



مركز الملك عبدالله للدراسات والبحوث البترولية
King Abdullah Petroleum Studies and Research Center

Effects of Saudi Arabia's Economic Reforms: Insights from a New DSGE Model (K-DSGE)

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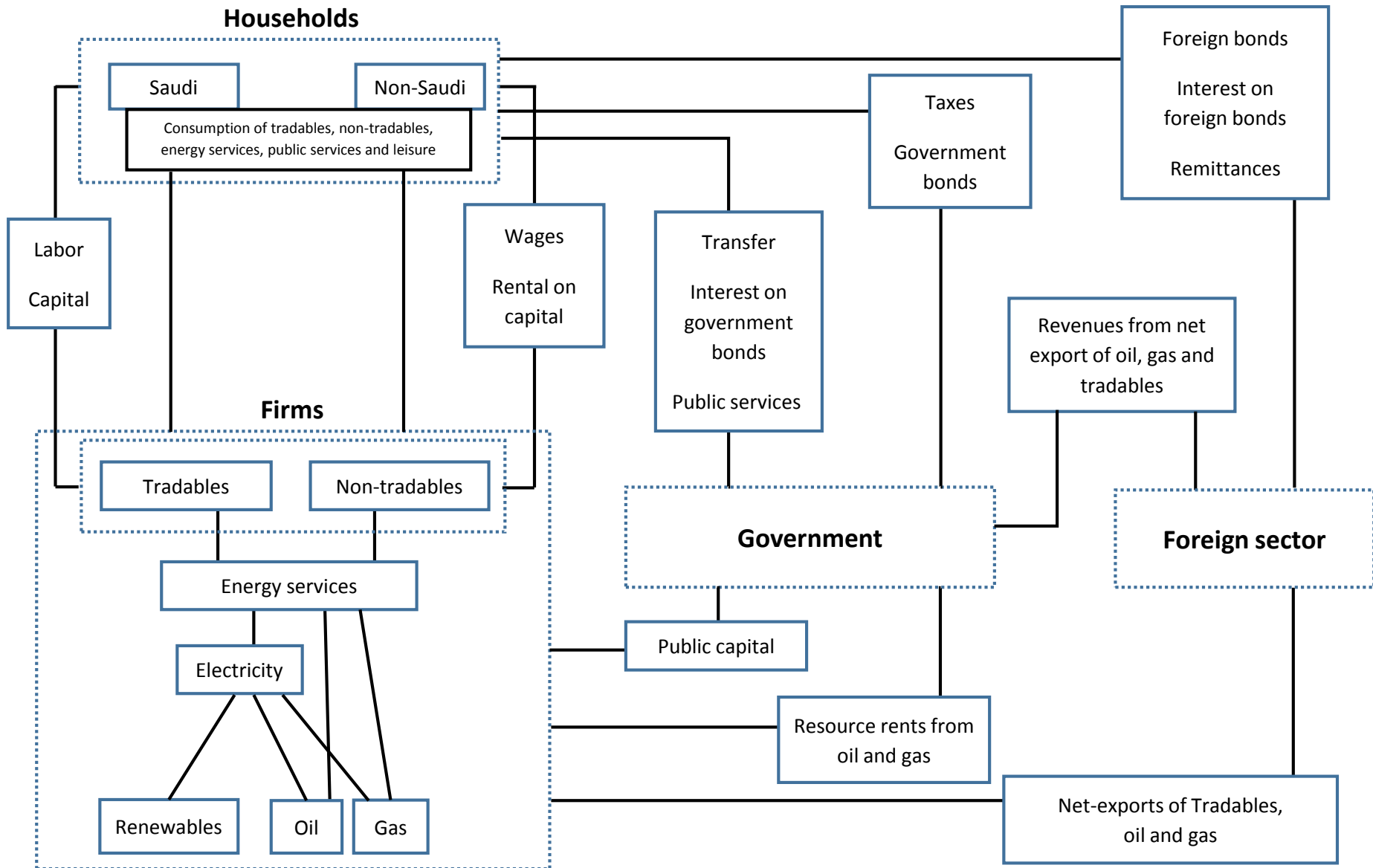
Background

- Saudi Arabia's Vision 2030 aims to create jobs and reduce the dependence on oil by diversifying the economy and developing service sectors with a set of programs, policy measures and targets.
- The Fiscal Balance Program (FBP) and the National Transformation Program (NTP) define goals and targets needed to be achieved through different policy measures.
- K-DSGE model is developed at KAPSARC that can be used as a framework to assess the macroeconomic effects of the economic policy reforms within the general framework of the Vision 2030.
- This paper analyzes the following three specific key policy measures:
 - Introduction of value added tax (VAT),
 - Deployment of renewable energy,
 - Energy price reform

Literature

- Few studies explore macroeconomic impacts of policy changes specific to the Vision 2030 plan in Saudi Arabia.
- Blazquez, Hunt and Manzano (2017) simulate the implications of the deployment of 9 GW of renewable energy in Saudi Arabia.
- Blazquez, Hunt, Manzano and Pierru (2019) analyzes the welfare impact of different policy measures aimed to reduce domestic oil consumption.
- We include specific characteristics of the Saudi economy
 - Saudi economy as oil-rich small open economy;
 - Dual labor market: Saudi and Expats; Energy sector
 - Expat households as a type of non-Ricardian households;
 - two types of final consumption goods: tradable and non-tradable goods;
 - the recently revised target of 27.3 GW of renewables' deployment in Saudi Arabia.

K-DSGE Model Structure



Model Calibration

Long-run Relationships in Data and Calibrated Model Economy

Long-run ratios	Average (1997-2016)	Model economy
Saudi labor to total labor supply	0.38	0.38
Share of tradable goods in total outputs	0.22	0.22
Oil exports to oil production	0.76	0.76
Gas exports to gas production	0	0
Trade-balance to nominal GDP	0.16	0.16
Private consumption to GDP	0.31	0.31
Public consumption to GDP	0.22	0.22
Public bonds to GDP	0.13	0.13
Remittances to GDP	0.05	0.05
Labor in tradable goods over total supply of labor	0.47	0.47
Energy services over total consumption expenditure Saudis	0.11	0.11
Energy services over total consumption expenditure non-Saudis	0.10	0.13
Share of oil in electricity demand for oil and gas	0.51	0.55

Policy experiments

VALUE ADDED TAX

The policy of a 5% VAT on goods and services was implemented in January 2018.

We simulate a 5% tax on households' consumption of goods and energy services. The tax is implemented in the first year and remains the same there after.

ENERGY PRICE REFORM

The policy targets to gradually increase domestic fuel prices to 'reference prices' by 2023.

We simulate an increase in the domestic prices of oil and gas to the international price level. The prices will remain the same there after.

DEPLOYMENT OF RENEWABLE ENERGY

The policy targets to deploy 27.3 GW of renewables by 2023.

We set public investment in renewable energy in five years to gradually reach a 13.75 renewable share in electricity generation.

The policies change the revenue and spending sides of the government budget. We consider two alternative ways of balancing the government constraint:

- 1) Government spending on public services
- 2) Lump-sum transfer to the Saudi households

Effects on Oil Exports

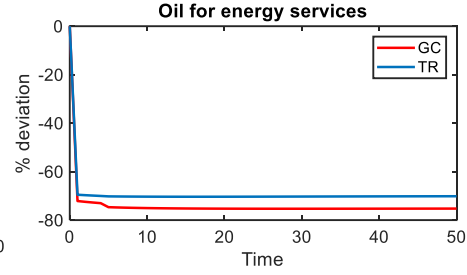
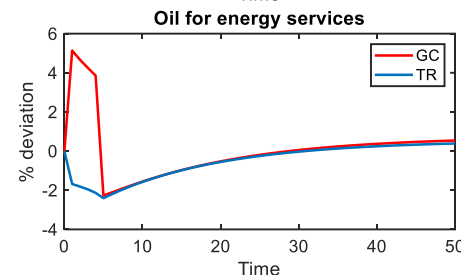
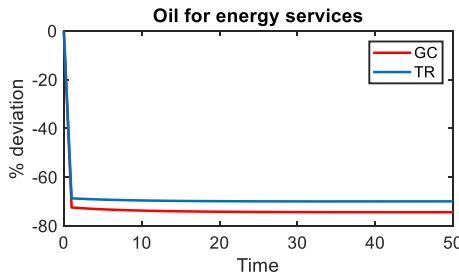
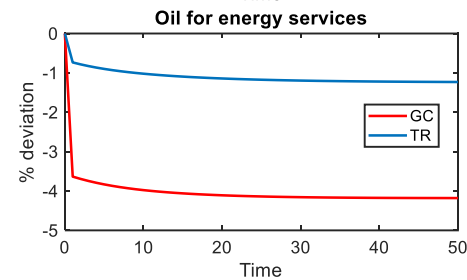
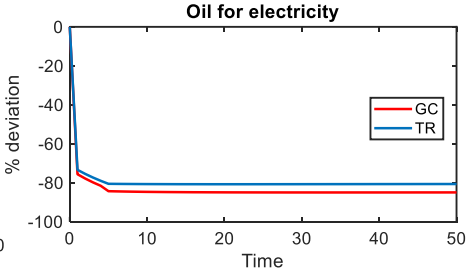
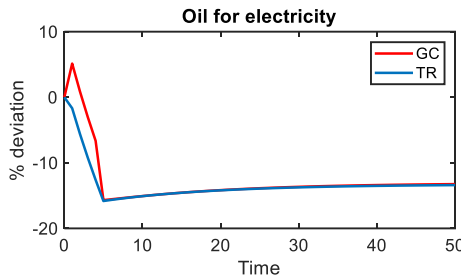
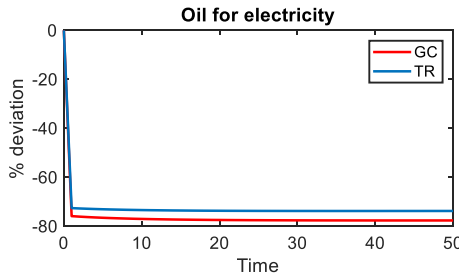
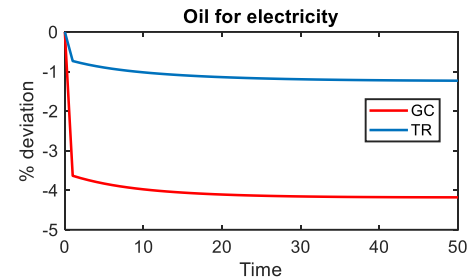
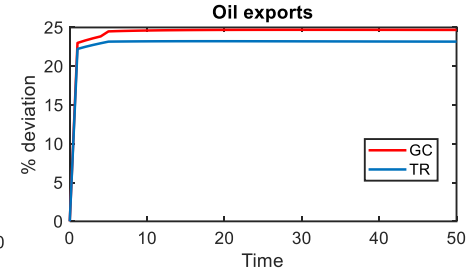
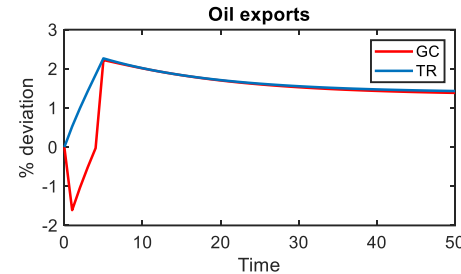
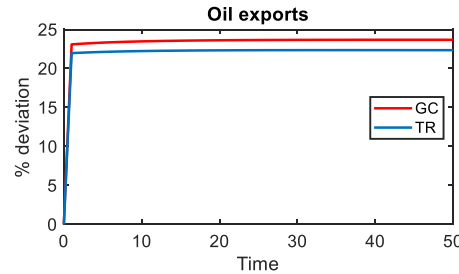
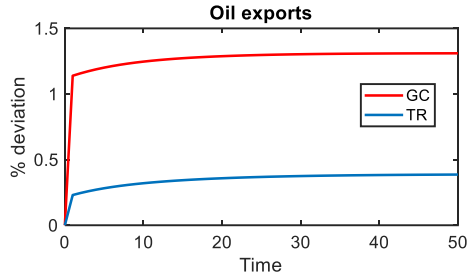
$$\text{Oil exports} = (\bar{O}_t - O_{EL,t} - O_{ES,t}) + (\bar{G}_t - G_{EL,t} - G_{ES,t})$$

Value Added Tax

Energy Price Reform

Deployment of Renewable Energy

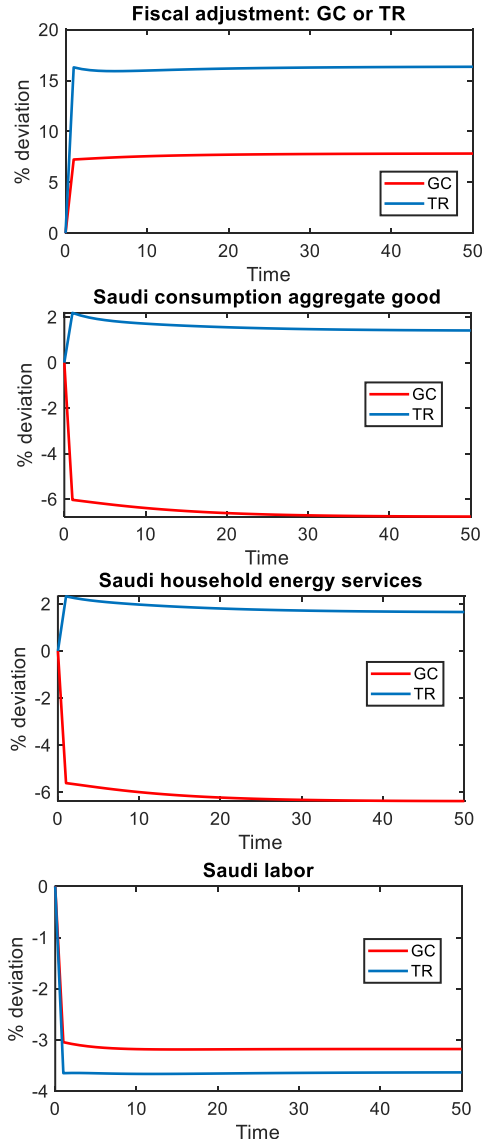
Joint Policy



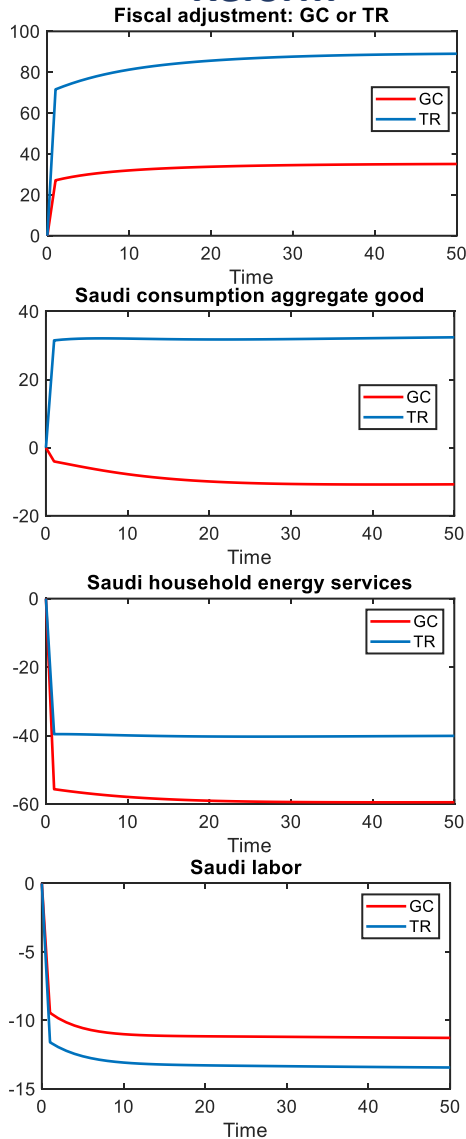
Effects on the Saudi Households

$$\text{Utility of the Saudi household} = \ln\{[(C_t^s)^\sigma + \kappa(ES_t^s)^\sigma]^{1/\sigma} + \alpha_{CG}GC_t\} - \left(\frac{\eta}{1+\nu}\right)(l_t^s + l_{g,t}^s)^{1+\nu}$$

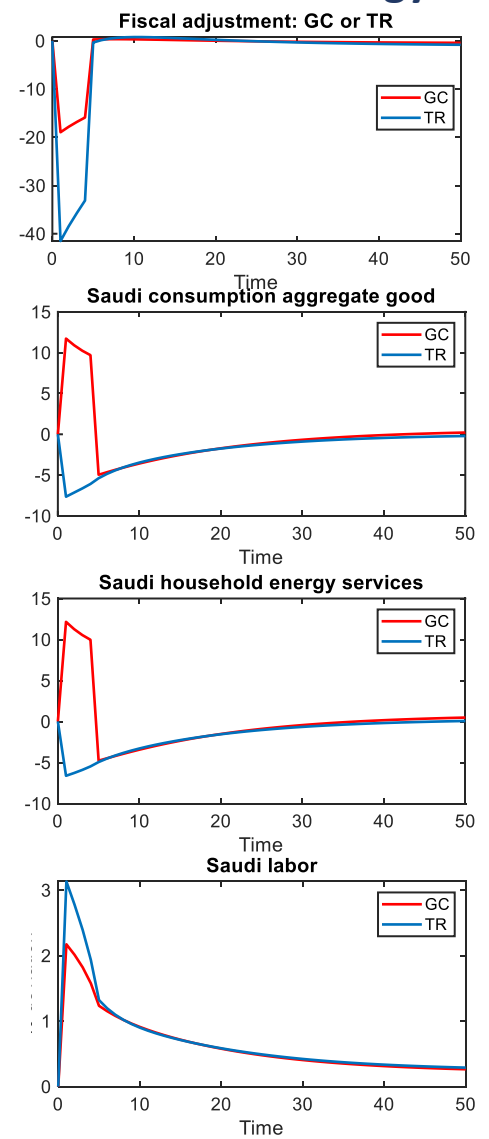
Value Added Tax



Energy Price Reform

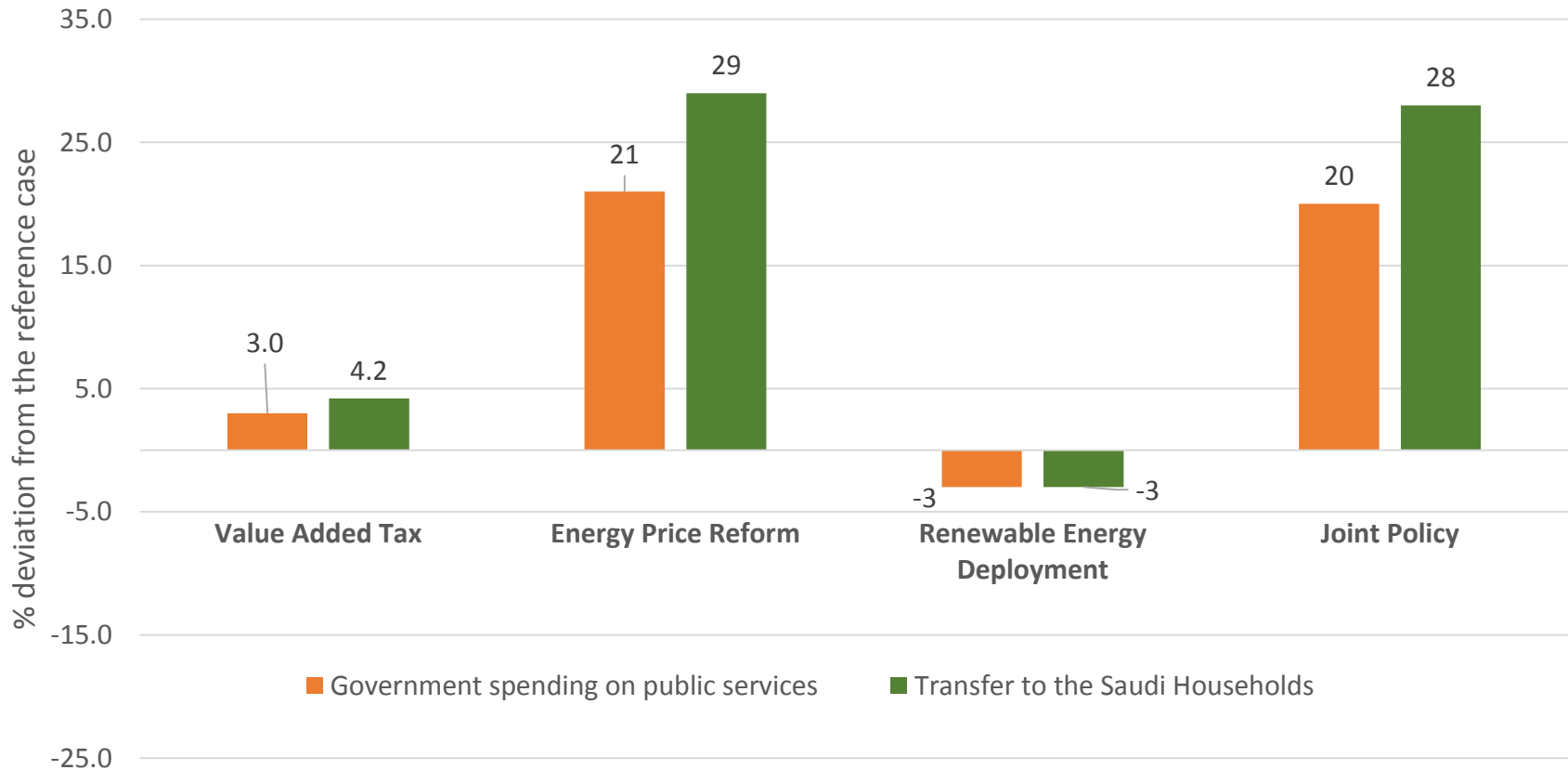


Deployment of Renewable Energy



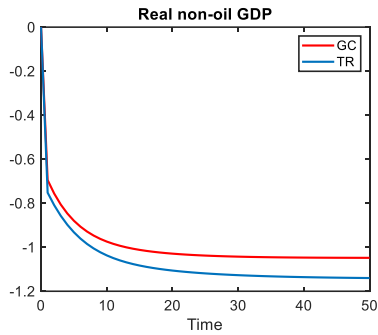
Welfare Gain (Equivalent Variation)

$$\frac{1}{1-\beta} U^s(\overline{AGC}^s(1+x), \overline{l^s + l_g^s}, \overline{GC}) = \sum_{t=0}^{\infty} \beta^t U^s(\overline{AGC}_t^s, \overline{l_t^s + l_{g,t}^s}, \overline{GC}_t)$$

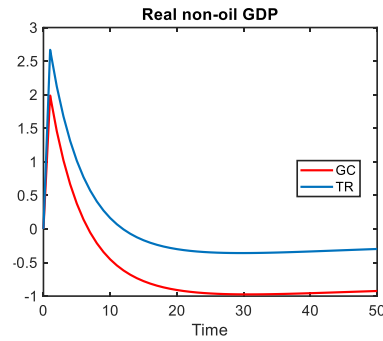


Effects on the Non-Oil Real GDP

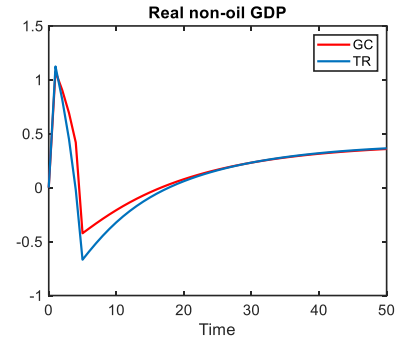
Value Added Tax



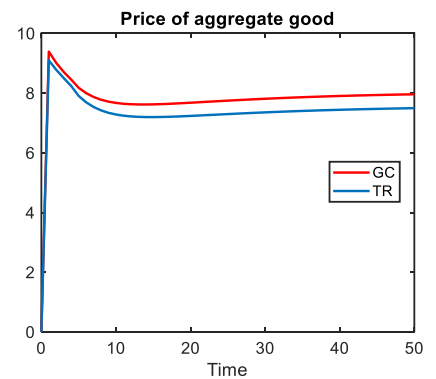
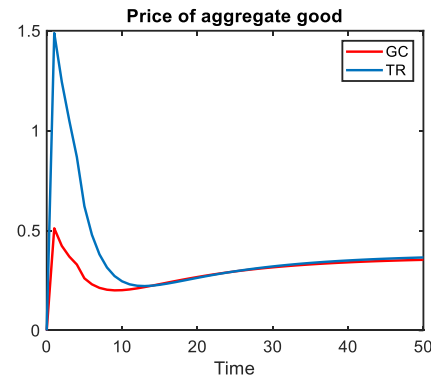
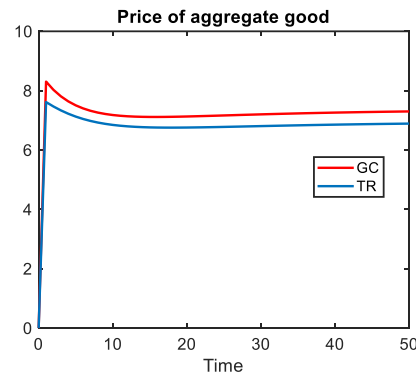
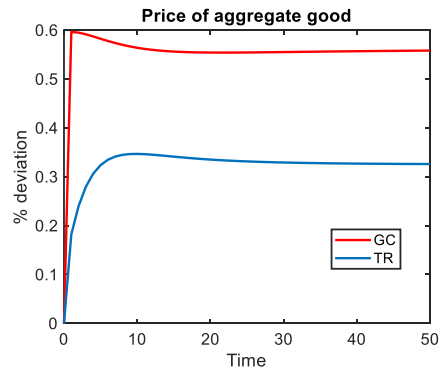
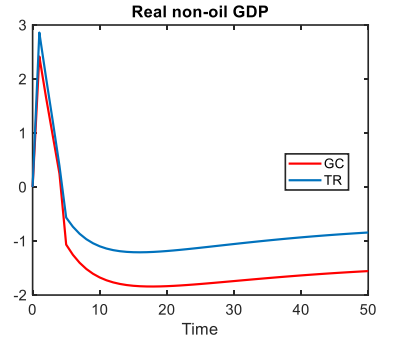
Energy Price Reform



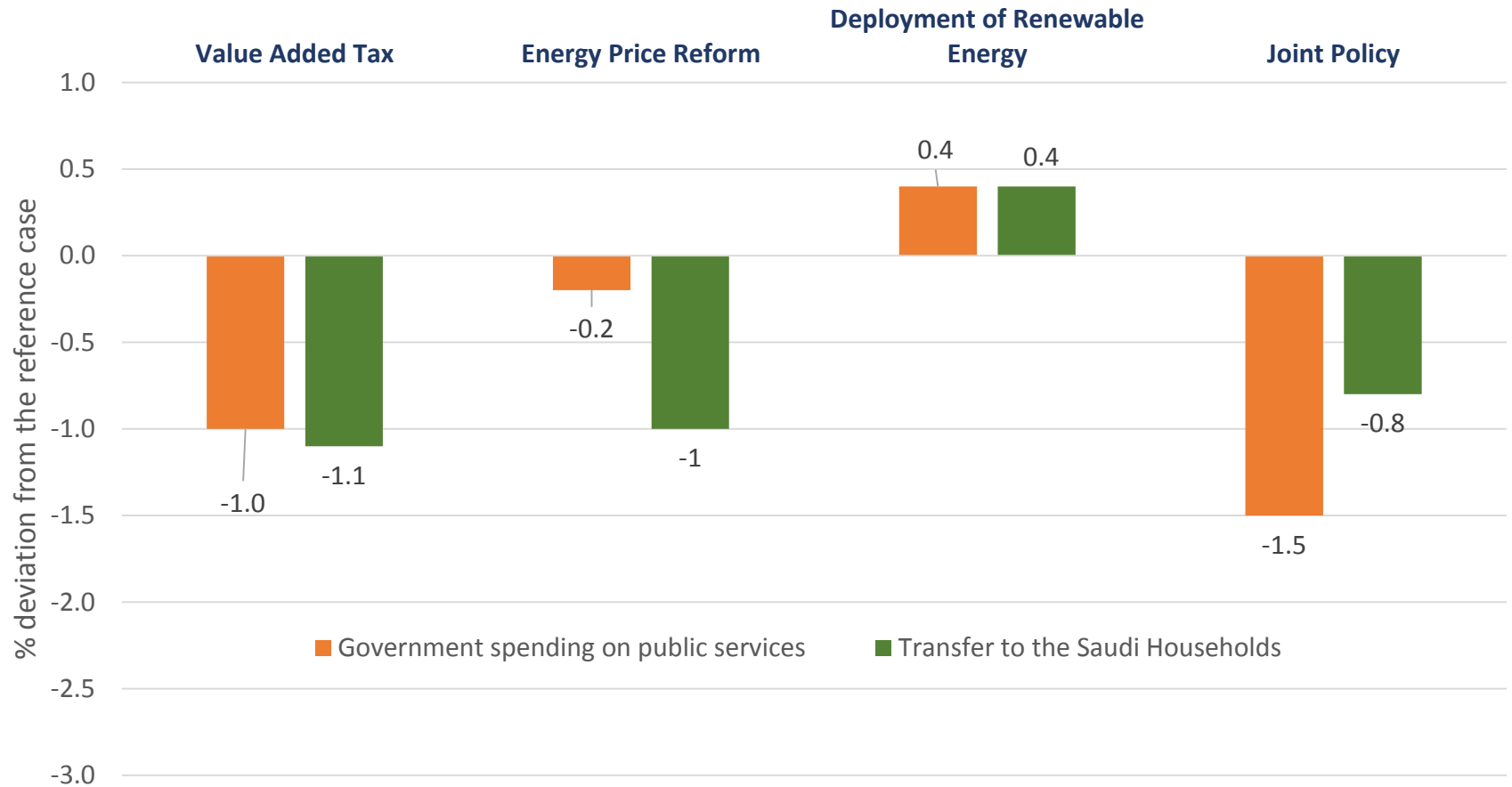
Deployment of Renewable Energy



Joint Policy

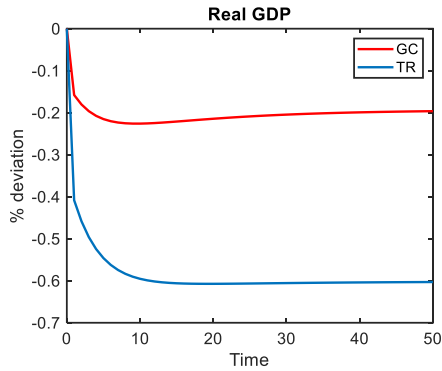


Effects on the Non-Oil Real GDP

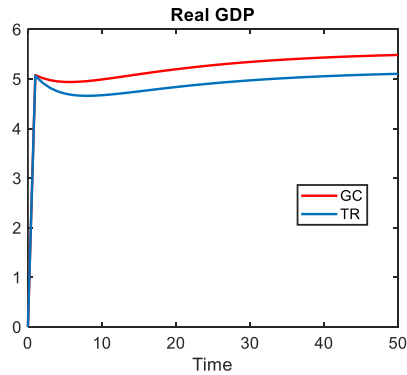


Effects on the Real GDP

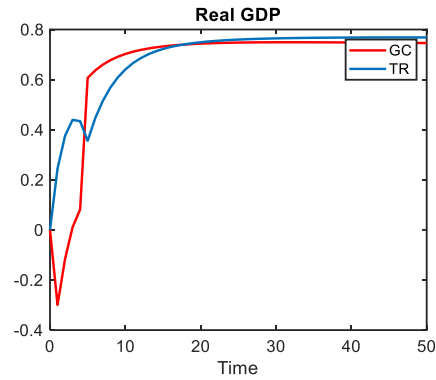
Value Added Tax



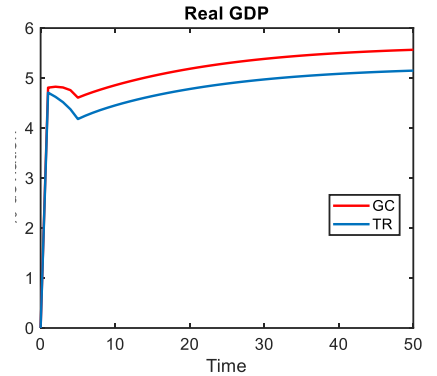
Energy Price Reform



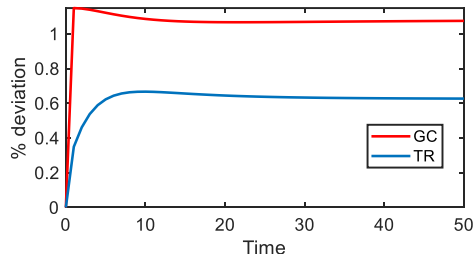
Deployment of Renewable Energy



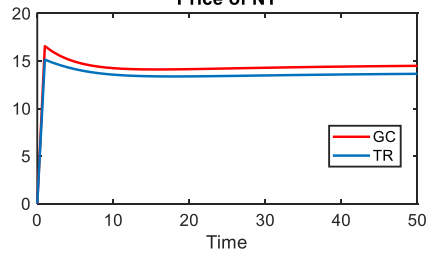
Joint Policy



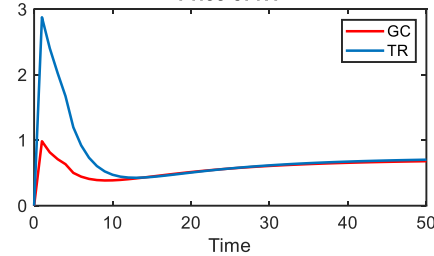
Price of NT



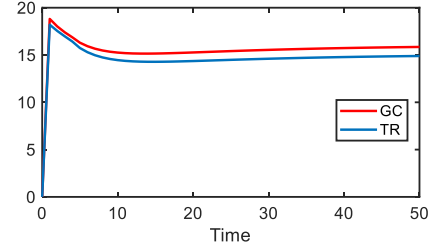
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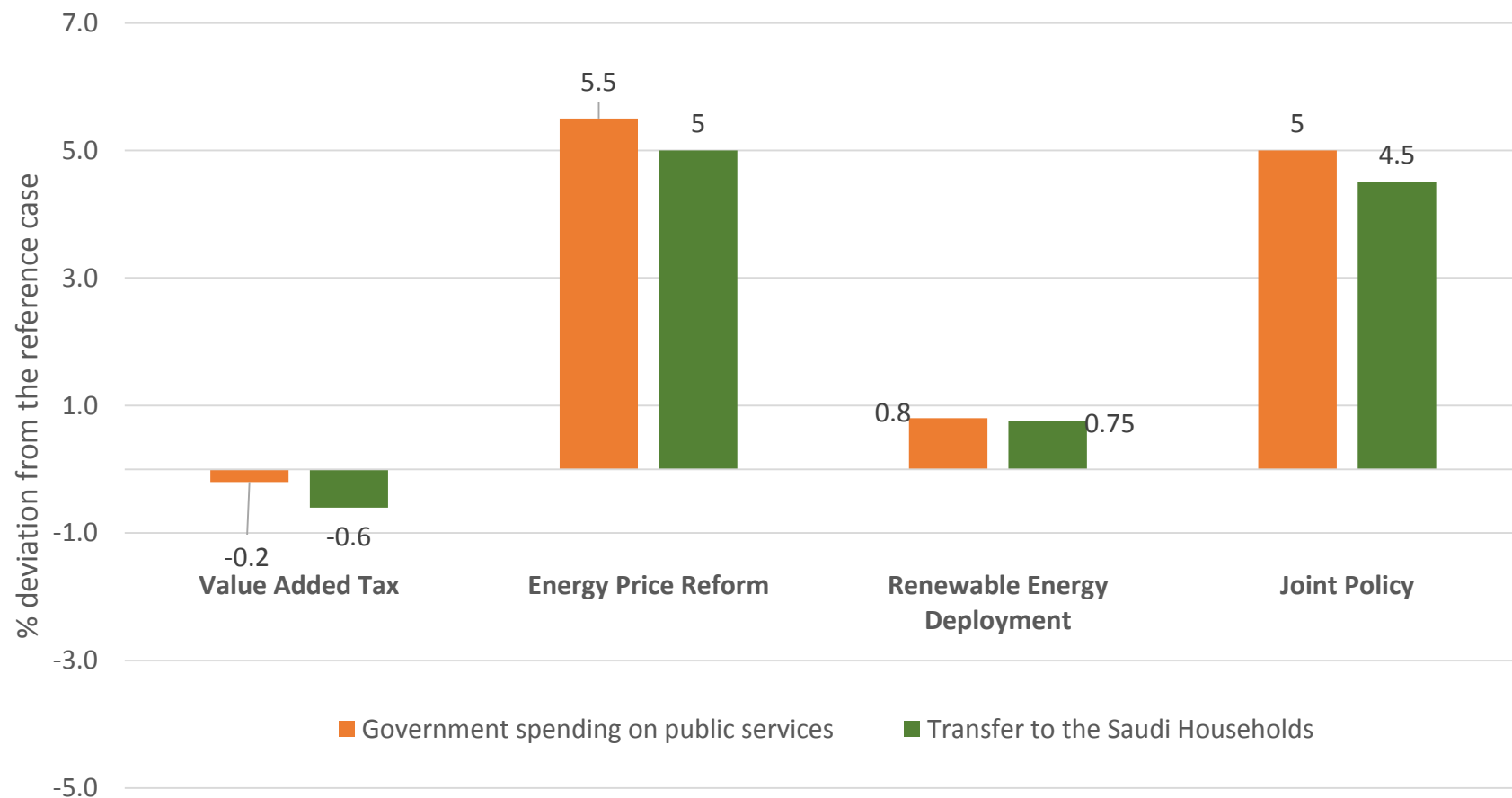
Price of NT



Price of NT



Effects on the Real GDP



Conclusions

- As the Saudi economy is heavily dependent on oil exports, reforms which reduce domestic energy consumption lead to increased oil exports.
 - Therefore, the impact of economic reforms on the Saudi economy depends upon how they impact the government's budget and on how revenues from taxes or oil exports are recycled back into the economy.
- Welfare gain:
 - VAT and Energy price reform policies result in surplus fiscal revenue. If the revenue is recycled to the economy through government spending or lump-sum transfers to the Saudi households, their welfare improves.
 - The deployment of renewables costs the government budget. The investment thus has a negative welfare effect to the Saudi households.
- Non-oil Real GDP:
 - Deployment of Renewables has a small positive impact which is relatively smaller than the negative impact from the other two policies.
- Real GDP:
 - VAT has a little negative impact and is nearly offset by positive impact from the deployment of renewables. Energy price reform has a large positive impact.
- The joint policy that combines the three policies shows a significant positive welfare effect to the Saudi households and also to the Real GDP but the policy has a negative effect on the Non-oil Real GDP.



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