

Could governments support the green transition by phasing out fossil fuels subsidies?

a Stock-Flows Consistent model approach

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A growing momentum for green investments

1. Unprecedented challenges: meeting the 2 deg C target by 2100 agreed at COP21 requires massive investments in the low-carbon transition:

- 93 trn to retrofit the whole economy by 2050 (NCE, 2016).
- Comparison: global bonds market 90 trn

2. Rising global awareness of climate risk:

- BoE started to talk about the weather: Carney '*climate change a tragedy of the horizons*' (2015)
- G20 FSB Task Force's recommended climate risk disclosure for business and finance (2016)

3. Risk transmission from climate policies to finance could be substantial and amplified by interconnectedness of financial system:

- Climate stress test: pension funds and investment funds most exposed to climate-policy relevant sectors via direct and indirect exposure (45% of equity portfolio, Battiston et al 2017).

But are governments keeping it?

- **Contradictory and misaligned policies** that contribute to increase investors' uncertainty and affect their expectations on unavoidable low-carbon transition
- G20 governments' subsidies to fossil fuels keep increasing:
 - **Fossil fuels subsidies: \$ 700 bn** in 2013 (IEA, 2015), could reach \$ 5.3 trn when we include negative externalities (Pigouvian tax, Coady et al. 2015)
 - Through direct spending and preferential tax treatments to mining companies (see Exxon in the US) to support fossil fuel exploration and production, increasing mining companies' profitability)
 - **Lack of transparency on their overall value by production/consumption**
- **In contrast, only \$135 bn** subsidies to renewable energy in 2015 (IEA, 2015) and **\$265.8 bn** investments in renewable power capacity in 2015 (BNEF).

Do fossil fuels subsidies represent an opportunity cost for green transition?

- The effects of phasing out fossil fuels subsidies not studied yet **in terms of opportunity cost for the low-carbon transition.**
- *2 research questions*
 1. *Under which conditions and at what cost (real economy, credit market, distributive effects) could governments support the low-carbon transition by phasing out of fossil fuels subsidies in high-income (but fossil fuels dependent) countries (e.g. Italy)?*
 2. *Do alternative forms of public support (e.g. green fiscal measures or green sovereign bonds) differ in terms of macroeconomic performance (jobs, investments, growth), credit market stability and distributive effects (wealth distribution and income inequality)?*
- To answer these questions we apply the **EIRIN Stock-Flows Consistent flow-of-funds model** (Monasterolo and Raberto 2017, R&R in Ecological Economics).

EIRIN's features

- **Sectors and agents with specific endowed with a specific behavioural function and adaptive expectations, and interact through a set of markets:**
 - Households: workers (heterogeneous skills), capital owners
 - Consumption goods producer who meet the consumption demand using *green/brown capital goods*
 - Capital goods producer (*green/brown*)
 - Energy sector (mining companies, utilities) modelled on the Global Change Assessment Model (GCAM)
 - Commercial bank
 - Central Bank (CB)
 - RoW that exports raw material and fossil fuels
 - Government who sets fiscal policy, collects taxation.
- No cash or gold in the model - bank's liquid is money deposited at the CB
- Bank has initial liquidity endowments, the depositors' liquidity and the borrowers' debt, and equity.
- Bank has leverage (ratio between risk weighted assets and equity) and CAR=10%.
- Investments influenced by CB's interest rates, banks' CAR and public budget/debt sustainability issues.
- Green capital goods have same productivity of brown capital goods but are more costly (K and wages of skilled workers)

Public support to renewable investments covered through fiscal measures or green sovereign bonds

- **Green public support** is provided to utility companies to cover the cost differential of **green** investments.
- Utility company chooses to use renewable energy if NPV higher than 0:

$$NPV = - (1 - \xi) \Delta n_{sp} p_{K,green} + \frac{\varepsilon \Delta n_{sp} p_E}{r_D}$$

ξ = gov subsidies for the cost of solar panel

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

PE = price of energy (exogenous – utility company is price taker from mining company)

ε = energy efficiency (parameter)

- If $NPV > 0$, then solar panels investments depends on **firms' balance sheet** and **target leverage (debt/equity)**
- *We explicit role of CB's monetary policy on investments' decisions (interest rate r_D).*

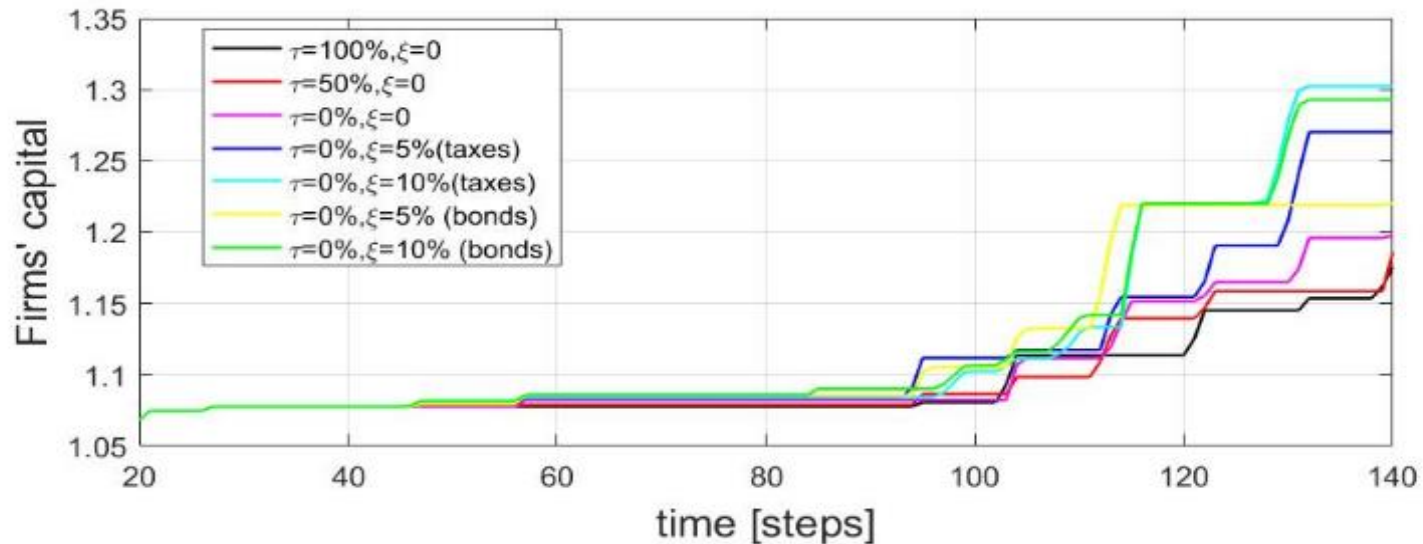
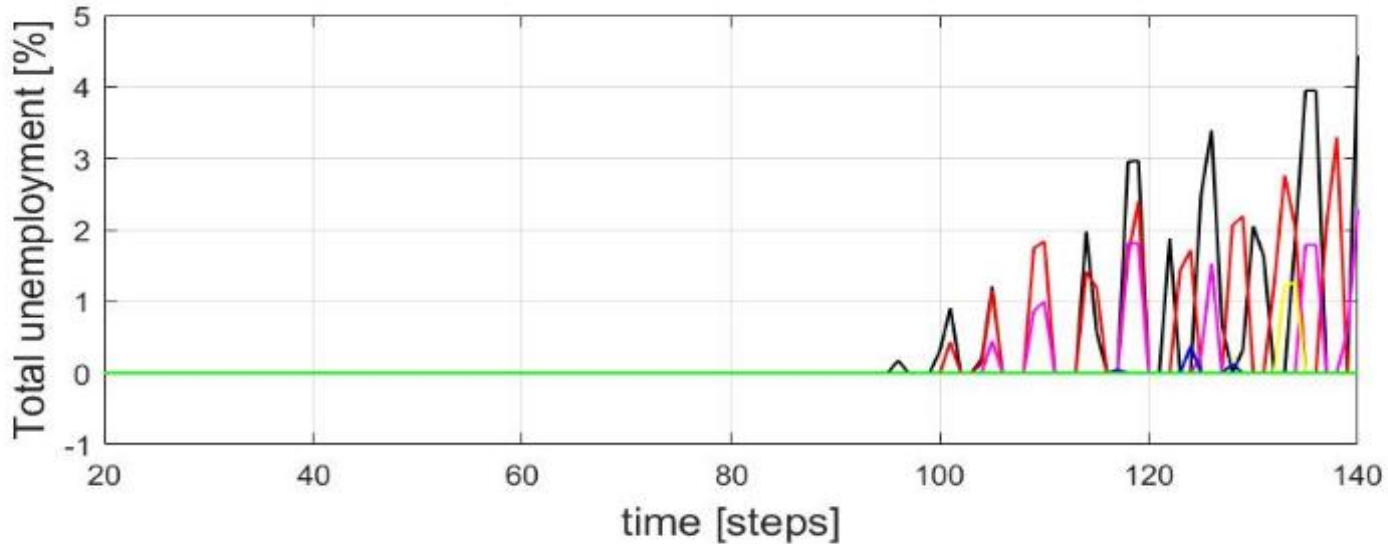
Why green sovereign bonds?

- **Green sovereign bonds** bought by the commercial bank agent:
 - No direct effect on households' income, consumption and demand for credit (as a difference from taxation to cover green public support).
 - *Green sov. bonds may represent eligible assets* that CB accepts in case of green Quantitative Easing (QE).
- **Why we started from green *sovereign* bonds:**
 1. Large share of global bonds issued (40% of the total)
 2. Role of 'green' entrepreneurial state to open market with mission-oriented investment (Mazzucato, 2015) and to *contribute to overcome the green market failure (too few green projects)*
 3. Being long-term yield they could represent a *stable green policy framework* that reduces investors' risk perception towards green projects.

7 model scenarios

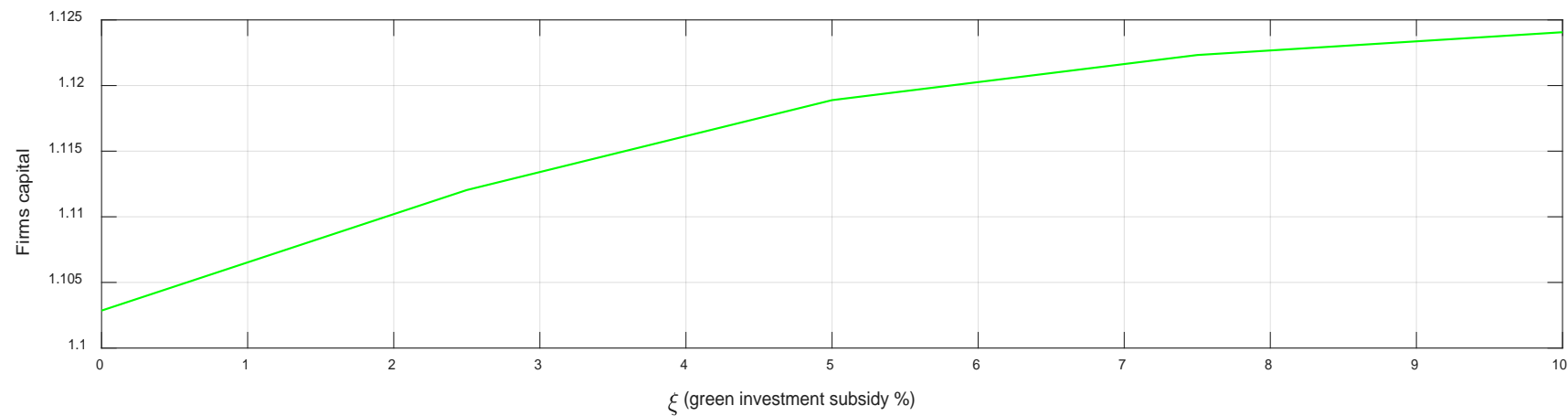
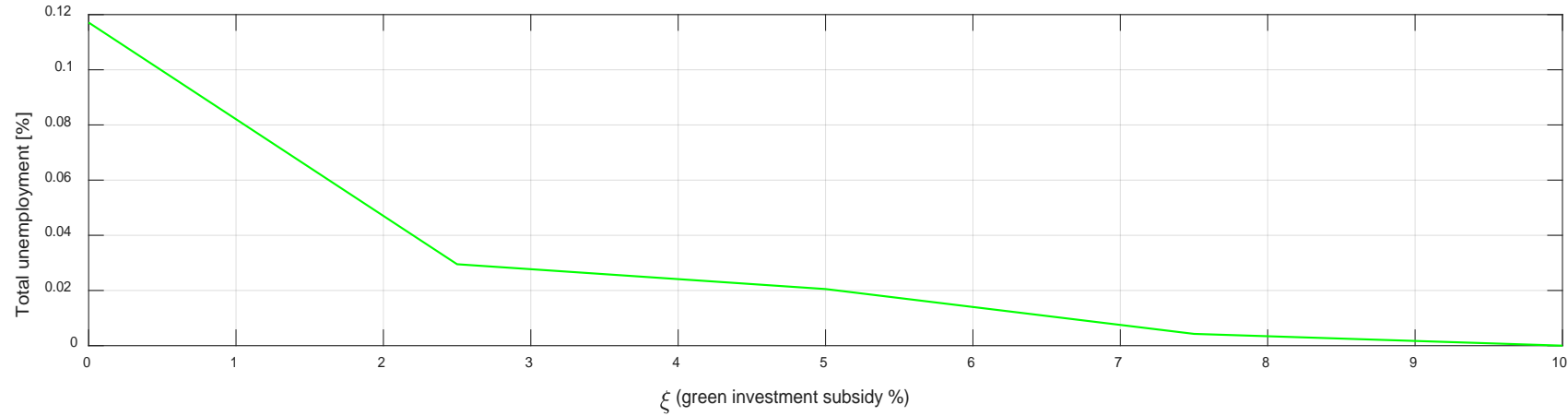
- 2 scenarios with fossil fuels subsidies (tax rebates to mining company):
 - $\tau = 100\%$: fossil fuels corporate tax exemption, 0% green subsidy
 - $\tau = 50\%$: fossil fuels corporate tax exemption, 0% green subsidy
- 1 scenario no fossil fuels subsidies, no green investment subsidy
- 2 scenarios with green investments subsidy: *gov.'s intervention covered through increase in general taxation*
 - ξ : 0% fossil fuels subsidy with 5% green investment cost subsidized
 - ξ : 0% fossil fuels subsidy with 10% green investment cost subsidized
- 2 scenarios with green investments subsidy: *gov.s' intervention covered by green sov bonds issuance:*
 - ξ : 0% fossil fuels subsidy, 5% green investment subsidy and green bonds
 - ξ : 0% fossil fuels subsidy, 10% green investment subsidy and green bonds

Production factors

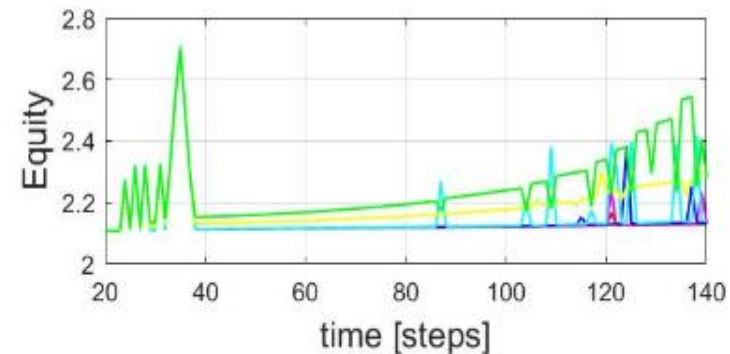
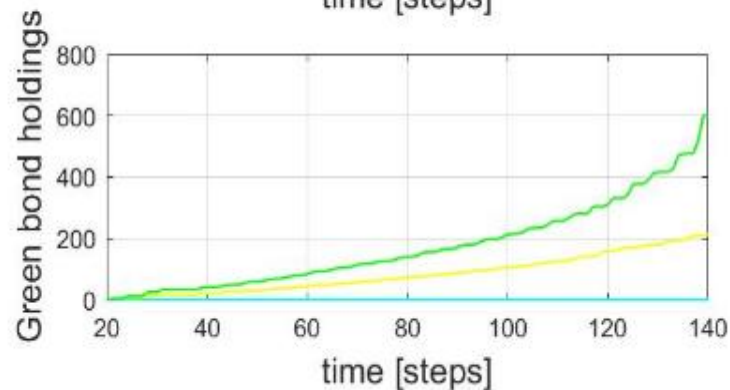
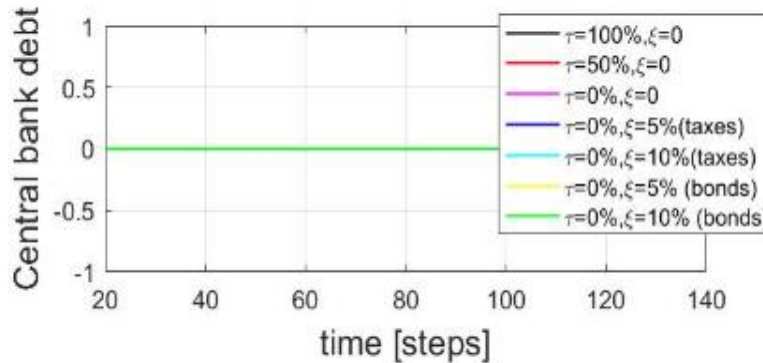
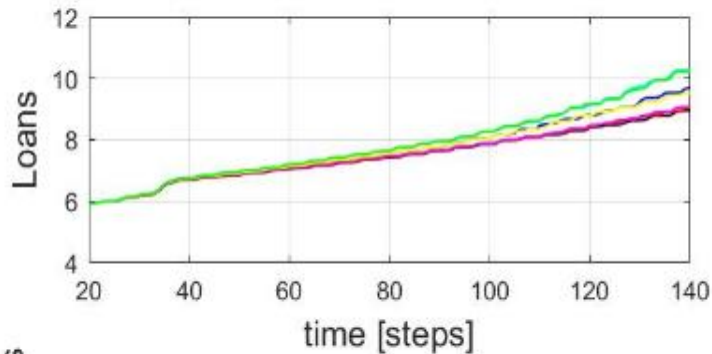
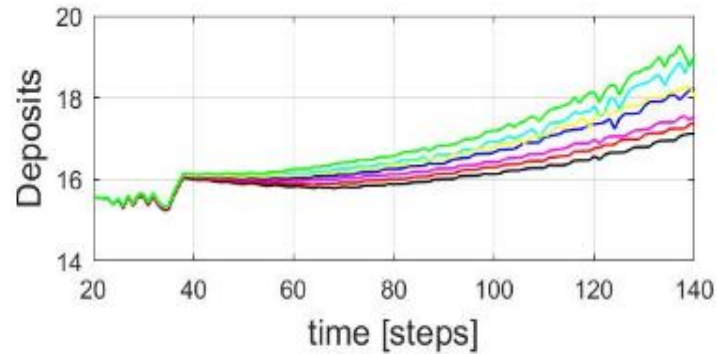
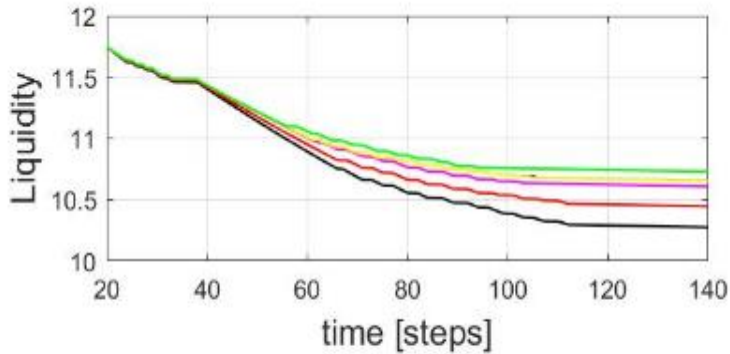


- **Black scenario is worst case for:**
 - Real economy: lower capital accumulation/higher unemployment due to higher taxation to cover tax exemption for mining company
- **Pink scenario** (no subsidies): economic situation improving - households' taxation decreases because mining companies contribute to gov. Revenues
- **Green tax** leads to lower capital accumulation, consumption, employment
 - effect on tax payers depends on how regressive the tax system is and level of fiscal compliance
- **Green bonds**: growing green investments and employment because being bought by banks, they don't affect households' purchasing power.

Effects of green sov bonds on production factors



Bank's balance sheet



- Bank has increasing deposits (result of new lendings, endog. money)
- bank's deposits (money supply) influenced by the raw materials' import bill: black scenario also worst case for bank because import of raw material from RoW represents exported wealth and contributes to lower investments in domestic economy and deposits.

• ***Green bonds' caveats:***

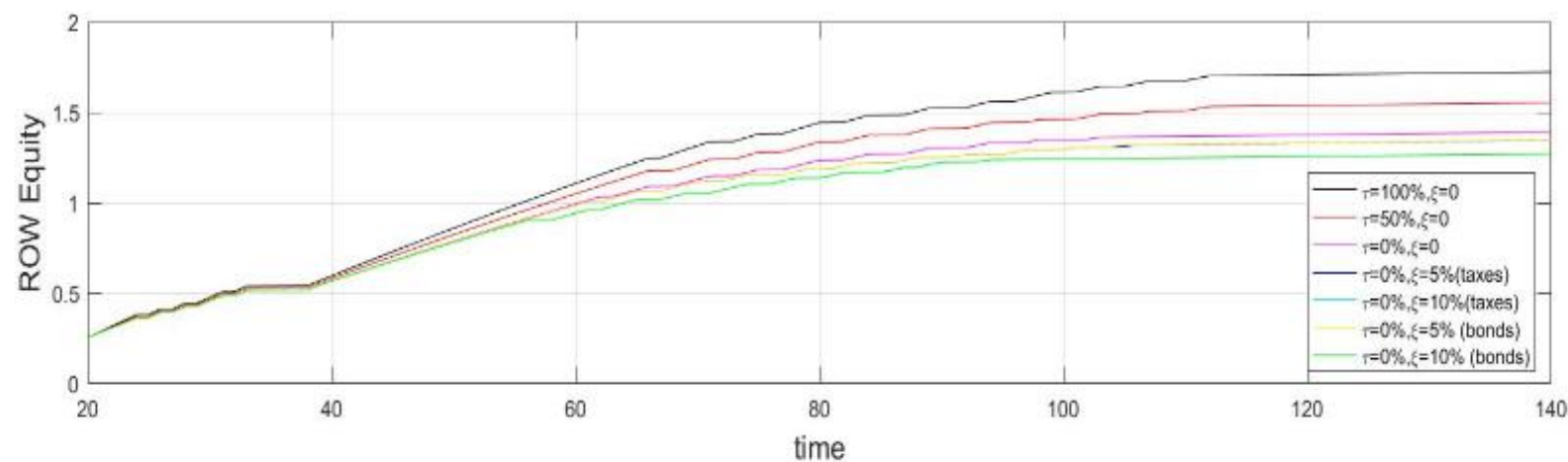
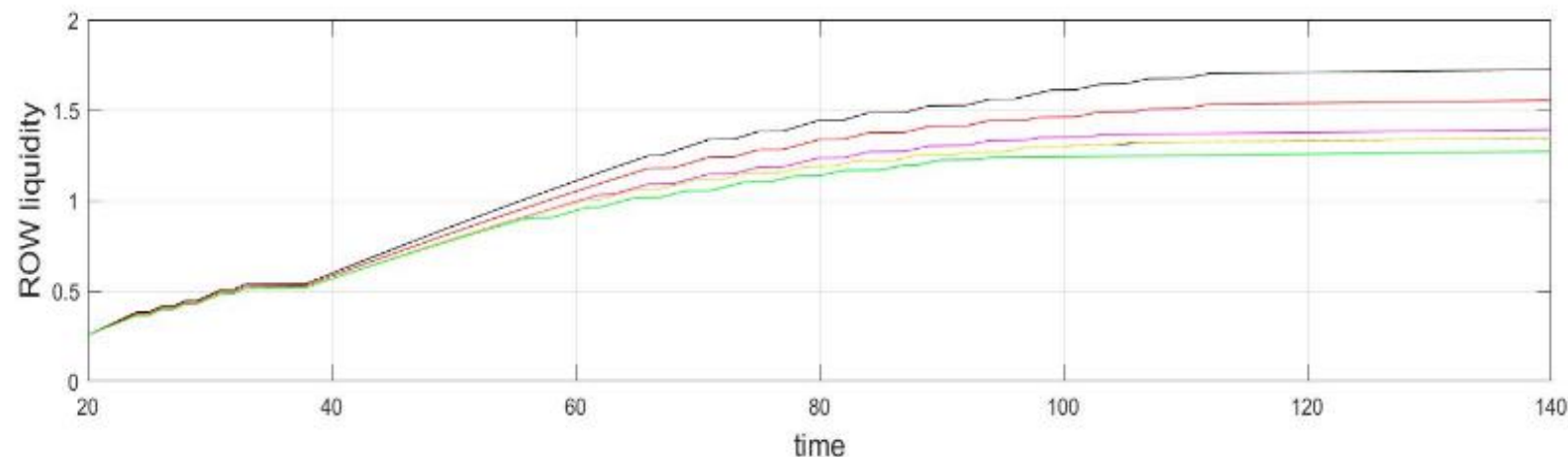
- Wealth concentration on bank because the only allowed buyer and seller (to the CB in case of green QE)
- Moral hazard for CB (who could accept the green bonds as a collateral in case of green QE) in absence of an harmonized classification of green bonds.

1. Gradually phasing out fossil fuels subsidies doesn't necessary lead to worse macroeconomic performance and credit market instability:

- In contrast, by phasing out fossil fuels subsidies governments contribute to decrease inequality and promote sustainable development:
 - Wealthy fossil fuels companies start to pay full taxation, and with the new revenue governments could finance green fiscal measures or pay out green bonds coupons.
 - Companies (CGP and utility) respond to public support to green investments by gradually switching energy use towards green: this creates new (and higher skilled jobs) in the green sector and drives GDP up

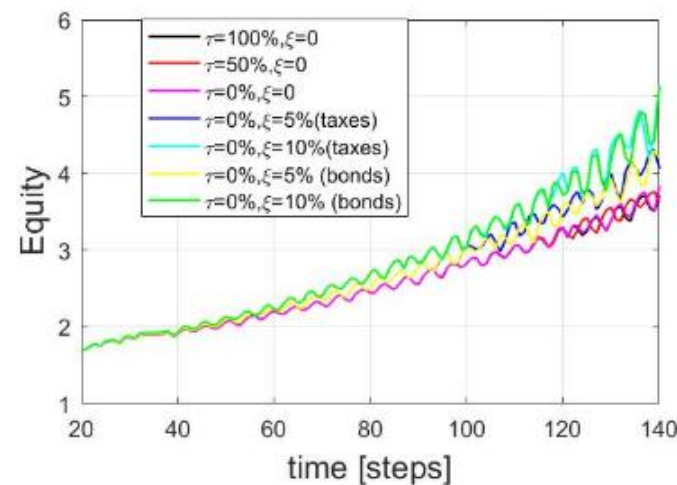
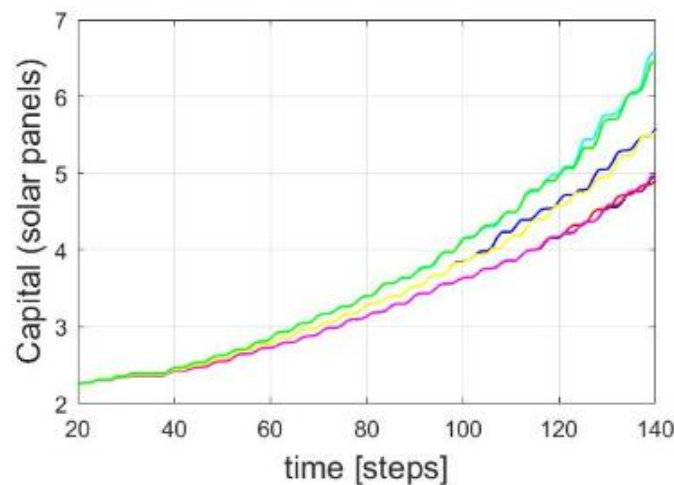
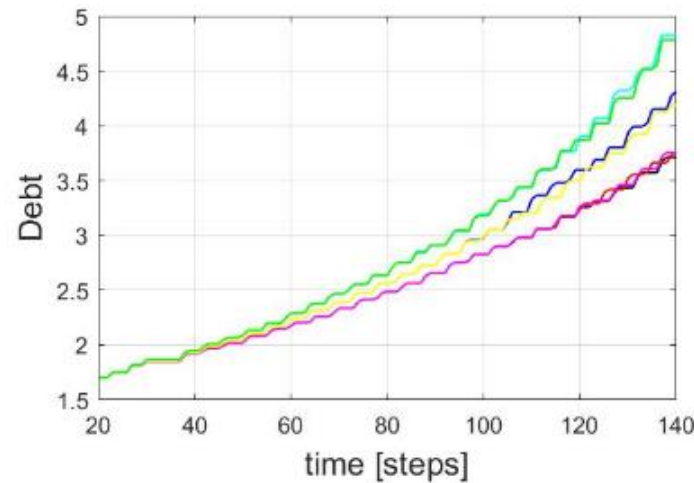
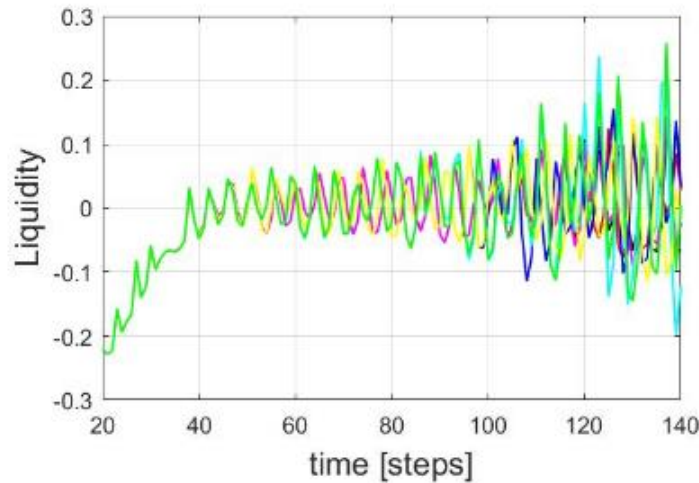
2. Green sov. bonds have less distributive effects than green fiscal measures but could lead to wealth concentration in the credit and financial sector.

RoW balance sheet



- Highest import of raw materials and fossil fuels in the black scenario
- **Also in green scenarios the country continues to import from RoW because new green energy produced cannot cover whole energy needs at the beginning of the transition process.**

Green utility company balance sheet



- Highest increase in renewable energy investments in the case of green bonds
- Also highest increase in debt and equity for utility company

Tax rate

