The 2014 Oil Price Collapse and the Diverse Tales of Three Oil Exporters

Samya Beidas-Ström and Marco Lorusso
ICD Seminar
13th March 2018
Central questions

• What has been the impact of the 2014 oil price collapse on oil exporters’ key macro variables?

• Are oil exporters’ economic structures and policy instruments/toolkits similar? If not, how different are they, and why is this distinction important?

• Given these differences, what is the best approach to fiscal consolidation in oil exporting economies?

• Does the global shift away from fossil fuels bode ill for oil exporters? Or can they support growth in their economies while oil is cheap? If they do, are their side effects?

• How can policy makers in these oil exporting economies better calibrate or target fiscal and other reforms to support medium-term output growth, without building up vulnerabilities?
Outline of Presentation

• Stylized facts from three oil exports: Russia, Saudi Arabia and the U.K.
• Modelling these oil exporters
• Estimation of our models—different underlying structures and rich policies
• Responses from fiscal and oil intensity shocks
• Drivers of output volatility in 2014
• Scenarios for better outcomes
• Conclusions and policy implications
Oil prices and TOT co-move reflecting exchange rate regime and extent of diversification

UK

Saudi

Russia
Public spending and oil prices

Saudi

Russia

SA GOV CONS / GDP (%)

RU GOV CONS / GDP (%)

SA Government Investment / GDP (%) vs Nominal Oil Price (US $)

RU Government Investment / GDP (%) vs Nominal Oil Price (US $)
MODEL OVERVIEW
Households’ maximization problem

Max utility

\[ E_t \left\{ \sum_{j=0}^{\infty} \beta^j \left( \frac{Z_{1,t}^C \left( C_{1,t+j} - \kappa_1 C_{1,t+j-1} \right)^{1-\sigma_1}}{1-\chi_1 (1-L_{1,t+j})^{1-\chi_1}} \right) \right\} \]

s.t. budget constraint

UK

\[
\begin{align*}
(1 + \tau_{1t}^e) P_{1t}^c C_{1,t} + P_{1t}^c I_{1,t} + (R_{1t}^h)^{-1} B_{1,t+1}^f + \frac{\epsilon_{1,t} (R_{1t}^h)^{-1} B_{1,t+1}^f}{\phi_{1,t}^b} \\
= (1 - \tau_{1t}^e - \tau_{1t}^p) W_{1t} L_{1t} + R_{1t}^h K_{1,t-1} + (1 - \tau_{1t}^d) D_{1t} \\
+ (1 - \tau_{1t}^p) P_{1t}^h Y_{1t}^h + B_{1t} + \epsilon_{1,t} B_{1t}^f
\end{align*}
\]

Saudi

\[
\begin{align*}
(1 + \tau_{1t}^e) P_{1t}^c C_{1,t} + P_{1t}^c I_{1,t} + (R_{1t}^h)^{-1} B_{1,t+1}^f + \frac{\epsilon_{1,t} (R_{1t}^h)^{-1} B_{1,t+1}^f}{\phi_{1,t}^b} \\
= (1 - \tau_{1t}^e) W_{1t} L_{1t} + R_{1t}^h K_{1,t-1} + (1 - \tau_{1t}^d) D_{1t} \\
+ (1 - \tau_{1t}^p) P_{1t}^h Y_{1t}^h + B_{1t} + \epsilon_{1,t} B_{1t}^f
\end{align*}
\]

Russia

\[
\begin{align*}
(1 + \tau_{1t}^e) P_{1t}^c C_{1,t} + P_{1t}^c I_{1,t} + (R_{1t}^h)^{-1} B_{1,t+1}^f + \frac{\epsilon_{1,t} (R_{1t}^h)^{-1} B_{1,t+1}^f}{\phi_{1,t}^b} \\
= (1 - \tau_{1t}^e) W_{1t} L_{1t} + R_{1t}^h K_{1,t-1} + (1 - \tau_{1t}^d) D_{1t} \\
+ (1 - \tau_{1t}^p) P_{1t}^h Y_{1t}^h + B_{1t} + \epsilon_{1,t} B_{1t}^f
\end{align*}
\]

and private capital accumulation

\[
K_{1,t} = (1 - \delta_1) K_{1,t-1} + \left( 1 - S \left( \frac{I_{1,t}}{I_{1,t-1}} \right)^2 \right) Z_{1,t} I_{1,t}
\]
Produce three types of goods, two of which use oil:

(i) **Demand side**: Final private consumption goods sold to hhs, produced competitively:

\[ C_{1,t} = \left( (\omega_1^{cc})^{1+\rho_1^1} \left( C_{1,t}^{mc} \right)^{1+\rho_1^3} + (\omega_1^{oc})^{1+\rho_1^3} \left( Z_{1,t}^o O_{1,t}^c \right)^{1+\rho_1^3} \right)^{1+\rho_1^3} \]

After combining domestic consumption goods with imported foreign goods:

\[ C_{1,t}^{me} = \left( (\omega_1^e)^{1+\rho_1^1} \left( C_{1,t}^{d} \right)^{1+\rho_1^3} + (\omega_1^{mc})^{1+\rho_1^3} \left( Z_{1,t}^{m} M_{1,t}^c \right)^{1+\rho_1^3} \right)^{1+\rho_1^3} \]

(ii) **Private investment goods**, produced competitively, with imported foreign goods:

\[ I_{1,t} = \left( (\omega_1^{i})^{1+\rho_1^1} \left( I_{1,t}^{d} \right)^{1+\rho_1^3} + (\omega_1^{mi})^{1+\rho_1^3} \left( Z_{1,t}^{m} M_{1,t}^i \right)^{1+\rho_1^3} \right)^{1+\rho_1^3} \]
Produce three types of goods, two of which use oil:

(iii) Supply side: Intermediate domestic goods produced monopolistically:

\[
V_{1,t} (i) = \left( \left( \omega_1^k \right)^{\frac{\rho_1^i}{1+\rho_1^i}} \left( K_{1,t-1} \right)^{\frac{1}{1+\rho_1^i}} + \left( \omega_1^l \right)^{\frac{\rho_1^i}{1+\rho_1^i}} \left( Z_{1,t} L_{1,t} \right)^{\frac{1}{1+\rho_1^i}} \right)^{1+\rho_1^i}
\]

With public capital playing a key role in recent years ( unlike UK)

Russia & Saudi Arabia

\[
V_{1,t} (i) = \left( \left( \omega_1^k \right)^{\frac{\rho_1^i}{1+\rho_1^i}} \left( K_{1,t-1} \right)^{\frac{1}{1+\rho_1^i}} + \left( \omega_1^g \right)^{\frac{\rho_1^i}{1+\rho_1^i}} \left( K_{1,t-1}^g \right)^{\frac{1}{1+\rho_1^i}} + \left( \omega_1^l \right)^{\frac{\rho_1^i}{1+\rho_1^i}} \left( Z_{1,t} L_{1,t} \right)^{\frac{1}{1+\rho_1^i}} \right)^{1+\rho_1^i}
\]

Being s.t. time-to-build delays

\[
K_{1,t}^g = (1 - \delta_1^g) K_{1,t-1}^g + A_{1,t}^g \quad I_{1,t}^{q_d} = 1 - \delta A_{1,t-1}
\]

And thus total output production

\[
Y_{1,t} = \left( \left( \omega_1^{uy} \right)^{\frac{\rho_1^i}{1+\rho_1^i}} \left( V_{1,t} \right)^{\frac{1}{1+\rho_1^i}} + \left( \omega_1^{a} \right)^{\frac{\rho_1^i}{1+\rho_1^i}} \left( Z_{1,t} O_{1,t} \right)^{\frac{1}{1+\rho_1^i}} \right)^{1+\rho_1^i}
\]
Fiscal and monetary sectors

Different fiscal regimes as manifest in these budget constraints:

**UK**

\[
P_{it}^d G_{it}^d + B_{it} = r_{1,t}^{d} P_{it}^d C_{it} + \left( r_{1,t}^{w} + r_{1,t}^{v} \right) W_{it} L_{it} + \]

\[
\tau_{1,t}^d D_{it} + \tau_{1,t}^e D_{it} + \left( \tau_{1,t}^p + \tau_{1,t}^v \right) Y_{it} + (R_{1,t}^b)^{-1} B_{i,t+1}
\]

**Saudi**

\[
P_{it}^d G_{it}^d + p_{it}^s Y_{it} + B_{it} = r_{1,t}^{d} P_{it}^d C_{it} + \left( r_{1,t}^{w} + r_{1,t}^{v} \right) W_{it} L_{it} + \]

\[
\tau_{1,t}^d D_{it} + \tau_{1,t}^e D_{it} + \left( \tau_{1,t}^p + \tau_{1,t}^v \right) Y_{it} + (R_{1,t}^b)^{-1} B_{i,t+1}
\]

**Russia**

\[
P_{it}^d G_{it}^d + p_{it}^s Y_{it} + B_{it} = r_{1,t}^{d} P_{it}^d C_{it} + \left( r_{1,t}^{w} + r_{1,t}^{v} \right) W_{it} L_{it} + \]

\[
\tau_{1,t}^d D_{it} + \tau_{1,t}^e D_{it} + \left( \tau_{1,t}^p + \tau_{1,t}^v \right) Y_{it} + (R_{1,t}^b)^{-1} B_{i,t+1}
\]

where tax elasticities are estimated

Different monetary regimes as manifest in these Taylor rules:

**UK**

\[
i_{1,t} = \frac{1}{\gamma_1} i_{1,t-1} - \frac{1}{\gamma_1} + (1 - \gamma_1) \left[ \frac{\pi_{1,t}^{core} - \pi_{1,t}^{core}}{\pi_{1,t}^{core} - \pi_{1,t}^{core}} \right] + \frac{\gamma_1 (\pi_{1,t}^{core} - \pi_{1,t}^{core})}{\pi_{1,t}^{core} - \pi_{1,t}^{core}} + \gamma_1 \gamma_{1,t}^{gap}
\]

where:

\[
i_{1,t} = R_{1,t}^b - 1
\]

**Saudi & Russia**

\[
i_{1,t} = \frac{1}{\gamma_1} i_{1,t-1} - \frac{1}{\gamma_1} + (1 - \gamma_1) \left[ \frac{\pi_{1,t}^{core} - \pi_{1,t}^{core}}{\pi_{1,t}^{core} - \pi_{1,t}^{core}} \right] + \frac{\gamma_1 (\pi_{1,t}^{core} - \pi_{1,t}^{core})}{\pi_{1,t}^{core} - \pi_{1,t}^{core}} + \gamma_1 \gamma_{1,t}^{gap} + \gamma_1 \left( r_{1,t} - r_{1,t-1} \right)
\]

where:

\[
i_{1,t} = R_{1,t}^b - 1
\]
Full set of fiscal tax rules

\[ \hat{\tau}^c_{1,t} = \psi_1^{cc} \hat{c}_{1,t} \]
\[ \hat{\tau}^l_{1,t} = \psi_1^{ly} \hat{y}^d_{1,t} + \psi_1^{lb} \hat{b}_{1,t-4} \]
\[ \hat{\tau}^{wh}_{1,t} = \psi_1^{wb} \hat{b}_{1,t-4} \]
\[ \hat{\tau}^{oc}_{1,t} = \psi_1^{ococ} \hat{\sigma}^c_{1,t} \]
\[ \hat{\tau}^{wf}_{1,t} = \psi_1^{wb} \hat{b}_{1,t-4} \]
\[ \hat{\tau}^d_{1,t} = \psi_1^{dd} \hat{d}_{1,t} \]
\[ \hat{\tau}^{yo}_{1,t} = \psi_1^{yopo} \left[ \frac{\hat{\rho}^o}{\hat{\rho}_{GDP}} \right]_{1,t} \]
Underlying structural features of oil economies—not all are alike:

- Although Russia and Saudi Arabia have big public spending ratios similar to UK, due to big role of the state in economy and welfare state, investment spending is smaller and:
  - Saudi Arabian HHs prefer to supply less labor
  - Both HHs face higher borrowing costs
  - Both are more capital intensive:
    - Capital especially large in goods production
    - And in imported capital Saudi goods production
  - Both more oil intense in consumption and production, with latter particularly large—both open up room for more adequate taxation
  - Russia’s consumption is less heavily weighted in imports—unlike the UK and Saudi
  - Public capital in both faces time-to-build delays and depreciates less than private capital
  - Wages and prices are more rigid or indexed in Russia and Saudi than in the UK, holding back potential output

<table>
<thead>
<tr>
<th>Estimated structural parameters</th>
<th>$\delta^g_1$</th>
<th>$\Phi^g_i$</th>
<th>$L^{SS}$</th>
<th>$\phi^b_1$</th>
<th>$\phi^k_1$</th>
<th>$\phi^{kg}_1$</th>
<th>$\omega^o_1$</th>
<th>$\omega^{oc}_1$</th>
<th>$\omega^{mc}_1$</th>
<th>$\omega^{mi}_1$</th>
<th>$(g^d_1)^{SS}$</th>
<th>$(r^d_1)^{SS}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>--</td>
<td>--</td>
<td>33</td>
<td>0.01</td>
<td>25</td>
<td>--</td>
<td>3</td>
<td>2</td>
<td>34</td>
<td>40</td>
<td>20</td>
<td>--</td>
</tr>
<tr>
<td>Russia</td>
<td>1.5</td>
<td>50</td>
<td>40</td>
<td>0.05</td>
<td>31</td>
<td>5</td>
<td>25</td>
<td>8</td>
<td>18</td>
<td>21</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>1.5</td>
<td>50</td>
<td>25</td>
<td>0.02</td>
<td>35</td>
<td>4</td>
<td>31</td>
<td>9</td>
<td>31</td>
<td>55</td>
<td>19</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>$\kappa_1$</th>
<th>$\xi^w_1$</th>
<th>$\xi^p_1$</th>
<th>$l^w_1$</th>
<th>$l^p_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>92</td>
<td>32</td>
<td>72</td>
<td>32</td>
<td>45</td>
</tr>
<tr>
<td>Russia</td>
<td>50</td>
<td>65</td>
<td>62</td>
<td>22</td>
<td>90</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>75</td>
<td>80</td>
<td>59</td>
<td>28</td>
<td>74</td>
</tr>
</tbody>
</table>
Policy toolkit differs—not all oil exporters are alike:

**Policy levers**
- Unlike the UK which taxes oil and labor more than other sectors, and whose monetary policy favors fighting inflation and interest rate volatility
- Saudi firms and HHs least taxed, whose monetary policy favors targeting the level of the exchange rate (peg)
- While Russia is an intermediate case

**Tax elasticities**
- UK makes full use of highly elastic VAT, with Saudi less so, opening room for further effort
- Russia makes full use of highly elastic CIT, with Saudi almost none, opening room for further effort
- Neither Russia nor Saudi have taxed fuel used in consumption or production, opening room for further effort

<table>
<thead>
<tr>
<th></th>
<th>(τ_{1}^{c})^{ss}</th>
<th>(τ_{1}^{l})^{ss}</th>
<th>(τ_{1}^{wh})^{ss}</th>
<th>(τ_{1}^{o})^{ss}</th>
<th>(w_{f})^{ss}</th>
<th>(τ_{1}^{d})^{ss}</th>
<th>(τ_{1}^{y})^{ss}</th>
<th>y_{1}</th>
<th>y_{1}</th>
<th>y_{1}</th>
<th>y_{1}</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>10</td>
<td>19</td>
<td>12</td>
<td>44</td>
<td>12</td>
<td>15</td>
<td>35</td>
<td>45</td>
<td>13</td>
<td>93</td>
<td>--</td>
</tr>
<tr>
<td>Russia</td>
<td>15</td>
<td>13</td>
<td>--</td>
<td>--</td>
<td>30</td>
<td>58</td>
<td>50</td>
<td>37</td>
<td>23</td>
<td>88</td>
<td>83</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>4</td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>71</td>
<td>19</td>
<td>29</td>
<td>20</td>
<td>108</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elasticities</th>
<th>VAT</th>
<th>Labor Income to GDP</th>
<th>Labor Income to public debt</th>
<th>Social security to public debt</th>
<th>Fuel taxes to oil demand</th>
<th>CIT to firm profitability</th>
<th>Taxes on natural resource sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>124</td>
<td>99</td>
<td>58</td>
<td>8</td>
<td>89</td>
<td>41</td>
<td>15</td>
</tr>
<tr>
<td>Russia</td>
<td>71</td>
<td>101</td>
<td>91</td>
<td>88</td>
<td>--</td>
<td>99</td>
<td>158</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>95</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>90</td>
<td>111</td>
</tr>
</tbody>
</table>
ESTIMATION—RESPONSES TO SHOCKS
Does it hurt?

Temporary pain for large and durable gains later

• Reducing size of Russian C₉ fruitful as estimated shock large and most persistent, $-\Delta\text{Debt}^{\text{gov}}$

• While output response to $-\Delta C₉$ hurts for 7 quarters, it’s a temporary pain

• As from the supply: the response of MP of all factors positive, esp. $+\Delta\text{MP}^L$, and competitiveness

• Reinforced from the demand side: HHS receive $+\Delta$ wealth effect, $-\Delta L^s$ and $+\Delta C_p$
Smaller gains from capital spending cuts

Does it hurt?

Less, with durable but smaller gains

- Saudi has the most persistent Ig shock, perhaps due to high correlation between Po and Ig, and large Ig share

- While $-\Delta Ig$ hurts Saudi Y initially, doesn’t affect Russian Y—with both $+\Delta Yp$ over MT

- Supply side channels dominate: $+\Delta MP^k$
Oil intensity has benefits, but dangerous in LT

Shifts away from fossil fuels—does it hurt oil exporters?

Medium term gains, but Dutch disease and vulnerabilities build

- Foreign oil intensity shock—i.e., demand for oil in ROW falls, reducing global Po
- Both Russia and Saudi are oil-intense in consumption and production, -so ΔPo results in a domestic boom in oil and labor demand, along with +ΔMPL,K
- While +ΔY, +ΔYp, only half of the +Δ absorption, i.e. large income windfall, with Dutch disease affects:
  - rer appreciates as pressure on relative NT/T from boom
  - +ΔDebtgov

![Graphs showing economic impacts of oil intensity on Saudi Arabia and Russia](image-url)
ESTIMATION—SHOCK DECOMPOSITIONS
Diverging output volatility drivers during 2014

Saudi Arabian economy started contracting 2012Q4, led by a domestic productivity collapse, with oil demand and supply attenuating. These roles reversed in 2014Q3, and in 2014Q3&4 weak foreign demand pushed the economy back into recession.

Prior to oil price collapse and Crimean war of 2014, the Russian economy was slowing on weak domestic and foreign confidence (e.g., low FDI), with oil supply and demand attenuating. 2014Q1 onwards, sanctions and oil price collapse led to a depreciating REER, IT thus interest rates were hiked temporarily hurting the economy.

Historical decomposition of GDP growth’s deviation from its mean
## What works best?

### Improving productivity

<table>
<thead>
<tr>
<th>No policy action</th>
<th>Floating the exchange rate</th>
</tr>
</thead>
</table>

**Russia**

- $\Delta Y, -\Delta RER, \Delta NX, \Delta INV$
- Channels: temporary and small
- $+\Delta$Non-oil prices and wages (no Balassa-Samuelson)

**Saudi Arabia**

- $\Delta Y, \Delta INV, -\Delta RER, \Delta NX$, but non-oil exports take 5 years to respond—NO DIVERSIFICATION—plus persistent
- $+\Delta$non-oil prices and wages (pressure on supply side); $+\Delta$interest rate

### Moving away from fossil fuels

<table>
<thead>
<tr>
<th>No policy action</th>
<th>Tax rate reforms</th>
</tr>
</thead>
</table>

**Russia**

- No difference

**Saudi Arabia**

- Key difference: Non-oil exports pick up immediately, despite much larger REER volatility. Why? $+\Delta$Non-oil prices and wage rise only a little and temporarily, but fall thereafter

- As before  
  Debt increase is marginal, while RER appreciation is very minor

- As before  
  Debt increase is marginal, while RER appreciation is very minor

- As before  
  Debt increase is marginal, while RER appreciation is very minor

- As before  
  Debt increase is marginal, while RER appreciation is very minor

- As before  
  Debt increase is marginal, while RER appreciation is very minor
POLICY IMPLICATIONS AND CONCLUSIONS
Bottom Lines and Policy Implications

• We have shown how the diverse underlying economic structures of oil exporters play a role in fiscal consolidation:
  – **Current spending**-led fiscal consolidation *has temporary contractionary effects*, as in text books or in the UK economy. But unlike the UK, current spending-led fiscal consolidation has *positive and durable medium-term effects*, especially in Russia, including an improvement in competitiveness.
  – **Capital spending**-led fiscal consolidation has *no temporary contractionary effects* in Russia and Saudi Arabia, unlike the text book and UK. But it’s *medium-term gains are smaller* than current spending led fiscal consolidation.

• When the global economy is doing well, a *decline in oil intensity* in the rest of the world (i.e., less oil used in consumption and production) surprisingly results in a semi-persistent domestic boom in these economies due to both supply and demand side factors and their own higher oil intensity. However, this boom results in Dutch disease and increasing vulnerabilities.

• To support medium-term growth, adjustment could target a *more flexible exchange rate in Saudi Arabia* if and only if there are reforms to support productivity gains.

• In the presence of *foreign oil intensity shocks*, i.e. a shift away from fossil fuels, tax reforms that shift the structure towards labor and fuel taxes, allows for a *reduction in debt and less Dutch disease*. 
Questions?

Contact us:  
sbeidasstrom@imf.org or m.lorusso@hw.ac.uk
Background

• **UK.** Post Brexit sterling depreciated, pushing up inflation, depressing private consumption, and business investment growth; growth moderated in 2017 despite significant monetary policy easing and strong trading partner growth; subdued in the near term; medium term growth depends on the extent of recovery of labor productivity

• **Russia.** Floated in Jan 2015 (stopped intervening and continued to hike interest rates); economy in 2017 stabilizing and coming out deep recession; but fiscal-state dominance and oil-dependency remain and structurally weak economy; suffered from Dutch disease in past; to lift growth diversify exports towards more complex and higher-value added products and services [and to sanction-free and faster growing trading partners]

• **Saudi Arabia.** Vision 2030 to diversify the economy; OPEC+ agreement to reduce oil supply & overall growth zero in 2017; but faster over MT due to structural reforms; 5% VAT introduced Jan 2018 but not enough to stem deficit/drain on NIR; reducing wage bill and administered utility prices would create room for pro-poor spending; removing obstacles to private sector led employment and growth. Exchange rate pegged.
And non-oil GDP Growth

UK Non-oil GDP Growth

Saudi Non-Oil GDP Growth