Management of oil rent and diversification facing climate challenge: The case of Saudi Arabia

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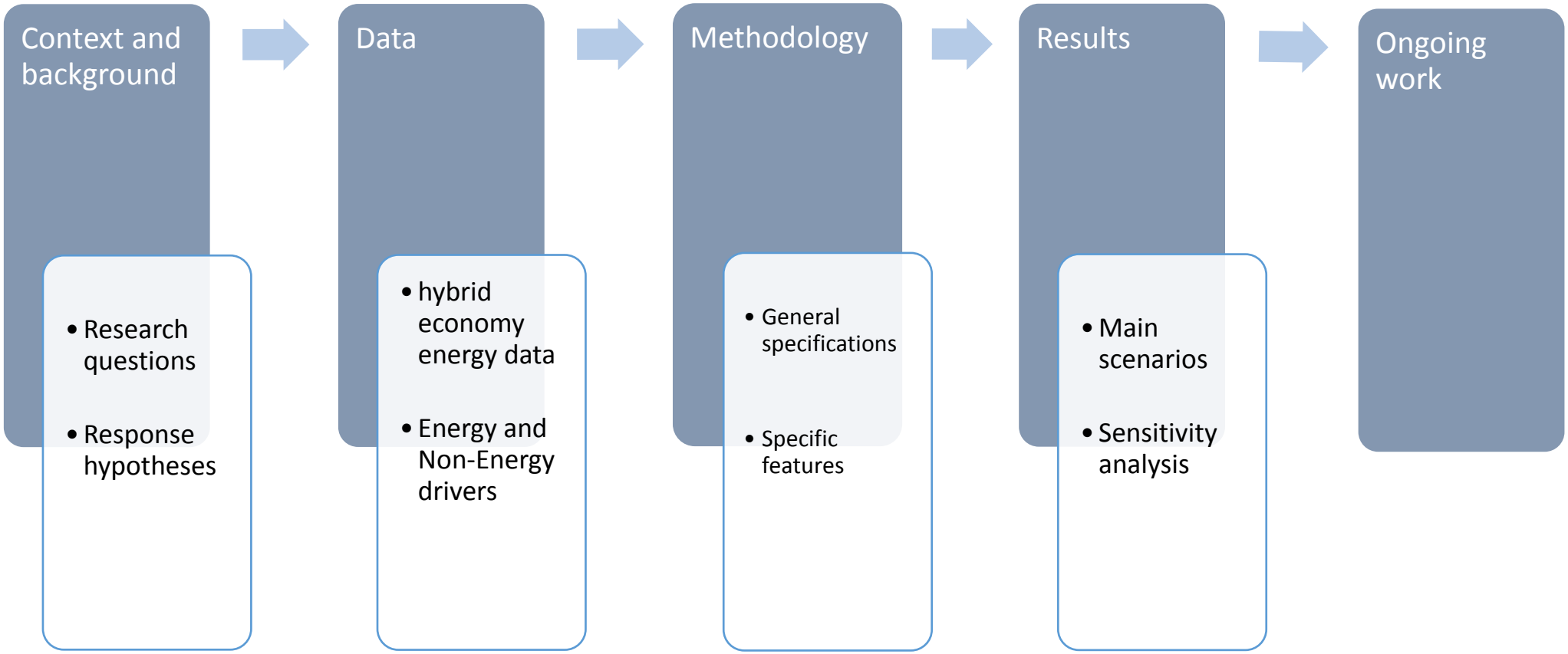
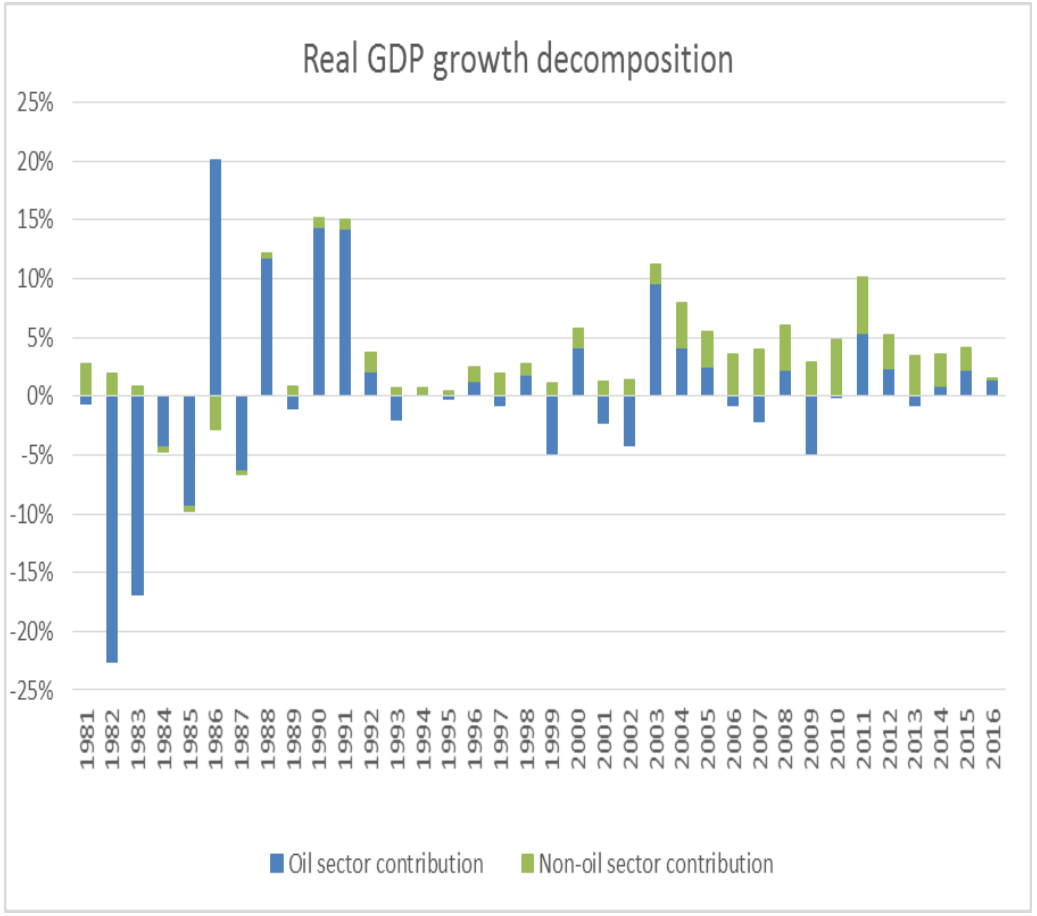
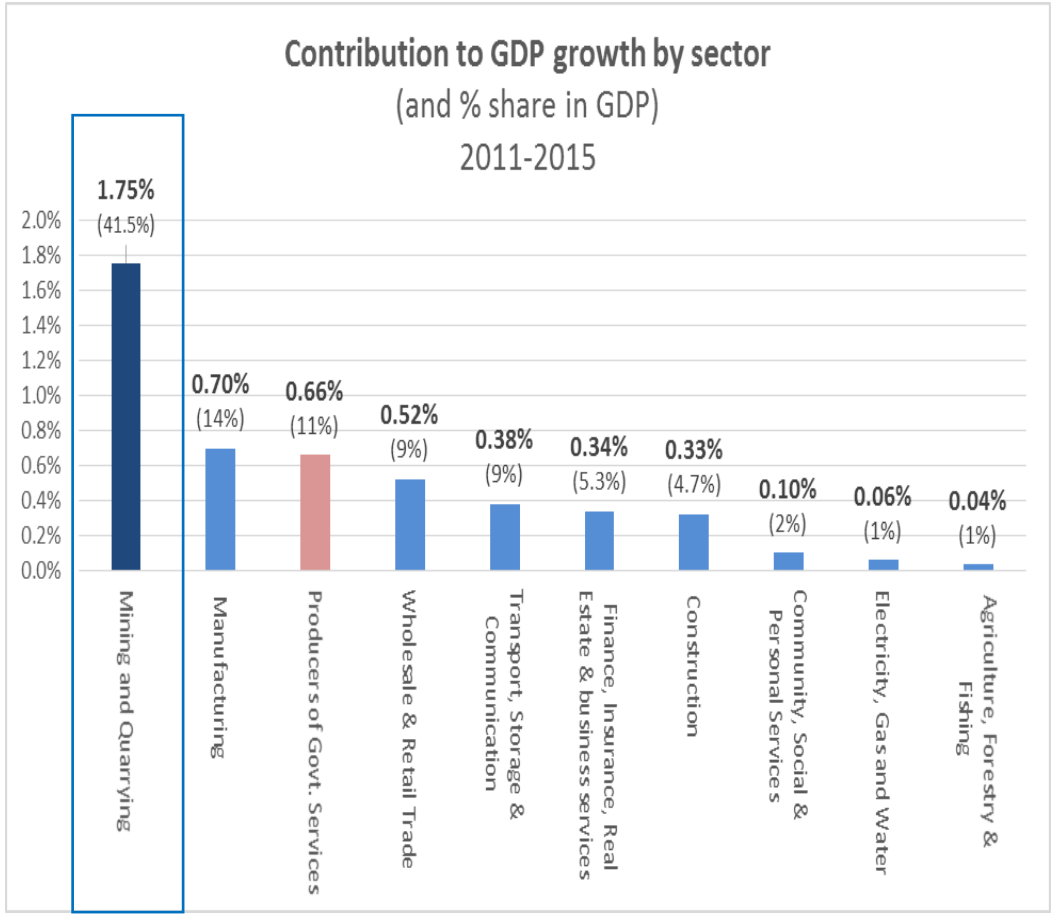
Outline


Context and background
• Research questions
• Response hypotheses
Data
• hybrid economy energy data
• Energy and Non-Energy drivers
Methodology
• General specifications
• Specific features
Results
• Main scenarios
• Sensitivity analysis
Ongoing work

Issue : Saudi Arabia is still characterized by a heavy reliance on oil sector





Sources: GAS, Oxford Economics, authors' estimations

- Oil sector: 42% of GDP, 85% of total revenues, 77% of exported products.
- Current low levels of oil price could last over the medium-term (IEA, 2016).
- Existing works suggest that oil exporters would experience losses due to global climate policies (Barnett et al., 2004 ; Waisman et al., 2013) because of weakening of global oil demand (Verbruggen and Van de Graaf, 2015).

Context and research questions: reminder

- ***Internal factors***

- Reliance of KSA on oil industry (revenues, exports)
- Diversification plans did not fully meet expected results.
- Current trends of domestic energy consumptions seems unstained.

- ***External factors***

- Concerns about weakening of global oil demand.
- Low oil prices level could become the *'new normal'*.

Research objectives

➢ What could be the gains/losses for KSA associated with a low-carbon transition scenario?

➢ How KSA could ensure its transition, both on economy and energy aspects?

Hypotheses

- At current trends, KSA could not face a scenario of depressed oil prices over the long-term.
- There are few relatively successful diversification cases (from natural-resource dependent to a diversified economy).
- Energy reforms aiming at diversifying energy mix would ‘free’ additional export capacity and add fiscal revenues.

Approach and expected results

- A General Equilibrium model.
- Threefold purpose: economy, energy, environment.
- Focus on feedback from international oil market (demand/price) on KSA, and potential impacts of KSA energy/environmental policies.
- Aiming at deriving consistent (economy/energy/environment) growth pathways with regard to structural change.

1 st step: construction of the hybrid economy/energy/environment matrix

Economy

I-O table, 19 sectors (for 2011) → (1) → I-O table 23 sectors → (2) → Accounting for strictly energy bills for energy sectors → (3) → Table with Energy/Composite goods

(1) Using information from I-O tables for KSA from OECD and GTAP in order to disaggregate manufacturing industries, transportation modes and aggregate commercial and public services.
(2) Using information from energy suppliers, such as refinery capacity of Aramco and installed capacity of SEC, in order to isolate integrated activities.
(3) Assuming that remainder of energy bills correspond to energy services, thus added to commercial services.

Energy

IEA Energy Balance (for 2011) → (1) → IEA with strictly physical flows with monetary counterpart → (2) → Estimation of commercial flows → (3) → Substitution of commercial flows in IOT.

(1) Deleting non-energy uses, absorption of statistical differences, distribution of bunker uses, treatment of auto-production, transfers, and stocks.
(2) Using price information from external sources (ECRA, literature, etc.).
(3) Where energy bills are : observed prices x quantities from EB.

Contribution: consistency of economy/energy inputs for modeling exercise

1st contribution:

- Revealing oil rent
  - As the difference between extraction cost of oil (409 Mtoe at 117 SAR/toe) and total uses (mainly exports at international price).
  - Oil rent amounted 41% of GDP.
- Revealing electricity subsidy
  - As the difference between production cost of 372 SAR/MWh and average selling price of 134 SAR/MWh.
  - Subsidies for electricity amounted 77 Bn SAR.

2nd contribution:

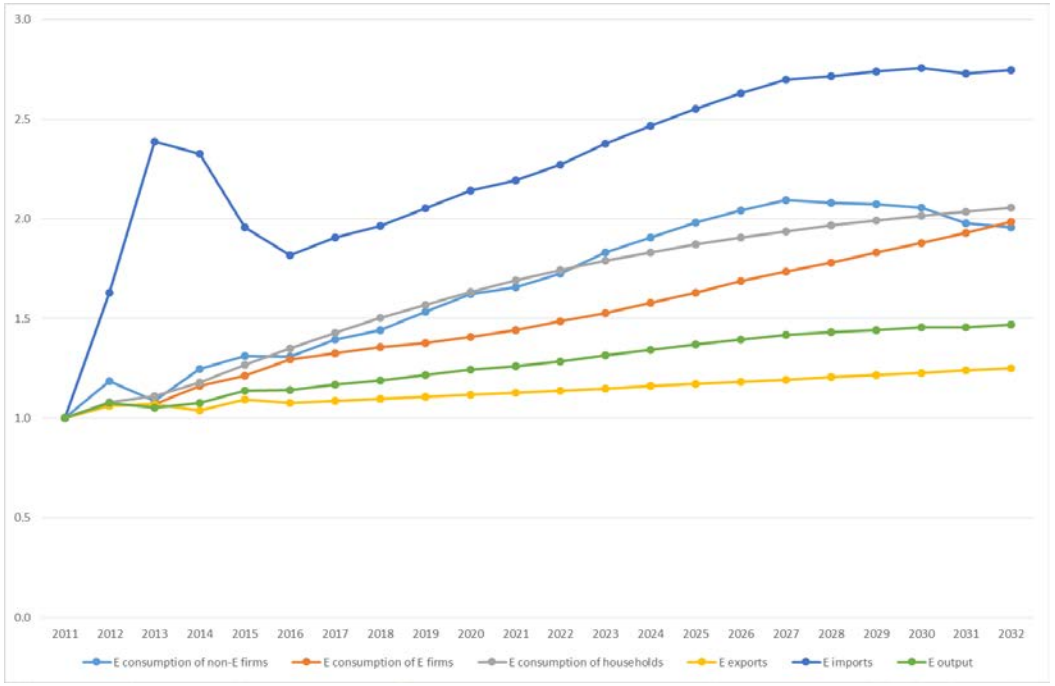
- Agent-specific energy pricing
  - Introduction of specific margins to represent the difference with average output price (i.e. total output / total quantity).

Illustration: 2-sector table

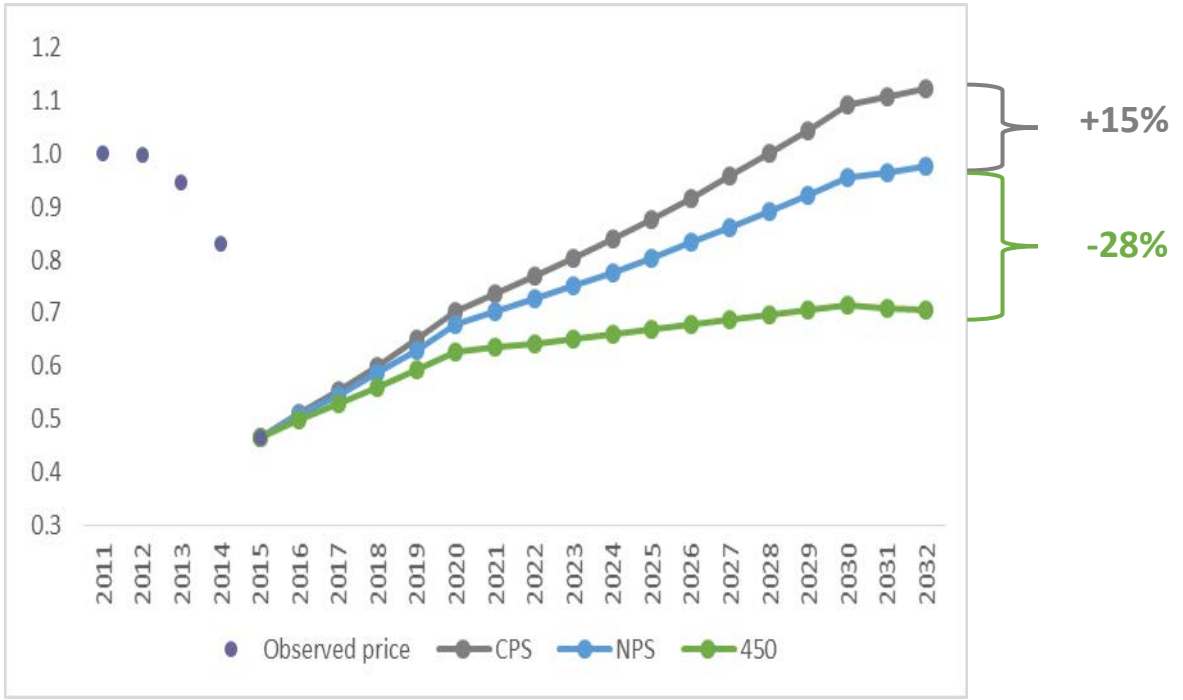
IOT, MSAR	Prod. Q	Prod. E	C	G	I	X	
Q uses	875 657	144 187	687 081	488 062	568 792	197 227	2 960 976
E uses	56 505	9 012	14 757	-	-	1 213 612	1 293 916
L net	436 816	51 291					
Y taxes	635	2 323					
K	844 689	113 201					
R	3 392	1 018 697					
M	648 971	32 231					
SM use in Q	-	-121 359					
SM use in E	-	-151 781					
SM use in C	-	-17 068					
SM use in X	-	290 208					
Sales taxes	94 310	-77 025					
	2 960 976	1 293 916					

Model inputs: Energy drivers

- We base domestic energy uses on KEM baseline scenario, *Administered price with quotas.*
- Energy exports trend based on scenarios from IEA (for crude oil) and OPEC (for refined products), we do not assume a loss of market share.
- Imports at a fixed share (6.6%) of total energy consumption.
- We derive energy price based on oil price scenarios of the IEA. Import price correspond to export price plus constant refining margins (+22%).



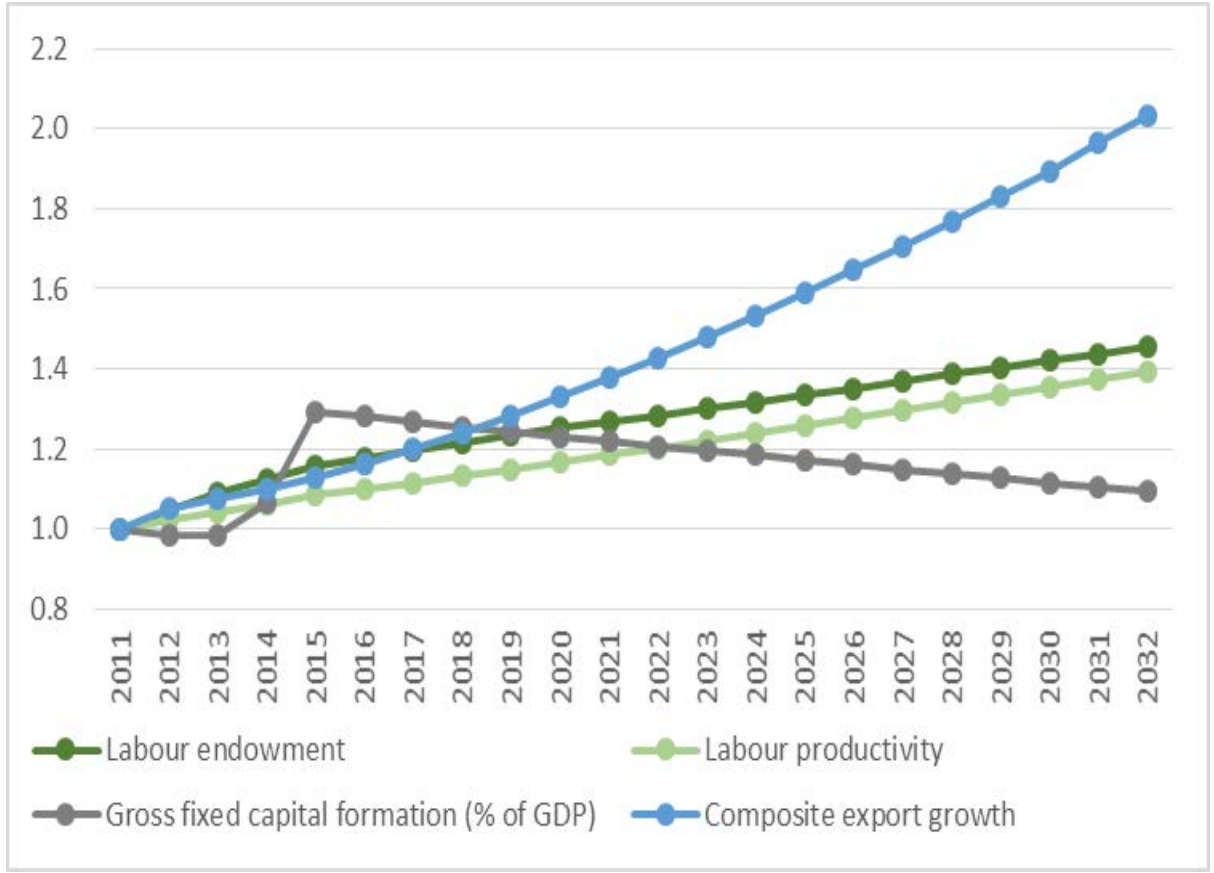
Estimated domestic demand growth for sectors consumptions and trade relative to 2011 (Source: KEM, IEA, authors' computations)



Real oil price relative to 2011 price (source: IEA, 2016)

Model inputs: Non-energy drivers

Variables	Description
Labor endowment ($\bar{L}$)	Extracted from ILO, where labor endowment increases by 1,9%/y on average between 2011 and 2032.
Labor productivity ($\boldsymbol{\Phi}$)	Between 2011 and 2012, we increase labour productivity at a rate of 2%/year. Between 2016 and 2032, we assign a rate of 1.5%/year to productivity growth. This rate is close to average productivity of 1.3/year over 2011-2015 for the overall economy from Al-Sadoun and Al-Khareif (2016).
Non-energy exports trend ($\boldsymbol{\delta_x}$)	Following growth of MENA zone, extracted from IMF WEO up to 2021, assumed growing at constant rate up to 2032 at 3.6%/year.
Investment rate (s_I)	Ratio of fixed capital formation to GDP, converging towards a target of 25% in 2032.



Non-energy drivers trajectories relative to 2011

(source: ILO, IMF, authors' computations)

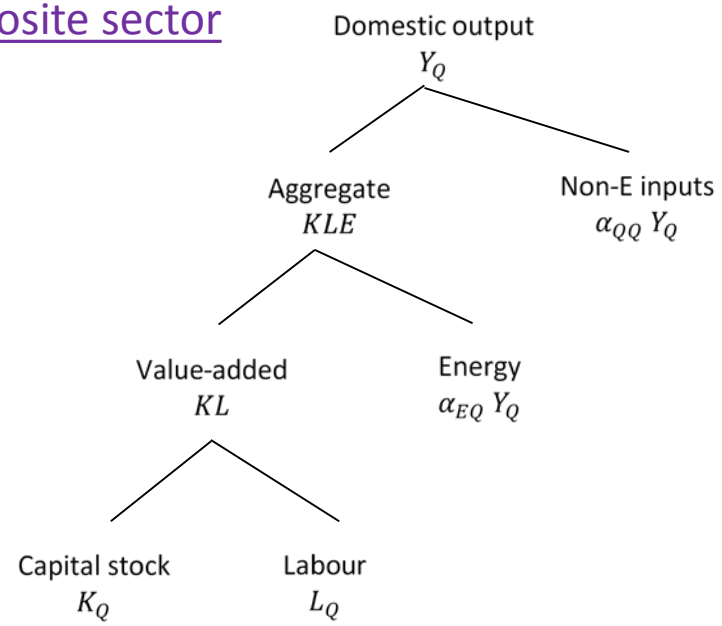
Logos from GAS.

Methodology of KLEM-KSA : Main features

General specifications

- Dynamic-recursive CGE.
- Solow growth model with standard accumulation rule $K_{t+1} = (1 - \delta)\, K_t + I_t,$ where δ=4%.
- Investment as exogenous share of GDP: $p_{I,t}\, I_t = s_{I,t}\, GDP_t$.
- Full exogeneity of energy block (with assumptions detailed previously).
- Constrained capital mobility: capital in energy sector cannot decrease faster than depreciation rate δ, in order to accommodate for potential large drop in energy production.
- Under-utilization of labor (i.e. unemployment): unemployment rate is elastic to real wage. Elasticity of 10% following Blanchflower and Oswald (2005).

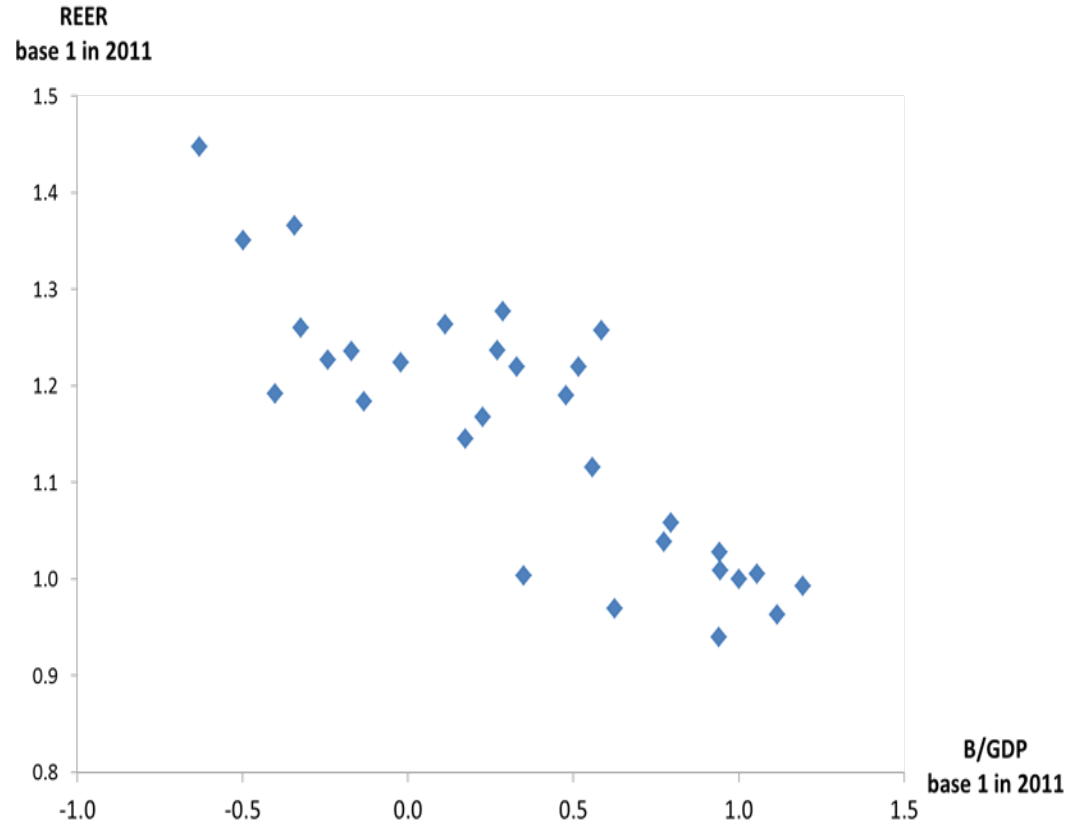
Specific to composite sector



- Nested production function, with CES specification. Elasticities from Okagwa and Ban (2008).
- Non-energy trade (mainly oil-related products) and imports based on Armington specification. We assume low non-energy trade elasticies.

Methodology of KLEM-KSA: where this model stands compared to existing literature ?

- Closure rule deviates from standard specification with a flexible trade balance and real exchange rate.
- Al-Thumairi (2012) and Al-Hawwas (2010) use CGE model with flexible/fixed real exchange and fixed/flexible trade balance.
- Chemingui and Lofgren (2004), model closes on domestic (households' savings). Closure rule cannot be ascertained in De Santis (2003).
- Adding disturbance factors as deviation from observed values (2012-2015) for: Trade balance, labor productivity, capital productivity in order to match observed GDP, trace balance and unemployment. We assume a convergence to average value of 2011-2015 in 2032.

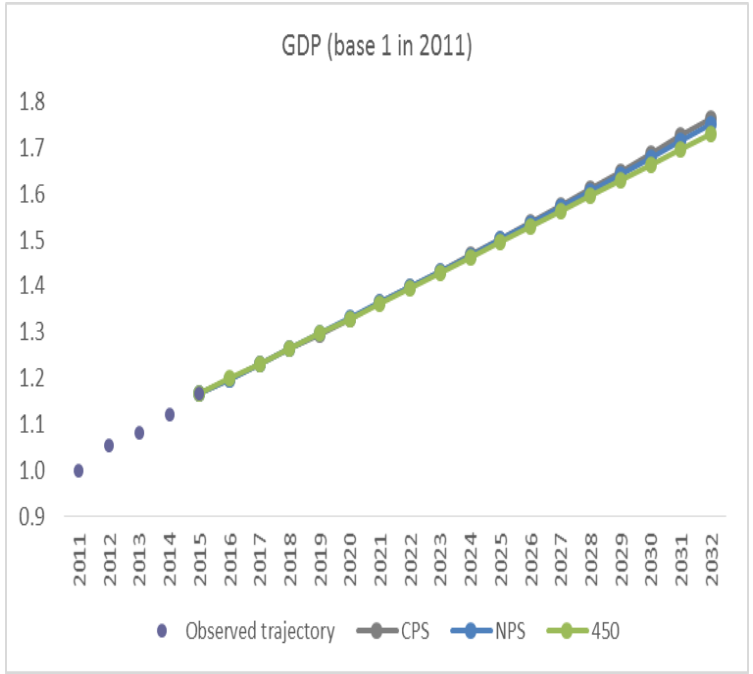


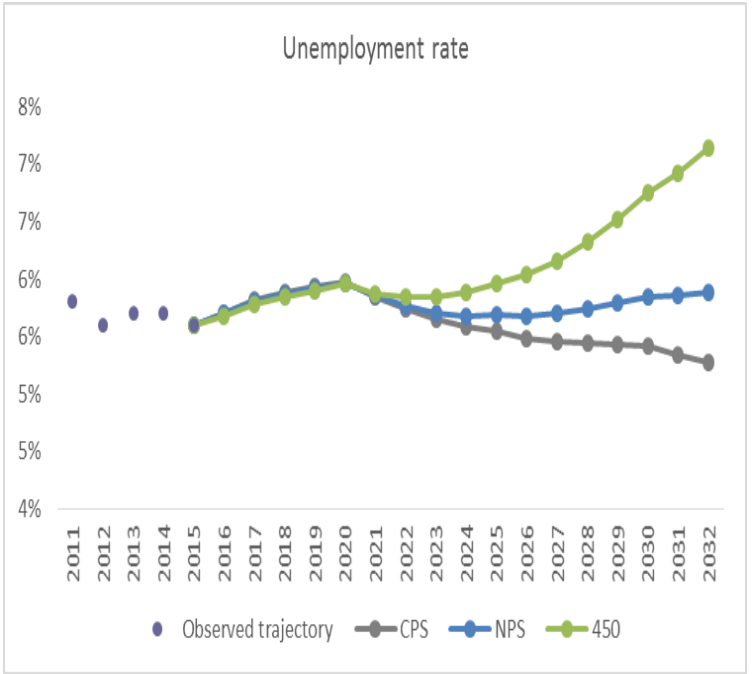
REER and share of B in GDP, yearly observations from 1986 to 2015
Source: Authors' computation on The World Bank data.

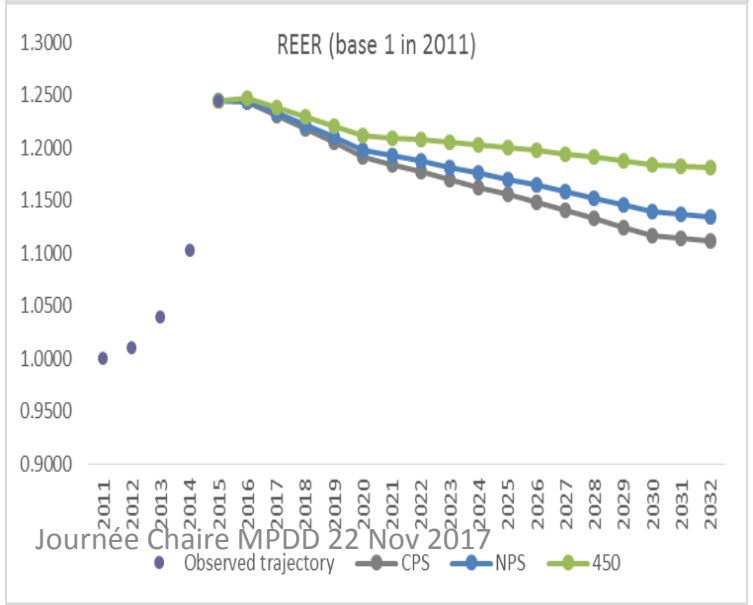
Results: higher oil prices drive trade balance, implying higher growth

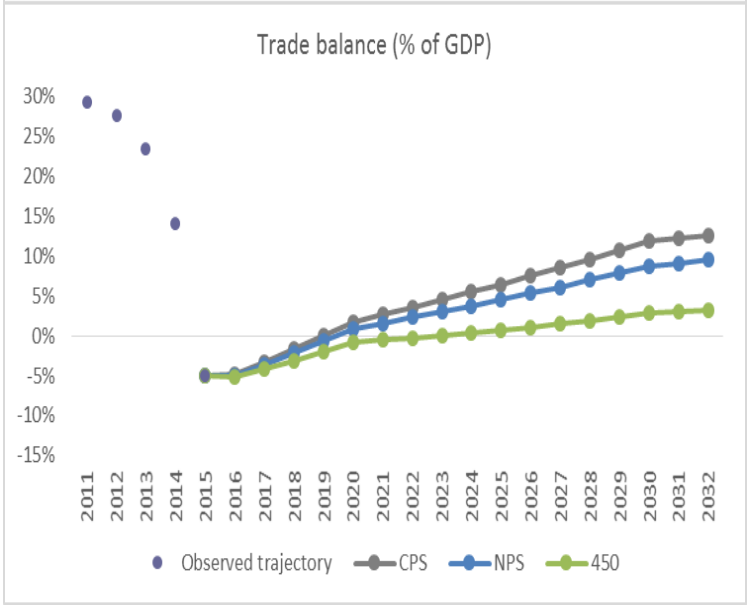
- By 2032:

  - Real export in *CPS* are 11% higher compared to *NPS*, and 21% percent lower in the *450S.*
  - Simulation results show a loss of 1.6% of real GDP by 2032 in the *450S* compared to *NPS*.
  - Real wage is 3.6% lower in *450*, and unemployment 1.5 pp higher.
  - REER depreciates slowly in the *450*, and will be 5.5% higher than *NPS.*



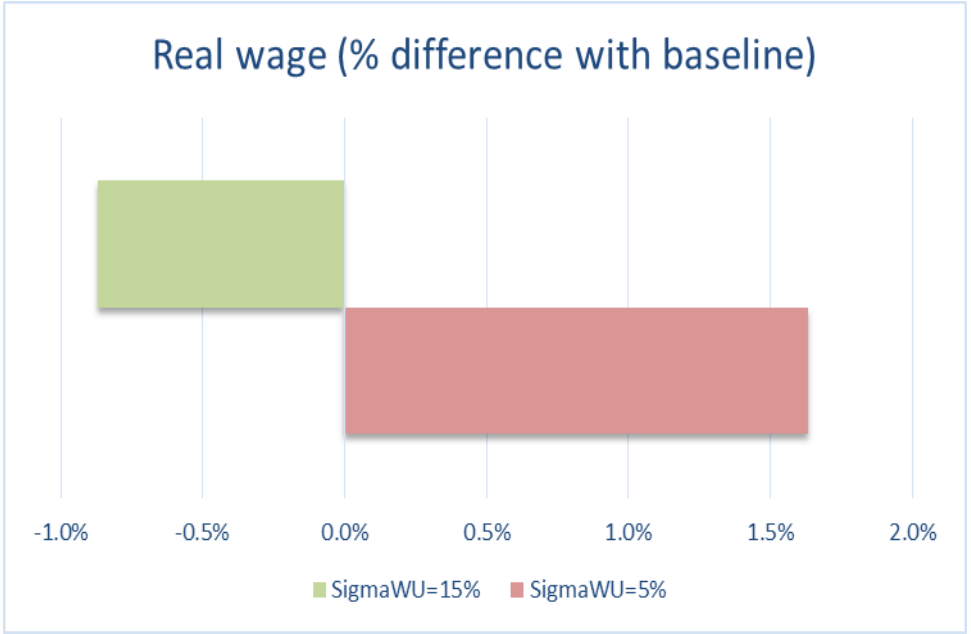


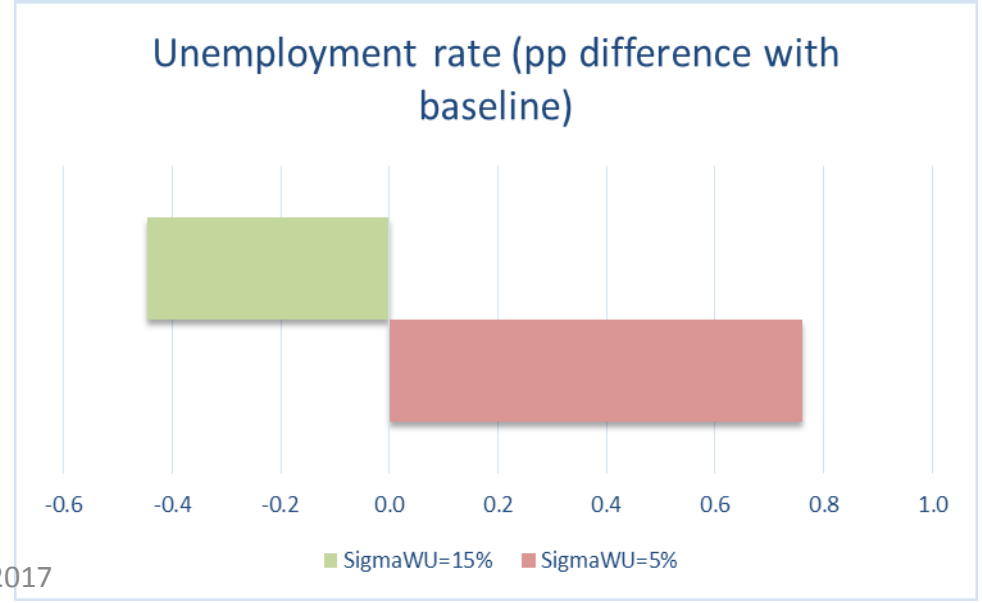




Sensitivity analysis (1): wage flexibility improves unemployment

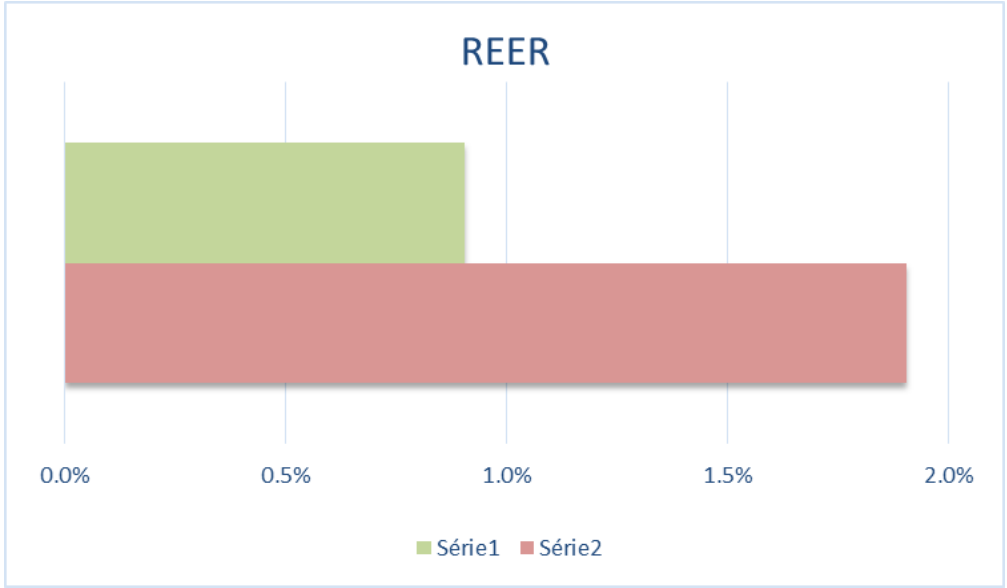
- In *450* with baseline specifications (i.e. sigma WU=10%), unemployment would reach 7.7% in 2032.
- Increasing unemployment/real wage elasticity reduces real wage, thus clearing unemployment.
  - Increasing elasticity (i.e. sigmaWU=15%) reduces unemployment by almost half *pp.*
- Reducing elasticity of unemployment to wages would worsen unemployment.
  - An elasticity of 5% increases unemployment by 0.8 *pp.*
- In the case of KSA, increasing labor market flexibility requires:
  - Improving training and education => increase mobility across sectors.
  - Support attractiveness of private sector by reducing protected work in public sector.

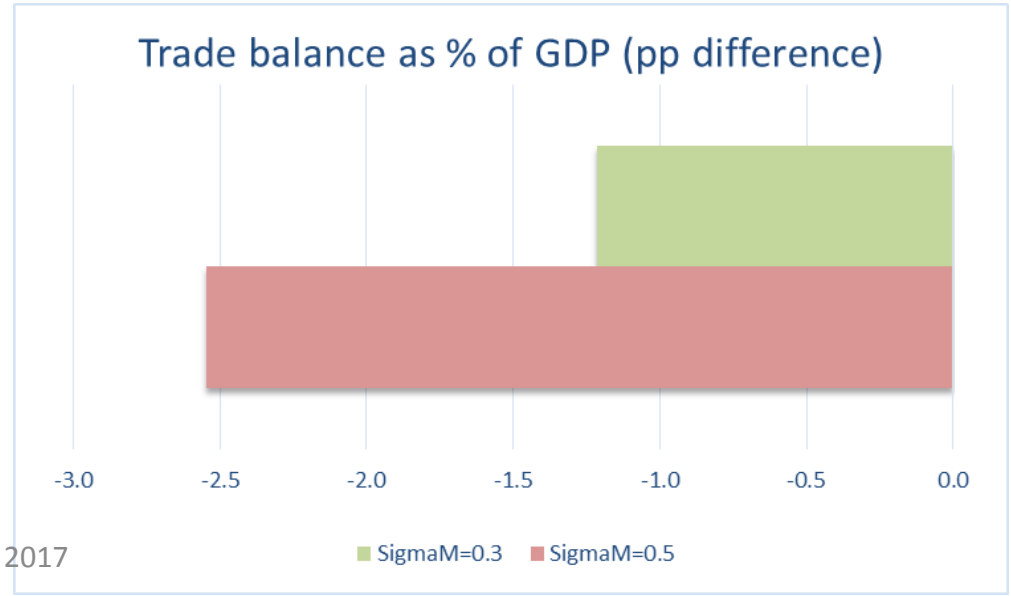




Sensitivity analysis (2): imports flexibility improves real exchange rate and growth

- Real exchange rate depreciates less with a higher imports elasticity.
  - REER is 2% higher with an elasticity of 0.5 compared to baseline.
- Strength of REER increases imports.
  - Real imports would increase by 10% with an elasticity of 0.5 compared to baseline.
- Private consumption increases
  - An import elasticity of 0.5 improves real private consumption by 6% compared to baseline.
- KSA could achieve higher imports flexibility by:
  - Ensuring competitive domestic substitutes.
  - Allowing exchange rate to reflect economic performance and perspective.





Ongoing work: Multisector analysis with structural change

- With regard to economy

  - Assessing impacts of various exports scenarios:
    - Impact of loss of market share.
    - Contrasted price scenarios.

  - Assessing contribution of alternative sectors:
    - Change in sectoral contribution to GDP.
    - Strategies to achieve this transformation (i.e. from past international experience with common challenge).

- With regard to energy/environment

  - Impact of global commitment on Saudi economy.
  - Impact of Saudi energy strategy on global supply.
  - Is transformation strategy consistent with Saudi NDC?

Ongoing work: contribution to reconcile economy/energy/environment targets

- With regard to economy
  - How KSA could benefit from its resources (natural and human) to achieve diversification?

- With regard to energy sector
  - What is the cost/benefice of decarbonizing KSA energy mix?

- With regard to labour market
  - Taking into account heterogeneity of labour supply (nationals vs. foreigners).
  - Assessing potential impact of economy/energy transformation on employment.

Thank you for your attention