Boom or gloom? Examining the Dutch disease in two-speed economies

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Background

- Much theoretical work has been carried out analysing the benefits and costs of energy discoveries, but relatively few empirical studies.

- Traditional Dutch Disease (DD): Inverse long run relationship between increased exploitation of natural resources and growth in the manufacturing sector.
  - Resource Movement Effect
  - Spending Effect
  - Real appreciation that will hurt some sectors and benefit others.

- Does it fit the data?
  - Since the early 1990s Australia and Norway, two commodity exporters, have experienced aggregate growth rates up to 0.5 percentage points higher than comparable countries
  - The average growth in the manufacturing sector has not been significantly lower than in comparable countries.
  - But...
Boom or gloom? Stylized facts

Australia

Norway

Employment

Prices

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Resource boom

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What we do and how we contribute

- Extend the traditional Dutch Disease theory:
  - Standard Dutch Disease models do not account for productivity spillovers between the resource rich sector and the rest of the economy.
  - We assume learning by doing (LBD) in the traded and non-traded sectors, as well as **learning spillovers** between these sectors and from the resource rich sector, i.e., augment Torvik (2001).
    - E.g., Norway: Offshore oil extraction demands complicated technical solutions which could in itself generate positive knowledge externalities that benefit other sectors.

- Develop a structural Bayesian Dynamic Factor Model that:
  - Explicitly distinguishes between a resource gift that is due to commodity price disturbances and a **boom** in the resource sector itself.
  - Potentially takes into account all the direct and indirect spillovers among the sectors in the economy. Control for global activity and (non-resource) domestic activity.
  - Study applied to Australia and Norway.
Do resource gifts contribute to a **boom** in the domestic economy?

- Resource sector has large *(productivity) spillovers* on non-resource sectors in Australia and Norway. Effects not captured in previous analysis.

- Value added and employment increases in the non-traded relative to the traded sectors, contributing to a **two-speed** transmission phase.
Questions and answers

- How does the domestic economy respond to commodity price changes?
  - **Norway**: Value added and employment in the technologically intense service sectors and the government sector increase temporarily. But, substantial real exchange rate appreciation and reduced cost competitiveness.
  - **Gloom**: For Australia there is evidence of crowding out and an eventual decline in tradeable sectors, i.e., more classical Dutch Disease effects.

- But, if commodity price increases are caused by positive disturbances to global demand, the commodity exporting countries are positively affected.
The theory model

- New mechanism: Allow for direct technology spillovers from the resource boom \((R_t)\) to the non-resource sectors.

- Following Corden (1984): \(R_t\) is exogenous (measured in terms of traded sector productivity units) and is happening in one of two ways:
  1. An (unpredicted) technical improvement in the booming sector, represented by a favourable shift in the production function.
  2. A windfall discovery of new resources.

- Augment Torvik (2001): Assume both the traded and the non-traded sector can contribute to learning and that there are spillovers between these sectors, in addition to the direct productivity spillovers from resource sector.

- Control for an exogenous rise in the world price of the resource that is exported in the empirical analysis.
Key equations

Productivity (output) growth and LBD:

\[ \frac{\dot{H}_{Nt}}{H_{Nt}} = u\eta(\lambda_t, R_t) + v\delta_T(1 - \eta(\lambda_t, R_t)) + \delta_R R_t, \quad 0 \leq \delta_T \leq 1 \]  
(1)

\[ \frac{\dot{H}_{Tt}}{H_{Tt}} = u\delta_N \eta(\lambda_t, R_t) + v(1 - \eta(\lambda_t, R_t)) + \delta_R R_t, \quad 0 \leq \delta_N \leq 1 \]  
(2)

Steady state (aggregate) output

\[ g^* = \delta_R R + \frac{v(1 - \delta_T)}{u(1 - \delta_N) + v(1 - \delta_T)} \]  
(3)

In traditional DD models with LBD: \( u = \delta_T = \delta_N = \delta_R = 0 \), i.e., no spillovers and learning happening in the traded sector only, or, \( u = \delta_N = \delta_R = 0 \), i.e., spillovers from the traded sector. We extend Torvik (2001) by having \( \delta_R \neq 0 \).
Goal:

- Analyse business cycle variation.
- Distinguish between transitory $R_t$ and commodity price shocks.
- Allow for spending and resource movement effects, and spillover between sectors.
Theory meets data cont’d

- Include a broad range of sectoral employment and production series, plus productivity, the real exchange rate, wage and investment series, the terms of trade, stock prices, consumer and producer prices, and the short term interest rate.

- In Norway, the real commodity price is the real price of oil. In Australia we use the Reserve Bank of Australia (RBA) Index of Commodity Prices (US dollars). Both commodity prices are deflated using the US CPI.

- Global activity reflect important trading partners and the largest economies in the world.

- Transformed to be stationary (year on year growth).

Theory meets empirical model: Bayesian dynamic factor model (BDFM)

Observation equation:

\[ y_t = \lambda_0 f_t + \cdots + \lambda_s f_{t-s} + \epsilon_t \]  \hfill (4)

Transition equation:

\[ f_t = \phi_1 f_{t-1} + \cdots + \phi_h f_{t-h} + u_t \]  \hfill (5)

with

\[
\begin{bmatrix}
\epsilon_t \\
u_t
\end{bmatrix}
\sim i.i.d. N\left(\begin{bmatrix} 0 \\
0 \end{bmatrix}, \begin{bmatrix} R & 0 \\
0 & Q \end{bmatrix}\right) \hfill (6)
\]

and autoregressive errors:

\[ \epsilon_{t,i} = \rho_{1,i} \epsilon_{t-1,i} + \cdots + \rho_{l,i} \epsilon_{t-l,i} + \omega_{t,i} \]  \hfill (7)

Restricting (see Bai and Wang (2012)):

\[ \lambda_0 = \begin{bmatrix} \lambda_{0,1} \\
\lambda_{0,2} \end{bmatrix} \quad \lambda_{0,1} = I_4 \]  \hfill (8)
The model: Identification of shocks

- Identify four structural shocks:
  - Global activity shock \( (e_{t}^{gact}) \)
  - Commodity price shock \( (e_{t}^{comp}) \)
  - Resource activity shock/resource booms \( (e_{t}^{ract}) \)
  - Non-resource (domestic) activity shock \( (e_{t}^{dact}) \).

- The mapping between the reduced form residuals \( u_t \) and structural disturbances \( e_t \), \( u_t = A_0 e_t \), is given by (recursive ordering):

\[
\begin{bmatrix}
  u_t^{gact} \\
  u_t^{comp} \\
  u_t^{ract} \\
  u_t^{dact}
\end{bmatrix} =
\begin{bmatrix}
a_{11} & 0 & 0 & 0 \\
 a_{21} & a_{22} & 0 & 0 \\
 a_{31} & a_{32} & a_{33} & 0 \\
 a_{41} & a_{42} & a_{43} & a_{44}
\end{bmatrix}
\begin{bmatrix}
  e_t^{gact} \\
  e_t^{comp} \\
  e_t^{ract} \\
  e_t^{dact}
\end{bmatrix}
\]

(9)
Note in the figures below….

- Norway: Solid lines and dark shaded probability bands
- Australia: Dotted lines and lighter shaded probability bands
Resource gifts and domestic impulse responses

- GDP
- Productivity
- Employment
- Real exchange rate

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Sectonal responses - Norway

Value added

Employment

Resource activity shock

Construction
Business
Hotel and food
Retail
Transportation
Non-resource
Financial
Manufacturing
Scientific
Real estate
Public

Construction
Real estate
Business
Retail
Manufacturing
Scientific
Non-resource
Hotel and food
Transportation
Public
Financial
Sectoral responses - Australia

Value added

Employment

Resource activity shock

Construction
Transportation
Retail
Non-resource
Financial
Real estate
Manufacturing
Public
Business
Hotel and food
Scientific

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

Public
Retail
Construction
Transportation
Non-resource
Manufacturing
Financial
Real estate
Hotel and food
Scientific
Business

-1 -0.5 0 0.5
Global activity shocks and commodity prices

- If commodity price increases are caused by positive disturbances to global demand, the commodity exporting countries are positively affected.

- But....
Commodity price shocks (not related to global activity) and domestic impulse responses

GDP
Productivity
Employment
Real exchange rate

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Resource boom

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Sectoral responses - Norway

Value added

Employment

Commodity price shock

Scientific
Public
Hotel and food
Manufacturing
Non-resource
Transportation
Business
Construction
Retail
Financial
Real estate

Scientific
Hotel and food
Transportation
Business
Non-resource
Real estate
Public
Financial
Retail
Construction

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Sectoral responses - Australia

Value added

Employment

Commodity price shock

Construction
Real estate
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Retail
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Hotel and food
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Commodity price shock

Construction
Real estate
Public
Non-resource
Transportation
Retail
Scientific
Manufacturing
Business
Hotel and food
Financial

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Propose theory model that allows for learning by doing (LBD) in the traded and non-traded sectors, as well as learning spillovers between these sectors and from the resource rich sector.

We develop a structural BDFM that potentially accounts for direct and indirect spillovers between the sectors in the economy and that explicitly distinguishes between a resource gift that is due to commodity price disturbances and a boom in the resource sector itself.

We find that:

- Booms in the resource sector have productivity and growth spillovers on the non-resource sectors, effects that have not been captured in previous analysis.
- For both Australia and Norway, resource gifts have contributed to the observed two-speed patterns in these economies.
- It is important to separate between resource gifts happening either as unexpected price movements or favourable shifts in the production function.