Can the central bank alleviate fiscal burdens?

DG ECFIN workshop - Brussels

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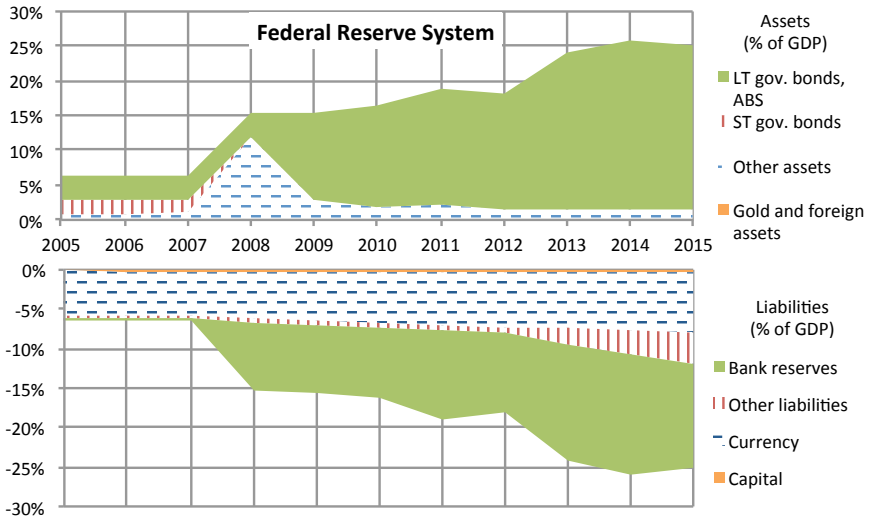
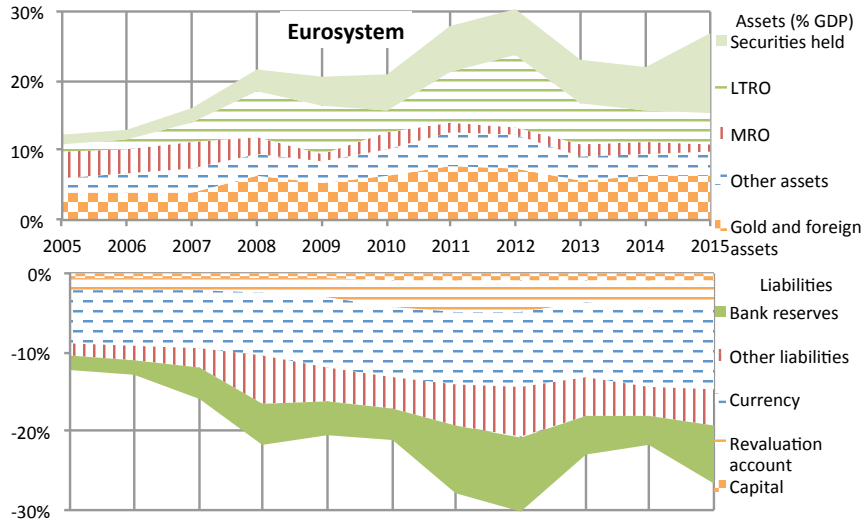
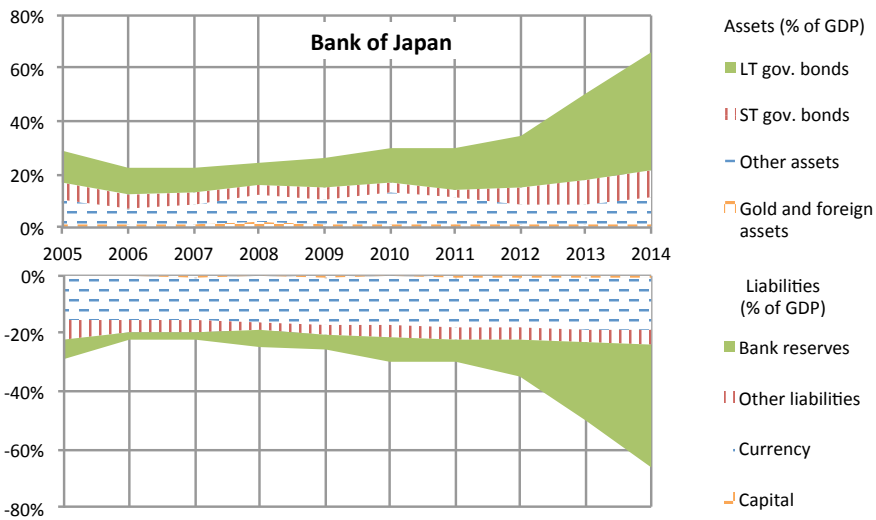
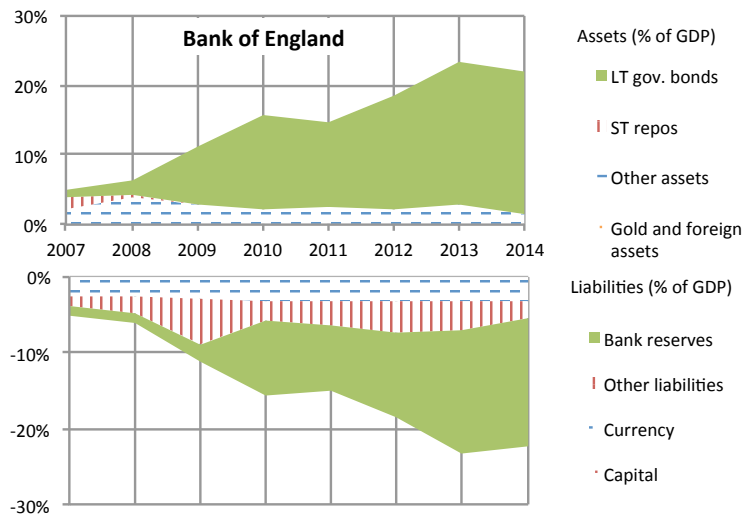
Modern CB: large reserves and long-term assets









Current claims

1. If a country raised its inflation target, it could wipe out the real value of its public debt and alleviate its fiscal burden.

2. A central bank can never go insolvent because there is no bankruptcy procedure for a central bank, and the central bank can print currency to settle any of its debts.

3. A country with its own central bank can never have a sovereign debt crisis because it can print money to pay any bills.

4. In the context of the Eurosystem, the ECB could buy and then forgive the debt of the periphery countries, becoming a vehicle for fiscal transfers within the currency union.

Define the fiscal burden

- The fiscal burden of the government is equal to the commitments that it has to honor to its creditors, bounded by inability to run Ponzi scheme

$$\Phi_t \equiv \frac{\sum_{j=0}^{\infty} Q_t^j B_t^j}{p_t} \leq \mathbb{E}_t \left[\sum_{j=0}^{\infty} m_{t,t+j} (f_{t+j} + d_{t+j}) \right].$$

- Fiscal channels for affecting fiscal burden:
  1. Increase price level, (p_t) inflate away the burden.
  2. Generate revenues, (d_{t+j}) transfer them to government.
  3. Burden may include the liabilities issued by the central bank.
  4. CB takes on risk, may incur losses, negative remittances.
  5. Redistribute burden across regions.

Traditional channels: inflation and seignorage

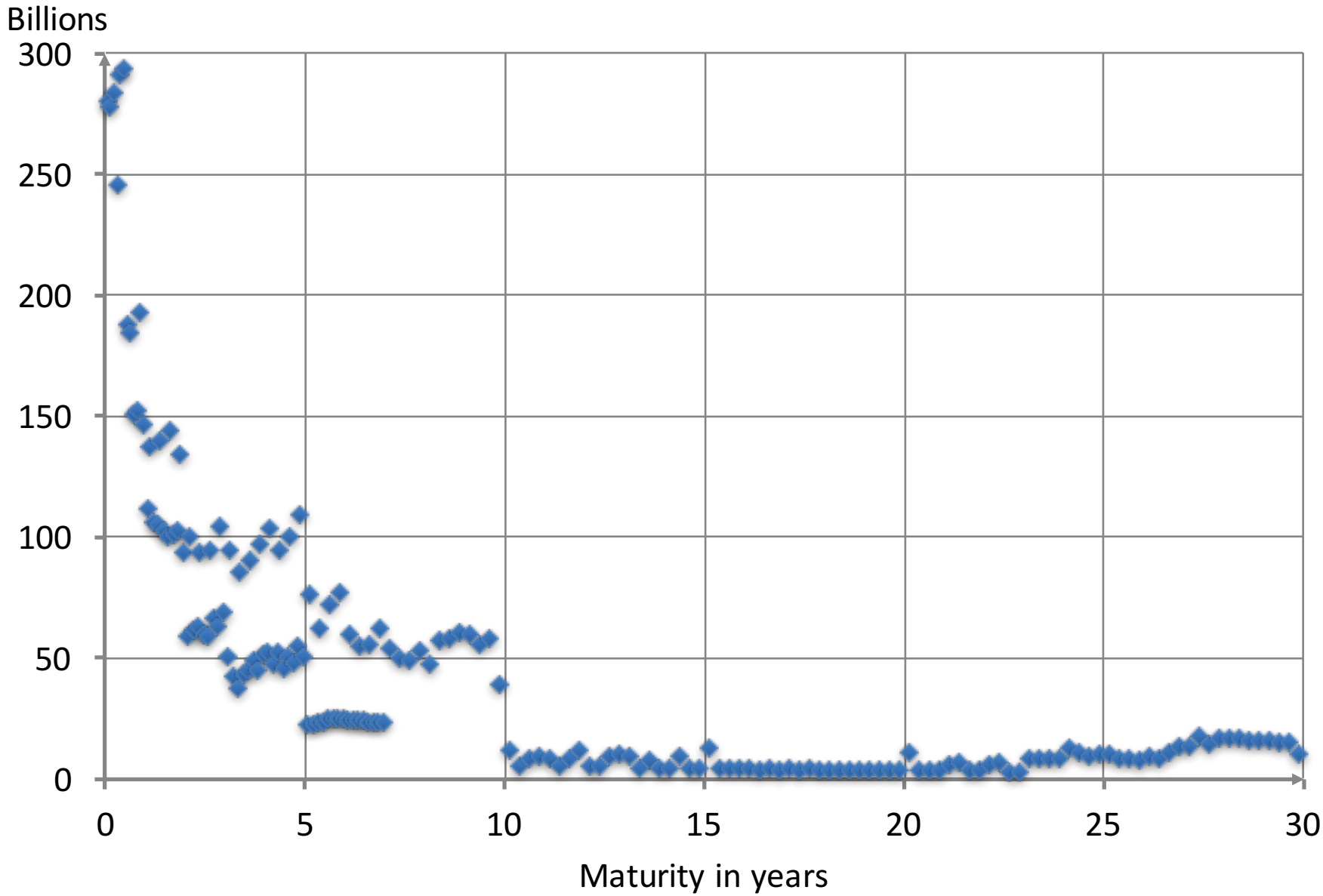
Inflating the debt

- Can rewrite fiscal burden as:

$$\Phi_t = \mathbb{E}_t \left[\sum_{j=0}^{\infty} m_{t,t+j} \left(\frac{B_t^j p_t}{p_t p_{t+j}} \right) \right]$$
$$= \sum_{j=0}^{\infty} (1 + r_{t,t+j}^f)^{-1} \left(\frac{B_t^j}{p_t} \right) \mathbb{E}^Q \left(\frac{1}{\pi_{t,t+j}} \right).$$

- Inflating the debt is about the combination of (i) unexpected, and (ii) sudden inflation interacting with maturity of debt.

U.S. debt


Billions
300
250
200
150
100
50
0
0
5
10
15
20
25
30
Maturity in years

Risk-adjusted probability to inflate debt

	Holders of the debt			
Percentile	*Privately held (48%)*	*Domestic (14%)*	*Foreign (34%)*	*Central Bank (14%)*
90th	2.2%	0.8%	1.4%	1.1%
95th	2.7%	1.0%	1.7%	1.3%
99th	3.7%	1.3%	2.4%	1.7%

Notes: Each cell shows the cutoff in the reduction of the real present value of debt as a share of GDP, so that the risk-adjusted probability of a larger loss (borne by the agent in the column) is equal to one minus the percentile in the row.

Required reserves and banknotes

- If H_t is required reserves plus currency, seignorage:

$$p_t d_t = H_t - H_{t-1}.$$

- No modern central bank chooses currency exogenously. They satisfy *any* demand that there is for this means of payment. Only way to increase seignorage is to change inflation.

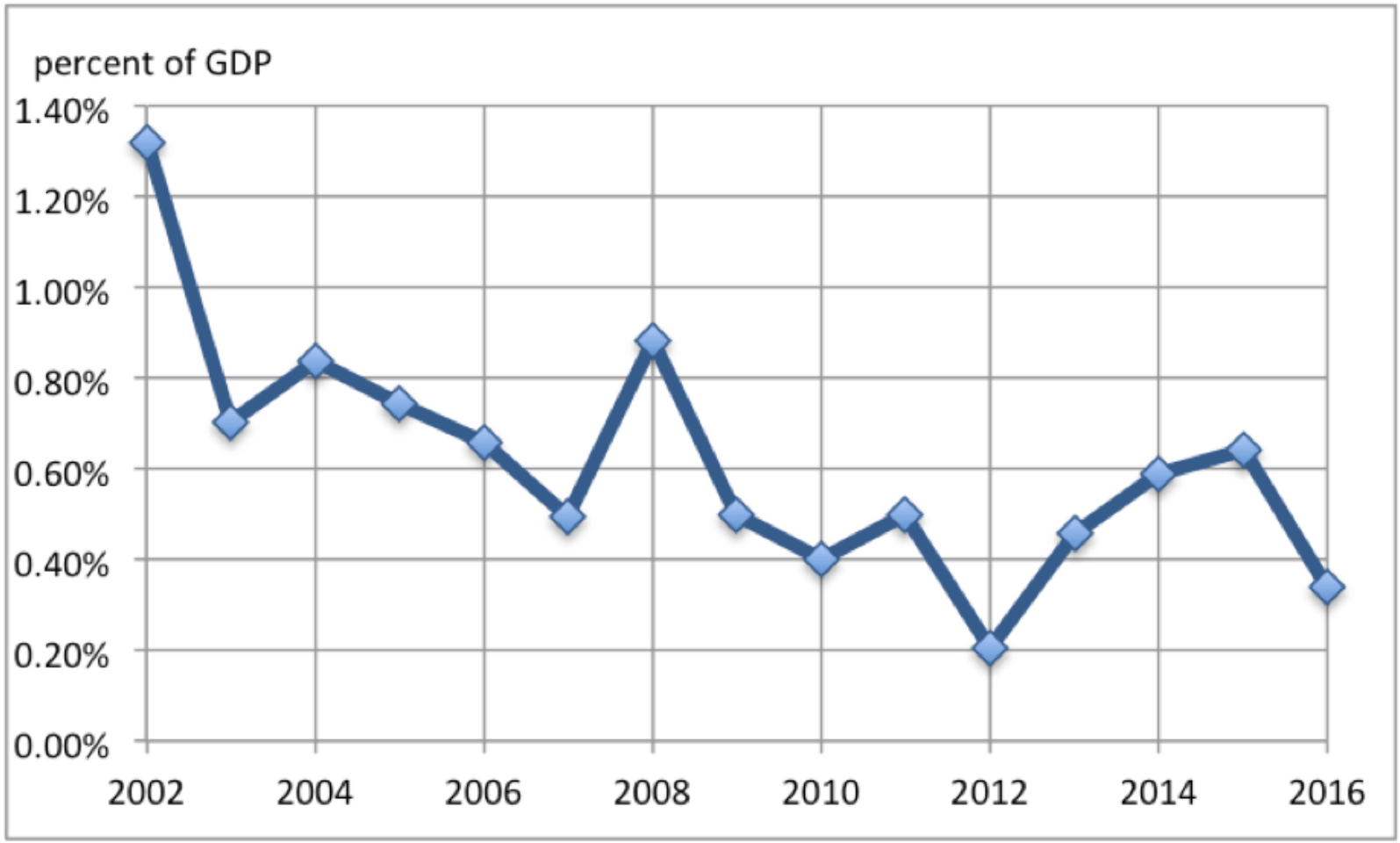
$$\frac{H_t}{p_t y_t} = L(1 + i_t).$$

- Given an exogenous d_t/y_t, equation for inflation:

$$\frac{d_t}{y_t} = L\left(\frac{1}{\mathbb{E}_t\left[\frac{m_{t,t+1}p_t}{p_{t+1}}\right]}\right) - L\left(\frac{1}{\mathbb{E}_{t-1}\left[\frac{m_{t-1,t}p_{t-1}}{p_t}\right]}\right)\left(\frac{y_{t-1}p_{t-1}}{y_t p_t}\right).$$

0.36% of GDP in steady state (0.31% in data).

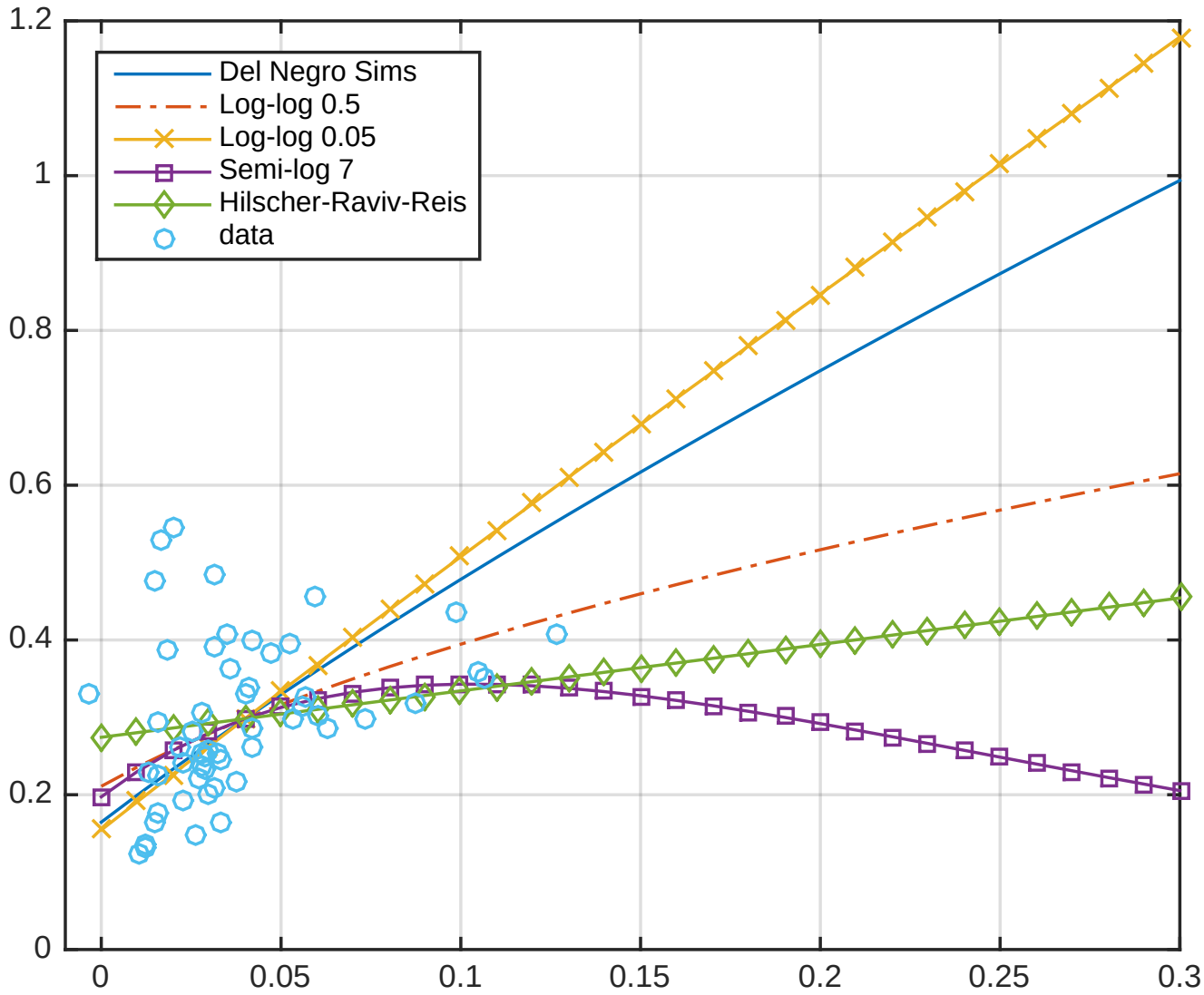
How large is seignorage in Euro-area?



Source: Reis (2017)

How large can it be?

Raising inflation by 10% increases seignorage by 0.17% of GDP.



Source: Reis (2015)

The ECB

- In a fiscal crisis, the maturity of the debt becomes very low, inflating it requires sudden unexpected hyperinflation.
- Seignorage falling all over the world, negative in Sweden, phasing out of 500 euro bill diminished it.
- Maastricht rules out these two traditional channels very explicitly.

Reserves and central bank insolvency

Reserves / deposits at the central bank

- Reserves are:
  - Overnight debt claims held by banks.
  - Issued by central bank, chooses their remuneration.
  - Economy's unit of value, so their real value $1/p$.
  - Default free in nominal terms.
  - Exchange one to one with currency, but no seignorage.
- Simpler case: zero asset. Law of motion:

$$s_t + v_t = (1 + r_t)v_{t-1} + d_t.$$

- Reserves cannot be a Ponzi scheme. Must have a positive real value. Intertemporal resource constraint:

$$\mathbb{E}_t \left(\sum_{j=0}^{\infty} m_{t,t+j} d_{t+j} \right) \leq \mathbb{E}_t \left(\sum_{j=0}^{\infty} m_{t,t+j} s_{t+j} \right) - (1 + r_t) v_{t-1}.$$

Reserves are a public debt

- The joint constraint:

$$(1 + r_t)v_{t-1} + \Phi_t \leq \mathbb{E}_t \left[\sum_{j=0}^{\infty} m_{t,t+j}(f_{t+j} + s_{t+j}) \right].$$

- Reserves are just another government liability, count for the fiscal burden.

- But, also (i) add seignorage to right-hand side, (ii) issuance of reserves often happens to fund the purchase of public debt.

- The ability to issue reserves does not alleviate per se the fiscal burden of the government; it is the present value of seignorage that matters.

Fiscal backing and independence

- Full fiscal backing: only the combined intertemporal resource constraint for the government as a whole is important. Example: Bank of England 2009 indemnity.
- Central bank independendence: a constraint on the sequence of remittance: $\{d_{t+j}\}_{j=0}^{\infty}$.
- Insolvent central bank: Ponzi scheme on reserves, real value 0, $p_t = \infty$. Central bank insolvency = worthless liabilities = hyperinflation = currency reform.
- Accounting and legal misconceptions: nothing to do with net worth, or with insolvency procedure

Happens all the time, experiences in the 1990s

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.

Source: Dalton Dziobek (2005)

The ECB

- Weakest among central banks in terms of fiscal backing.
- Thus, the one that more often talks of recapitalizations, provisions.
- ECB versus eurosystem is important here. Every eurozone central bank must have adequate capital to stay in the euro. Every member has different rules on remittances. In that sense, independence is not uniform across Europe.
- Recent example: Portugal

Income risks

Dividend rules and solvency

- Risk from assets:
  1. Foreign currency, amount z_t, real price e_t
  2. Real loan, amount b_t, price q_t and $\delta_{t+1} \leq 1$ repayment
  3. Default-free nominal bond, amount B_t^1, price Q_t^1
  4. Two-period bond, amount B_t^2, price Q_t^2
  5. Foreign + loans + gov. bonds = reserves + currency + capital

- If net income is negative, charters have limited mechanisms for recapitalization: provisioning, deferred accounts

$$
\begin{aligned}
d_t = {} & s_t - r_t v_{t-1} + (e_t - e_{t-1}) z_{t-1} && \text{currency appreciation} \\
& + (\delta_t - q_{t-1}) b_{t-1} && \text{default on assets} \\
& + \left(\frac{B_{t-1}^1}{p_{t-1}} \right) \left(\frac{p_{t-1}}{p_t} - Q_{t-1}^1 \right) && \text{unexpected inflation} \\
& + \left(\frac{B_{t-1}^2}{p_{t-1}} \right) \left(\frac{Q_t^1 p_{t-1}}{p_t} - Q_{t-1}^2 \right) && \text{steeper yield curve}
\end{aligned}
$$

Fully safe central bank

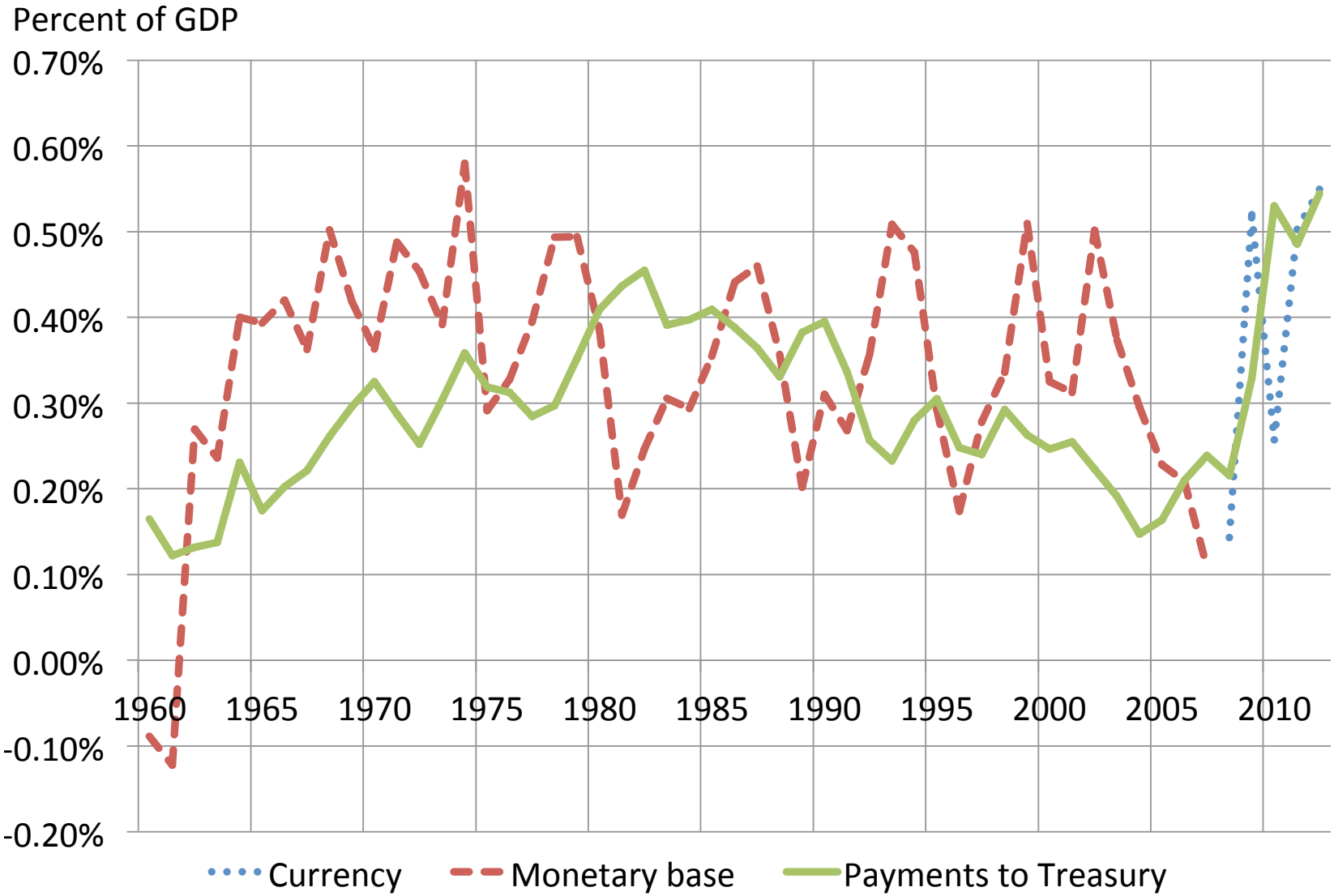
Only short-term government bonds:

$$d_t = s_t + r_t n_{t-1} + \left[\frac{1}{Q^1_{t-1}} - (1 + i_{t-1}) \right] \frac{Q^1_{t-1} B^1_{t-1}}{p_t}$$

Very very safe

- Return on net worth buffers any shocks to seignorage
- If zero interest on reserves, $i_t = 0$ since market nominal rates non-negative ($Q^1_{t-1} < 1$) then always make profits on assets
- If satiate market for reserves, then exactly matched assets and liabilities $1 = Q^1_{t-1}(1 + i_{t-1})$, size of balance sheet B^1_{t-1} can be as large as you want.
- If minor duration (up to 1 year bonds) earn term premium

Federal Reserve dividends and seignorage



Source: Reis (2015)

"Treasuries only"

Only government bonds, some maturity transformation:

$$
\begin{aligned}
d_t = {} & s_t + r_t n_{t-1} \\
& + \left[\frac{1}{Q^1_{t-1}} - (1 + i_{t-1}) \right] \frac{Q^1_{t-1} B^1_{t-1}}{p_t} \\
& + \left[\frac{Q^1_t}{Q^2_{t-1}} - (1 + i_{t-1}) \right] \frac{Q^2_{t-1} B^2_{t-1}}{p_t}
\end{aligned}
$$

Main risk is yield curve:

- Central bank of course controls it
- Temptation to hold off raising rates too fast not to suffer large losses
- Inflation scares working through yield curve

Yield curve risk

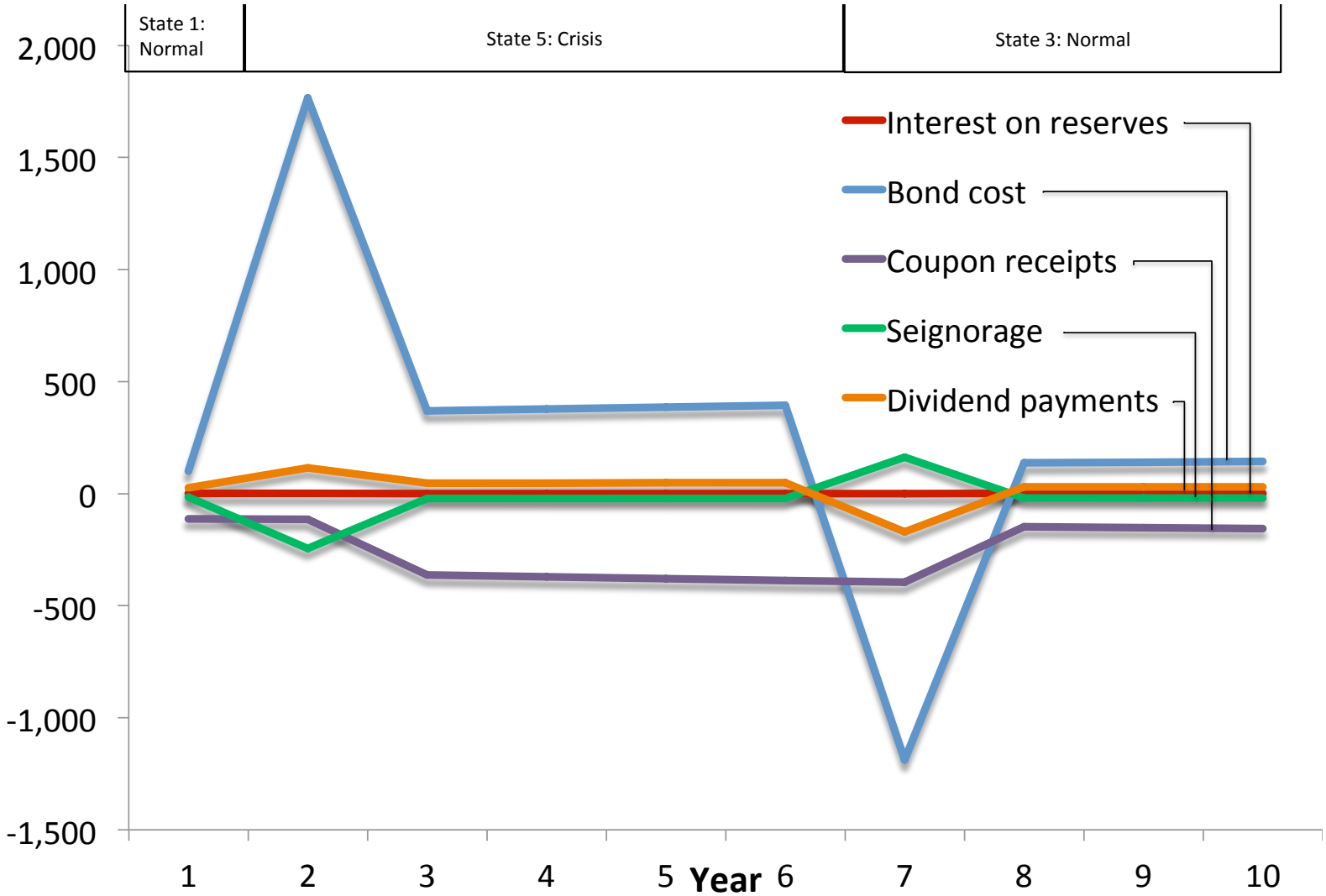
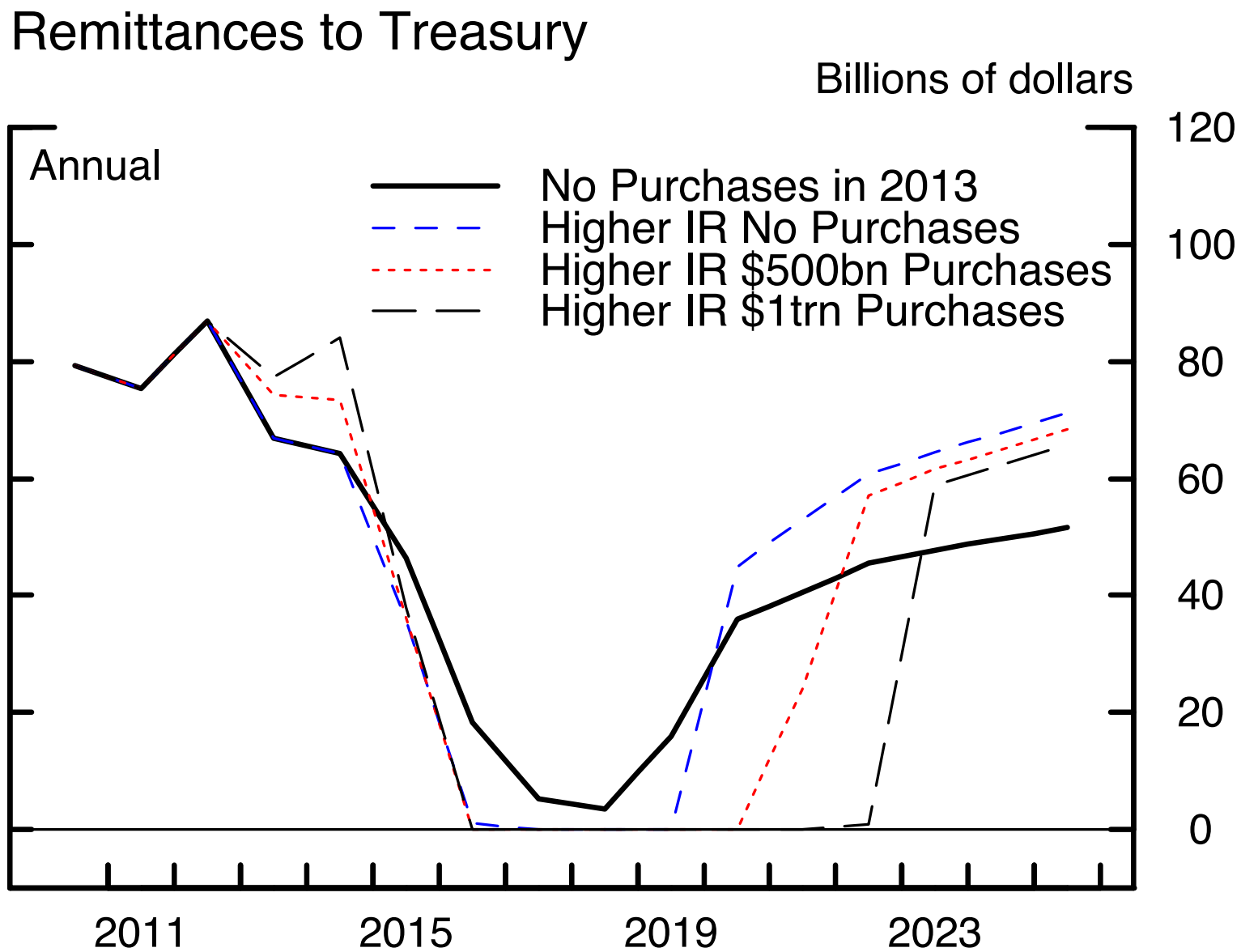


Figure 4: Flows Into and Out of Reserves

Source: Hall and Reis (2013)

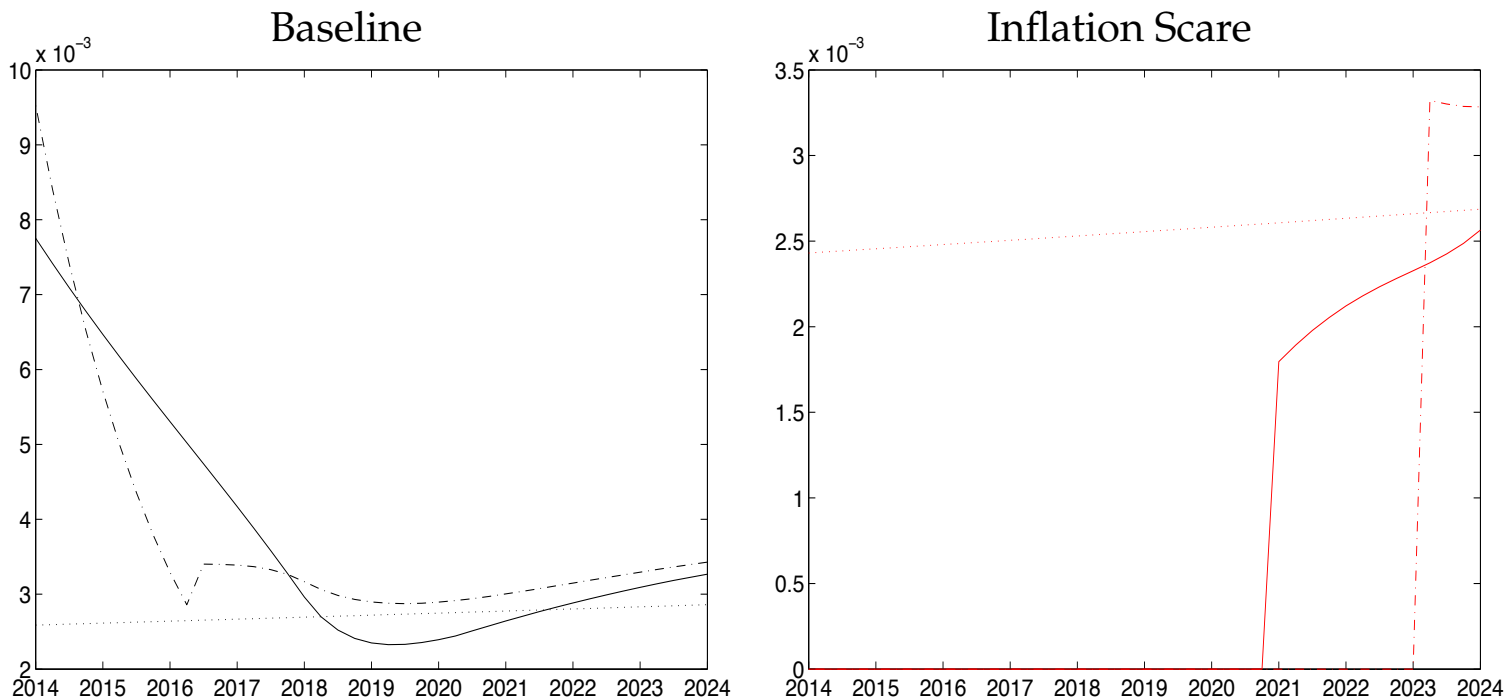
Yield curve risk



Source: Carpenter et al (2016)

Inflation risk

FIGURE 4. Paths for remittances



Notes: Each panel shows remittances under two assumptions for the path of assets B^C: under the first assumption (solid line) the central bank lets its assets depreciate, while in the second one it actively sells assets at a rate of 20 percent per year. The paths in the left and right panels are obtained under the baseline and "inflation scare" scenario, respectively.

Source: Del Negro and Sims (2015)

Small open economies

Large "foreign reserves" to defend pegs

$$d_t = s_t + r_t n_{t-1} + \left[\frac{e_t}{e_{t-1}} - (1 + r_t) \right] e_{t-1} z_{t-1}$$

Path to losses:

- Market expects float, central bank holds off, exchange rate depreciates less than expected, losses accumulate, z_t large
- When it lets the peg go, z_t is small, so the gains are modest.
- Ironically, the more it held off, the larger the losses.
- In many countries, foreign currency is held at the central bank by the government, so automatically fiscally backed.

Pegs: asian crisis

Table 2
Central banks' losses in a group of Asian countries (in local currencies)

Years	Thailand bill. baht	S. Korea bill. won	Sri Lanka bill. rupee	Indonesia bill. rupiah	Nepal bill. rupee	Philippine bill. peso
1997	–67.6	1825.2	..	..	..	..
1998	–24.9	1661.9	..	..	..	..
1999	–13.2	3180.3	..	..	..	..
2000	–52.9	1483.4	..	..	..	..
2001	–8.6	4214.3	13.4	..	..	..
2002	11.9	2936.8	16.0	2.9	..	..
2003	5.0	2175.0	10.8	–7.2	–0.1	6.6
2004	20.8	–150.2	25.7	0.7	3.0	6.2
2005	–1.7	–1877.6	–6.3	16.2	–2.5	4.1
2006	–102.3	–1759.7	27.9	–6.9	11.6	3.8
2007	–10.5	–444.7	28.9	–1.4	–7.5	–62.5
2008	30.6	3402.9	–5.1	17.3	15.7	12.6
2009	..	..	..	..	..	10.3

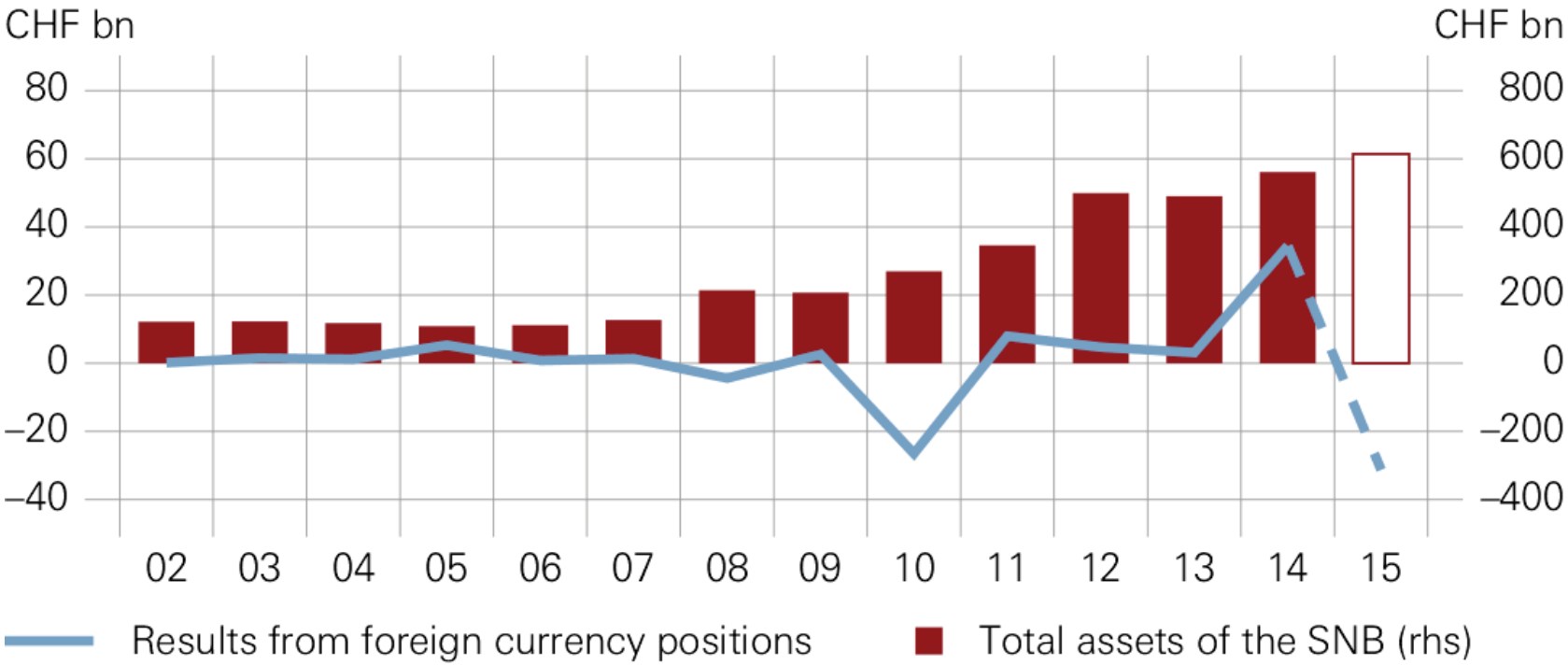
Note: Negative sign indicates a loss.
Source: Central banks' annual reports.

Source: Sweidan (2011)

SNB February 2015

TOTAL ASSETS AND RESULTS OF THE SNB

Values for 2015 are provisional and include only the first three quarters



Source: SNB

Source: SNB

In developing countries

Central banks make loans, take on risk, support some industries as part of industrial policy

$$d_t = s_t + r_t n_{t-1} + \left[\frac{\delta_t}{q_{t-1}} - (1 + r_t) \right] q_{t-1} b_{t-1}$$

Make losses frequently.

Private asset losses

Table 3
Reasons for central banks' losses of different countries

	Country	Reasons of losses	Years
1	Brazil	1. Interest differentials between domestic liabilities (including securities issued by the CB for monetary policy purposes) and foreign assets.	1997
2	Chile	1. Interest rate differential between domestic liabilities (including securities issued by the CB) and foreign assets in sterilization operations. 2. Recapitalize the banking system.	1997
3	Czech Republic	1. Interest rate differential between domestic liabilities (including securities issued by the CB) and foreign assets in sterilization operations.	1996
4	Hungary	1. Operations to sterilize the effects of foreign currency inflows. 2. Foreign borrowing with foreign exchange fluctuations.	1996
5	S. Korea	1. Open market operations (Negative interest margins between central bank's securities issued and counterpart foreign currency assets).	2004–2007
6	Thailand	1. Interest differentials between domestic liabilities (including securities issued by the CB for monetary policy purposes) and foreign assets. 2. Interest payments on loans from international financial institutions. 3. Foreign exchange rate fluctuations	(1997–2007)
7	Philippines	1. Interest differentials between domestic liabilities (including securities issued by the CB for monetary policy purposes) and foreign assets. 2. Foreign exchange rate fluctuations.	2007
8	Sri Lanka	1. Foreign exchange revaluation	(2005–2008)
9	Nepal	1. Foreign exchange revaluation	(2005–2007)
10	Indonesia	1. Interest differentials between domestic liabilities (including securities issued by the CB for monetary policy purposes) and foreign assets.	(2003–2007)
11	Jamaica	1. Open market operation (central bank issues securities with high interest rate cost).	(1985–1996)
12	Uruguay	1. Weak loan portfolio.	(1989–1995)
14	Jordan	1. Interest differentials between domestic liabilities (including securities issued by the CB for monetary policy purposes) and foreign assets.	(1996–2005)
15	Israel	1. Wide exchange rate fluctuations.	(1996–1999)
17	Zimbabwe	1. Open market operations (issuing central bank's securities). 2. Subsidies. 3. Foreign exchange rate fluctuations.	(2004–2007)

Sources: Leone (1993), Dalton and Dziobek (2005), Sweidan and Kalaji (2005), Mackenzie and Stella (1996), Munoz (2007), and the annual reports of the central banks of Thailand, South Korea, Sri Lanka, Indonesia, Nepal, and the Philippines.

Source: Sweidan (2011)

The ECB

- Foreign exchange: smaller today. Risky defaultable debt: Greece. Under control?
- Yield curve risk: very significant. QE and exit strategies.
- Counting reserves for public debt? Yes, but then deduct public debt held by central bank. Approximately nets out.
- What is the market value of the central bank? Net worth plus the present value of seignorage. Since first is close to zero, the value if really the size of the inflation tax.

Fiscal redistribution

Dividend redistribution

- 2 regions, one source of risk (default), net income rule:

$$d_t^a + d_t^b = s_t + r_t n_t +$$
$$\left[\frac{\delta_t^a}{q_{t-1}^a} - (1 + r_t)\right] q_{t-1}^a b_{t-1}^a + \left[\frac{\delta_t^b}{q_{t-1}^b} - (1 + r_t)\right] q_{t-1}^b b_{t-1}^b.$$

- Unlimited redistribution: large d_t^a, drive d_t^b to zero.

- ECB has **no discretion** allocating its dividends. Strict rule. Exception in 2014 with Greek bonds. Almost ruled out with new rule that national central banks hold 92% of the bonds of their country.

Redistribution via assets and reserves

- Resource constraint in no-Ponzi scheme version:

$$\lim_{T\to\infty} \mathbb{E}_t \left[m_{t,T} \left(v_T^a + v_T^b - q_T^a b_T^a - q_T^b b_T^b \right) \right] \leq 0.$$

- If larger b_T^a relative to b_T^b forever, letting a run a Ponzi scheme on b, using ECB as intermediary.

- ECB's MRO has collateral list, does not control the composition. For SMP no, but crucial criteria, temporary program.

- On reserves, TARGET2 makes sure that changes in reserves have no effect on individual v_t^i. ELA no, again temporary or not key.

Conclusion

ECB's fiscal role

- All central banks always have a fiscal role.
- Past: seignorage and inflating away the debt. Limited, under control.
- Fiscal backing, independence, and insolvency: continue somewhat undefined in the ECB's institutional structure.
- Income risk: always there, always need to manage risks. Maturity risk more relevant right now.
- Redistribution: the fragile middle ground of all European institutions.