Assessing green (un)conventional monetary policies in the EIRIN Stock-Flow Consistent model

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EIRIN's research questions and focus

1. *Under which conditions* a high-income country could foster the transition to a low-carbon economy while avoiding risk of stranded assets?
   - We assess the impact of (un)conventional monetary policies and new financial instruments (green sovereign bonds) on green investments, jobs, credit market, income and wealth

2. To what extent could *spillovers and externalities emerge?*
   - We look at *distributive effects* (income inequality and wealth concentration) and *credit market performance and stability*

- Focus on:
  - (Un)conventional monetary policies introduced after the financial crisis
  - Green sovereign bonds
  - Last decade's structural characteristics (low growth, inflation, interest rates)

Results in a nutshell:
green growth and distributive effects

1. Central Bank (CB) could support public policies for low-carbon transition *if:*
   - Monetary policy targets sovereign bonds conditioned to green investments

2. Green Quantitative Easing (QE) has positive effects on the green economy, credit, bonds market, decreasing exposure to risk of stranded assets

3. Green QE's transmission channels to the economy work by:
   - Decreasing cost of capital for green investments
   - Releasing government's budget conditions, while avoiding tax increase
   - Supporting the development of the green bonds market

4. Distributive effects depend on how QE and fiscal policy are implemented

5. Results obtained moving beyond some of DSGE's strong structural and behavioral characteristics

Behavioural conditions for green growth in EIRIN

1. Coherence of government's policies with Paris Agreement and EU2030 targets
    - Public intervention to overcome market failure and internalize climate costs
    - Entrepreneurial market-maker state: the government (G) issues green bonds conditional to green investments (solar pv) to overcome green credit constraint
2. CBs are committed on their mandate of prices and financial stability
    - Art. 3 of the EU Treaty: ECB's alignment with the EU objectives...e.g. EU2030
    - Recognizes carbon stranded assets as a risk for price and financial stability
        - In case of shocks and uncertainty on timing/magnitude of climate policies, market players don't fully anticipate prices changes (Monasterolo et al. 2017), leading to systematic mispricing
3. Economic actors (households, firms, banks) respond to G's incentives and CB's monetary policies by revising their investment/consumption/lending behaviours

Structural conditions for sustainable green growth

- G. issues green bonds to finance subsidies for green capital purchase
- Positive Net Present Value achieved under (at least) one of these conditions:
  - High subsidies (thus high issuance of green sovreign bonds)
  - Low cost of capital for green investments
  - Low discount rate (rD)
- The CB purchases via the QE sovereign bonds:
  - Pays back the interests (bond coupons) to G. releasing ist budget constraints
  - This allows G. to keep tax rates low, promote GDP growth and keep public debt under control
- Stochasticity: random component affecting the weights calculation of financial products in portfolios' allocation

Public support to renewable investments via green bonds

- Green utility company decides to invest in solar pv based on NPV of acquiring Δn_{sp} units of solar panels at price $p_{K_{green}}$ subsidized for γ_{sp} by the government

$$NPV = -(1 - \gamma_{sp})p_{K_{green}}\Delta n_{sp} + \frac{p_e \varepsilon_{sp} \Delta n_{sp}}{r_D}$$

Total initial investment cost

Total discounted cash flow

γ_{sp} = % of gov subsidy for the cost of green investments (e.g. solar panel)

Δn_{sp}: new solar panels acquired. Solar panel is identified as a unit of green capital

Pe = price of energy (based on unit costs i.e. raw material and debt

ε_{sp} = energy efficiency (parameter)

price $p_{K_{green}}$ set as a fixed mark-up μ_K on units labour costs

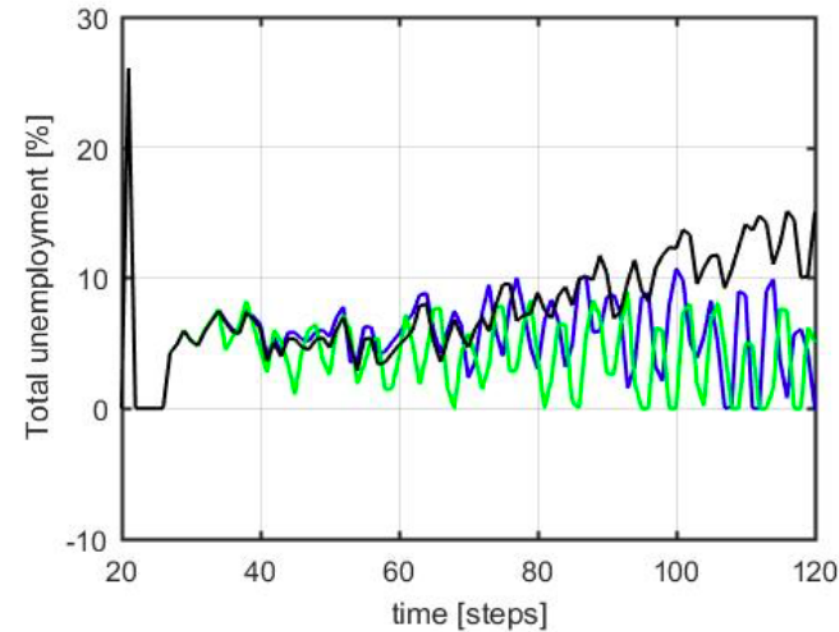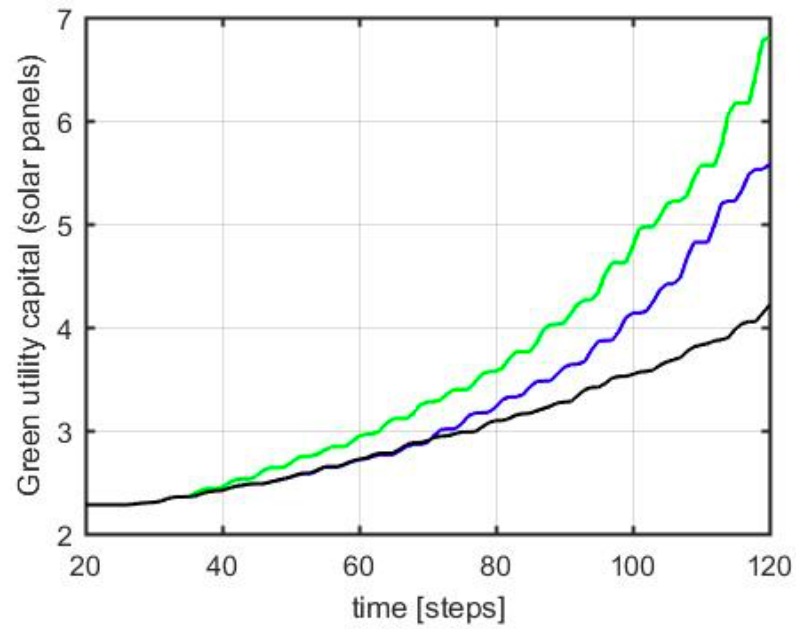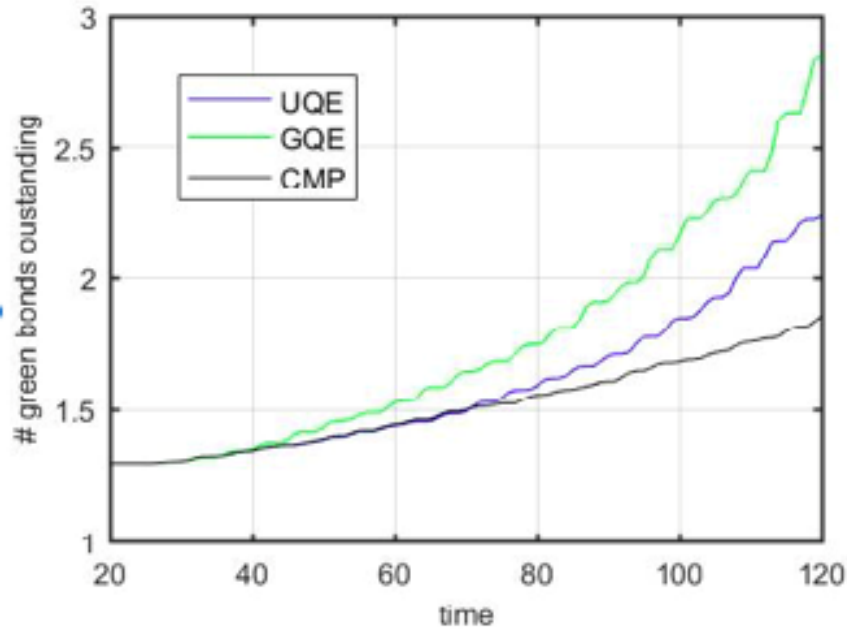r_D: *cost opportunity of capital and used to discount future cash flows*

EIRIN's complementarity and added value with regards to DSGEs

- No single equilibrium to see emerging (often unexpected) macroeconomic dynamics and business cycles, time delays and feedback loops

- No representative but heterogeneous agents, no full coordination and information

- Heterogeneous households (consumption/savings, access to financial markets and yields), goods and capital (green/brown)' resource intensity, skills, R&D

- Endogenous policy shocks: G's subsidies and CB's monetary policies

- Distinction between credit/bond/capital market to fund green investments:
  - Compare conventional monetary policies (via interest rate) with unconventional ones (via bonds' prices/yields)
  - Assess effect on banks' stability and on green bonds market
  - Assess distributive effects: income inequality from differential HH's access to financial markets, wealth concentration towards financial actors

(Un)conventional monetary policies:
## transmission channels and feedbacks

Balancing feedback loop

MONETARY POLICIES

- Conventional: Taylor's rule
- Unconditioned QE
- Conditioned green QE

VARIABLES DIRECTLY AFFECTED

- Interest rate
- Bonds' prices/yield
- Bonds' prices/yield

MACROECONOMY

- Inflation
- Cost of capital (green/brown)
- Investments (green/brown)
- Unemployment
- Renewable capacity
- Sovereign debt
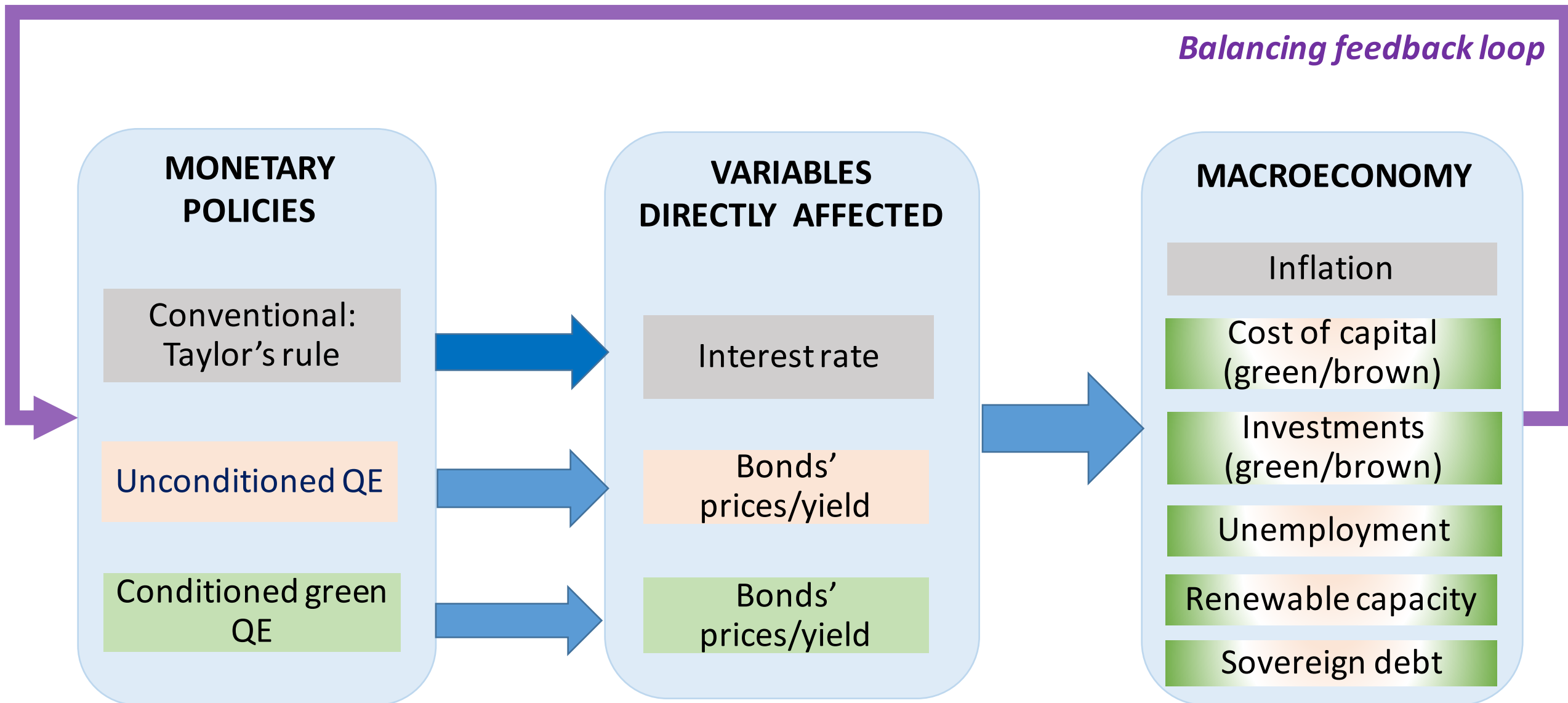
# Green QE (green) pushes low-carbon investments and transition

- Moving from Conventional Monetary Policies (CMP) to **Unconditioned QE (UQE)** and **GQE:** increase in solar pv while unemployment decreases
- Trend of green utility capital mirrors that of green sovereign bonds' outstanding
- Labour market: fluctuations depend on those in investment demand (green/brown), leading to adjustment in consumption goods demand and thus in the demand for labour

Credit market: endogenous money pushed by new green investments
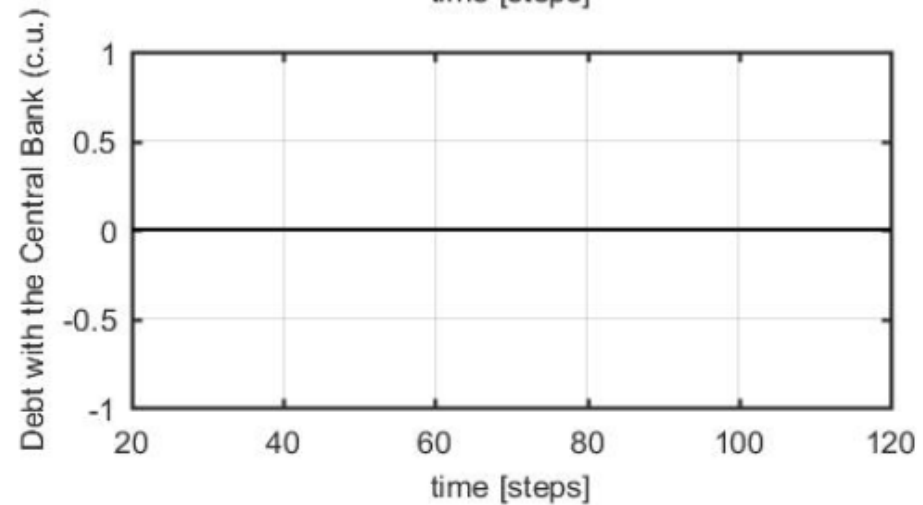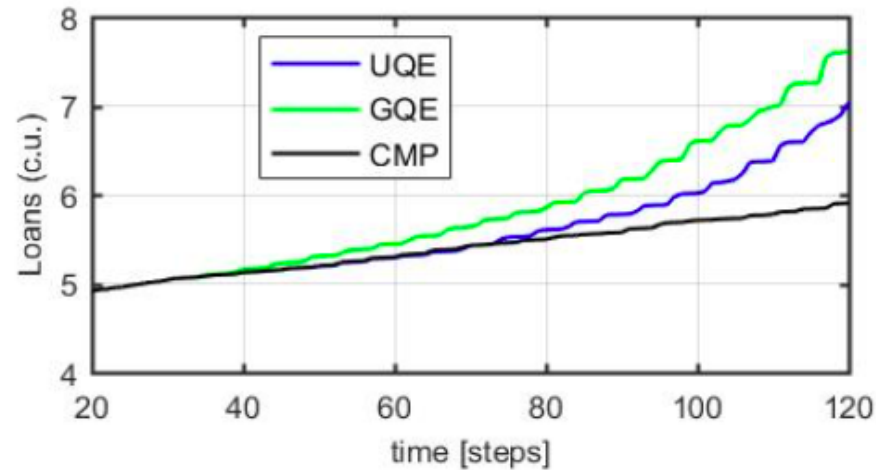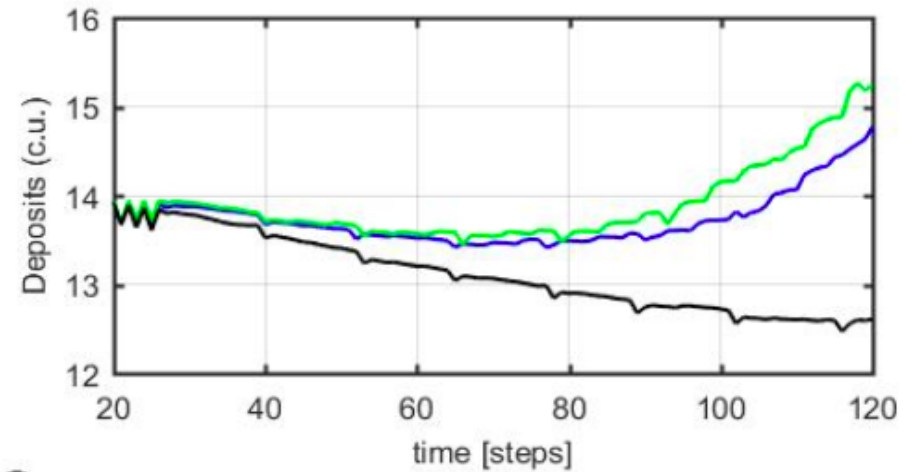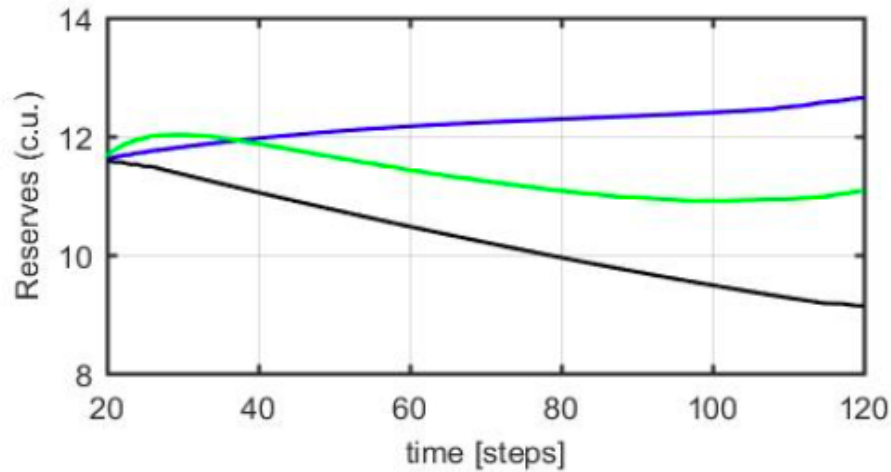
- **GQE** triggers development of green capital goods market and borrowing from the bank
- New loans drive BA's profits up and thus Hk's profits (through the dividends channel)
- Wealth concentration in BA increases in **UQE** and **GQE** (bank is the sole intermediary of QE)

Government's interest expenditures, public employment, taxation
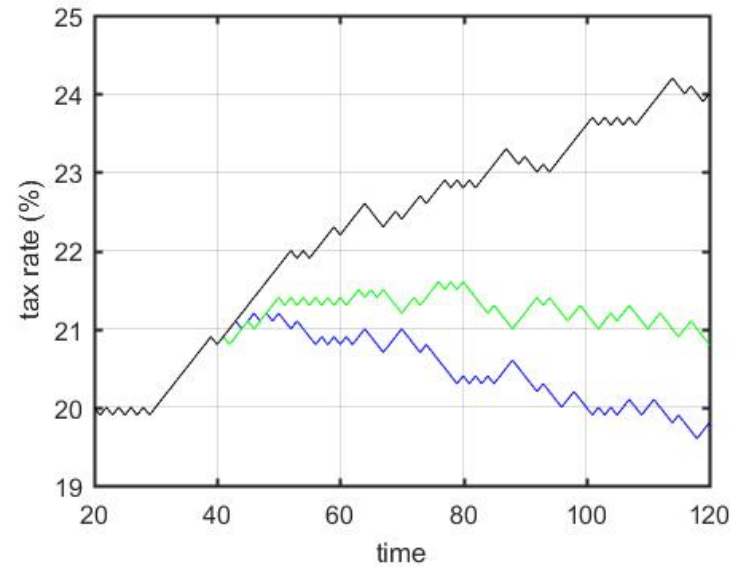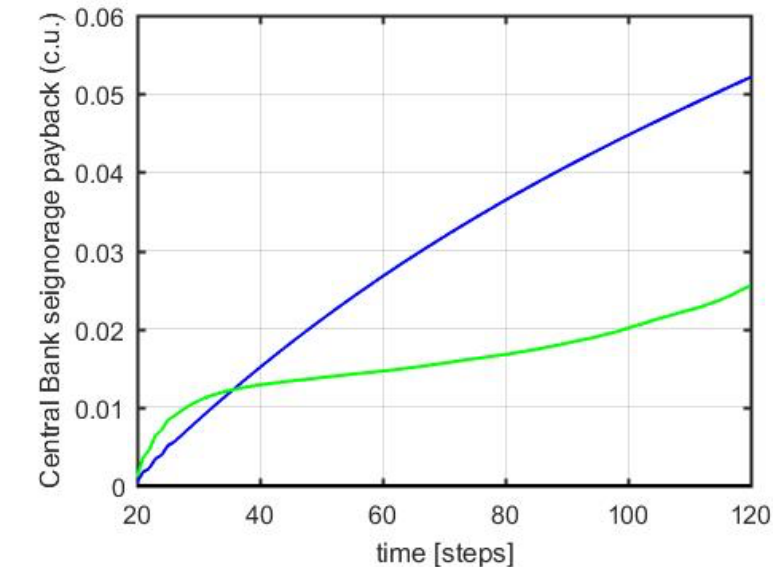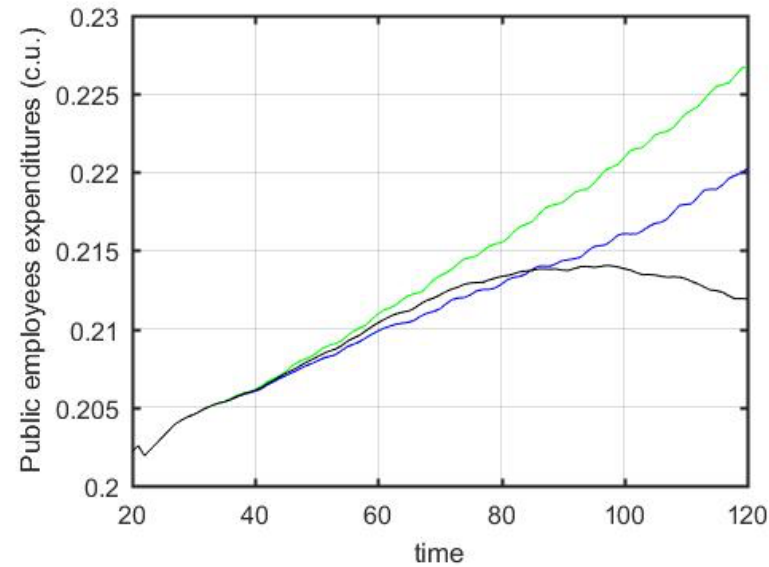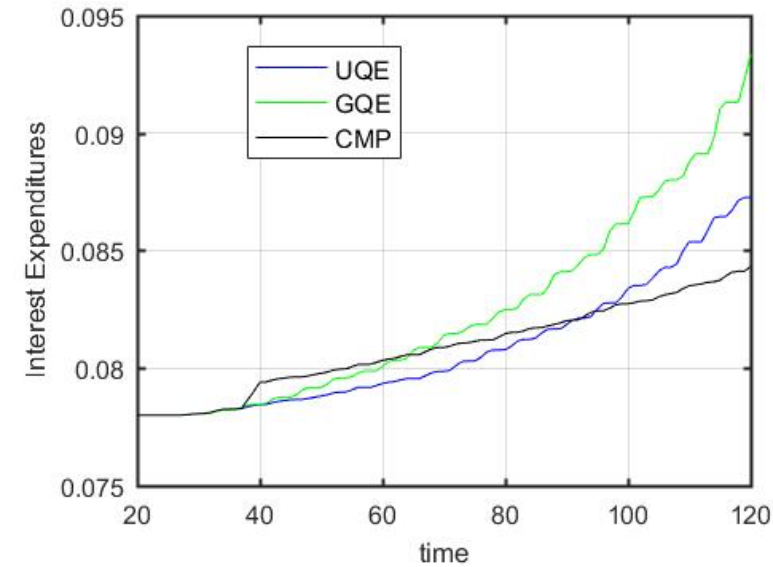
- Green growth provides fiscal revenues to the government, which doesn't need to increase tax rates

- CB pay-back of bonds' coupon is highest in UQE because both green/brown bonds purchased by CB

- *Strong QE helps the government to support green investments and meet its budget balance with low distributive effects via taxation*

Conclusion: green by design?

1. Government and CB could play a crucial and mutually reinforcing role in the low-carbon transition influencing agents' behavior and market's performance

2. In particular, GQE has positive effects on the green economy, credit and bonds market, decreasing portfolios' (including CB's) exposure to stranded assets' risk

3. However, in GQE distributive effects emerge:
   - Income inequality: Hk's profits increase due to the dividends paid by BA
   - Wealth concentration towards BA (sole intermediary of the QE)

4. To smooth the low-carbon transition, regulation could play a key role:
   - Taxation on financial returns to prevent inequality
   - Green bonds' taxonomy to evaluate different risk-return and avoid moral hazard