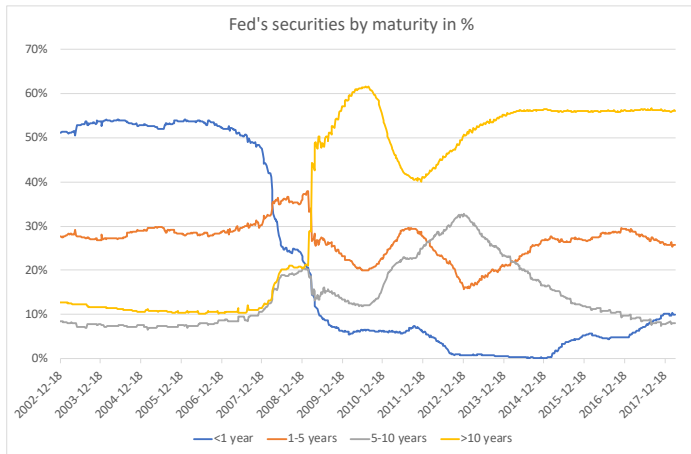
Quantitative easing: purchase of longer-maturity government bonds, raising duration to years. More aggressive form of debt management.

BUT TREASURY RESPONDED

US: Duration of combined privately-held US Treasuries and reserves
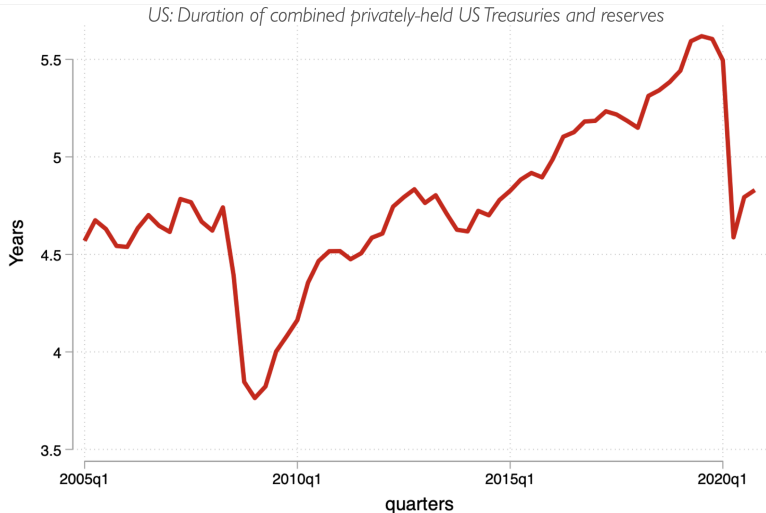
- At first duration shrank

- But Treasury offset it

- 2020 new jump, not time to offset,

- We did not inflate the public debt as much as in past wars.

DEBT MANAGEMENT IMPACT ON SOLVENCY

- Default-free bonds:
    - → Real one-period, amount b_t, price q_t
    - → Nominal one-period bond, amount B_t^1, price Q_t^1
    - → Two-period bond, amount B_t^2, price Q_t^2

- Net income

$$d_t = s_t + r_t n_{t-1} + \left[\frac{1}{Q_{t-1}^1} - (1 + i_{t-1})\right]\frac{Q_{t-1}^1 B_{t-1}^1}{p_t} + \left[\frac{Q_t^1}{Q_{t-1}^2} - (1 + i_{t-1})\right]\frac{Q_{t-1}^2 B_{t-1}^2}{p_t}$$

- Yield curve risk: the last term. Losses in 2022.

RESULT OF WHEN INTEREST RATES HIKED

EA: Simulations of ECB losses from Gros and Shamsfakhr (2022)

Table 1. Expected cumulative losses on PEPP and PSPP holdings (in EUR billion)

	Total holdings	Total loss 2023-2034
Belgium	152.7	26.7
Germany	1062.4	192.7
Spain	513.2	76.9
France	829.5	138.5
Italy	736.6	88.1
Netherlands	212.3	41.2
Supranationals	434.5	75.7
Six countries plus supranational	3941.2	639.8
As % of total Eurosystem	89.4 %	

Source: own calculations based on ECB data. Total holdings as of July 2022. Losses cumulated over 2023-2034. Details available upon request from the authors.

- CB losses are Treasury gains

- Overall, on net not so much of a difference in total.

- Political economy of fiscal support matters

What happened in 2021-23?

HOW WE CONQUERED INFLATION

- Policy rule for interest rates, rely on arbitrage

- Taylor principle with expectations management. Frequent communication and rules-based policymaking.

- Have an escape clause based on a monetary pillar to prevent animal spirits: emphasis on credibility and inflation target overriding.

- Forbid monetizing the deficit and so no imposed seignorage fiscal dominance, and full fiscal backing through dividend rules. Central bank independence

- Deviations in 2021-23

THE SHOCKS OF 2021: EXCESS DEMAND
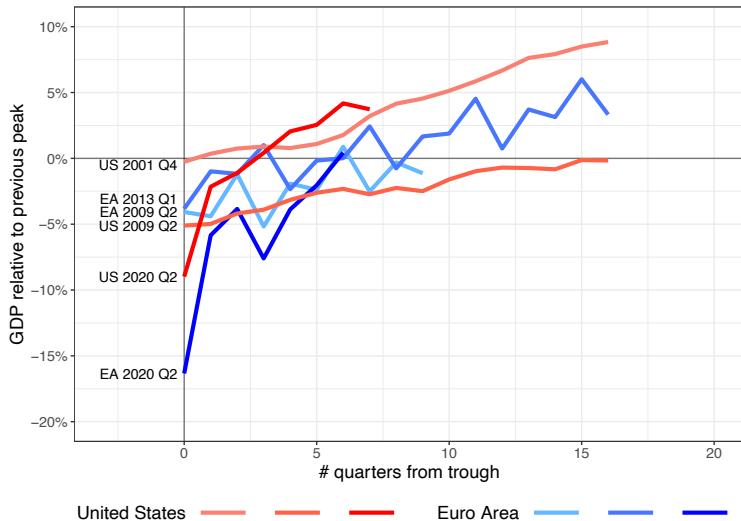
- Phillips curve effect (through output or r)

- Faster recovery than anyone saw coming

- Ex post did not see so much easing in 2000

THE SHOCKS OF 2021: SUPPLY BOTTLENECKS
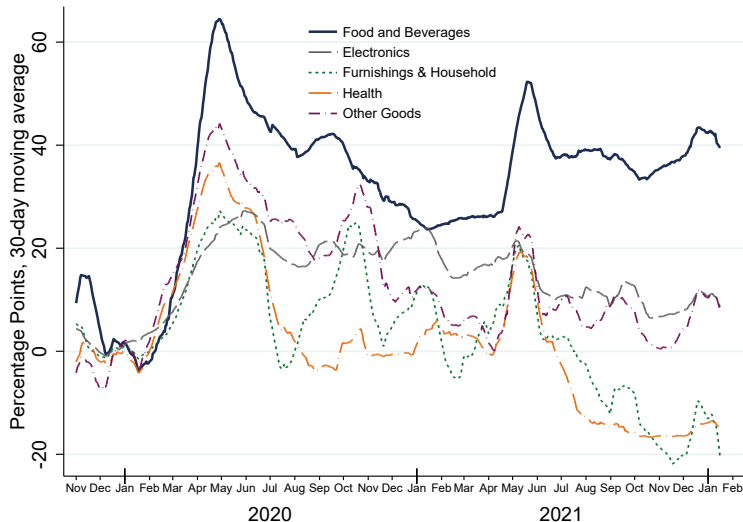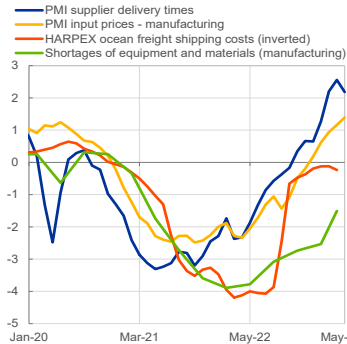
Figure 3: All Stockouts in U.S. Sectors

THE SHOCKS OF 2021: EXPECTATIONS
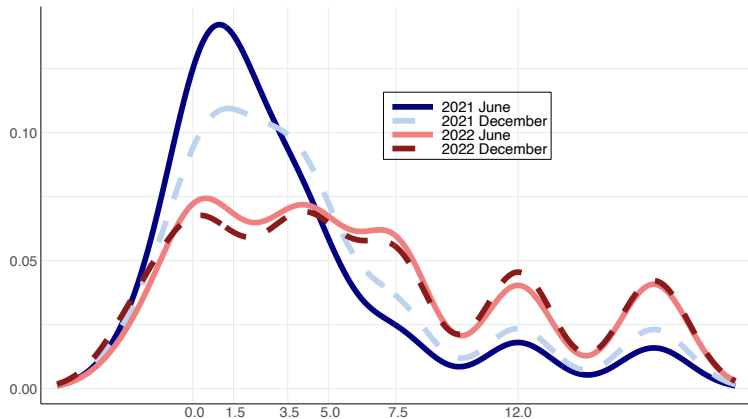
How survey expectations tend to shift:

- First get skewness

- Then get variance

- Then both decline, and the mean has definitely shifted

THE SHOCKS OF 2023: ENERGY

Inflation drivers in February 2022
(annual percentage changes, percentage point contributions)
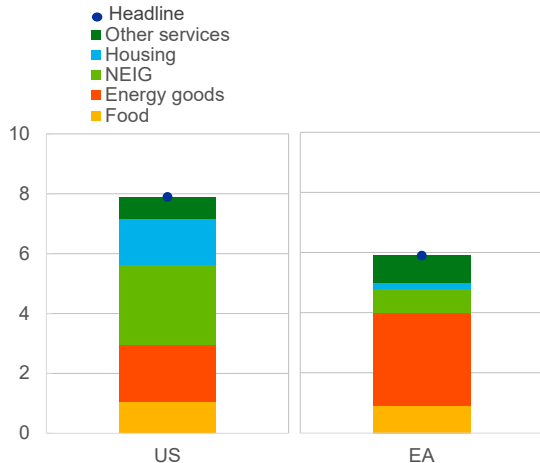
Inflation momentum for HICP and sub
(annual percentage changes; annualised 3-month-on-3-mont
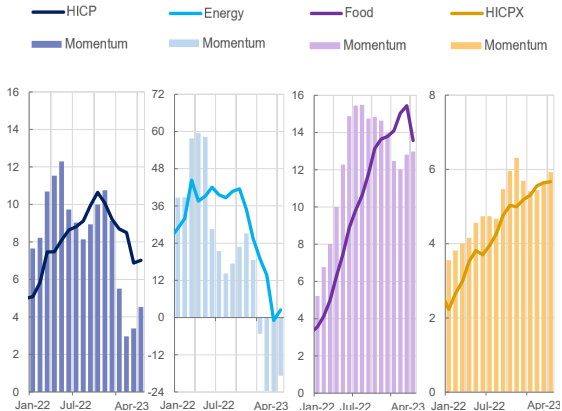
THE POLICIES OF 2021-23: STIMULUS

Figure 1.6. Fiscal Impulse: Advanced Economies
*(Percentage points)*
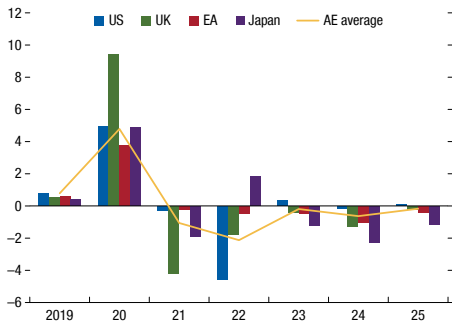
Sources: IMF, World Economic Outlook database; and IMF staff calculations.
Note: The fiscal impulse is calculated as the annual change in the cyclically adjusted primary balance, multiplied by −1. A positive (negative) fiscal impulse implies an expansionary (contractionary) fiscal stance. Advanced economy (AE) averages are weighted by purchasing-power-adjusted nominal GDP in US dollars. EA = euro area; UK = United Kingdom; US = United States.

Unemployment Rate Euro Area
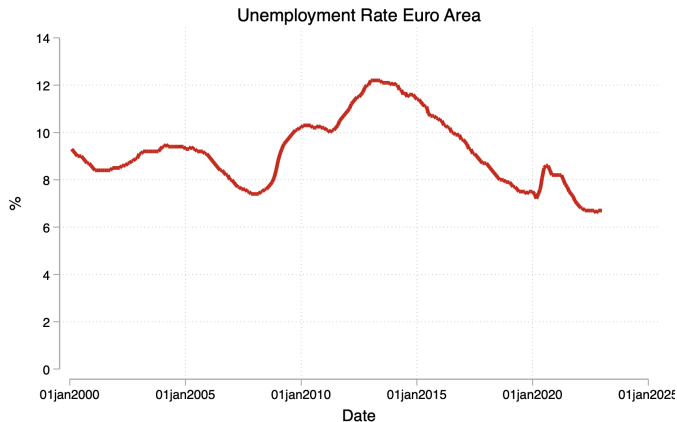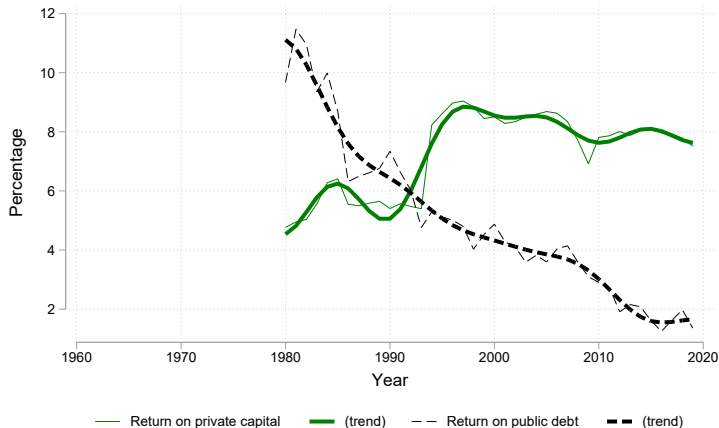
THE POLICIES OF 2021-23: LOOSE MONETARY

Short-term interest rates
(% per annum)
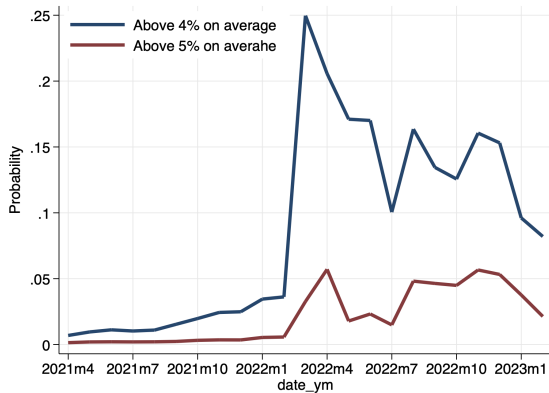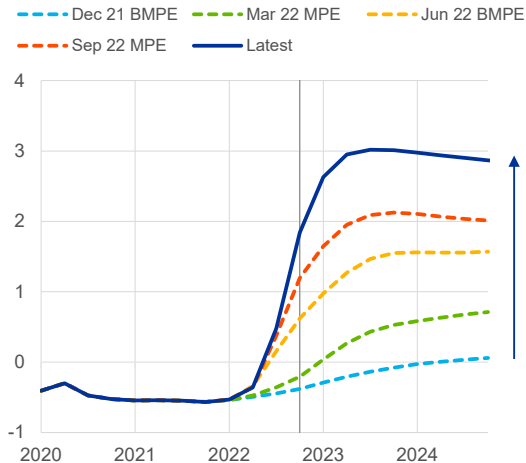
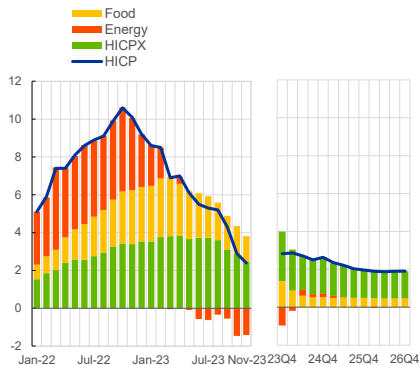# FRAMEWORK PROBLEM: ECB REVIEW

G7

Focus on low r^*, natural or neutral real interest rate

- More likely policy is too tight once hit ZLB

- Deflation trap, insufficient demand, ZLB, commit to be irresponsible

- Focus on aggregate demand

HICP inflation and components
(annual percentage changes, percentage point contributions)

- Tightened monetary policy

- Stabilised expectations by talking tough

- Went through CB losses without losing fiscal support

- Theory worked

Conclusion

CONCLUSION

- Central banks cannot be insolvent in an accounting sense but they have resource constraints (and can be economically insolvent)

- Fiscal support prevents these from driving inflation. Important pillar.

- Fiscal support is being tested right now, as QE created losses. So far holding up

- Pandemic inflation: not a failure of theory, but bad luck and some policy mistakes along the way