

# Macro and Sectoral Impacts of External and Domestic Shocks: Empirical Evidence from Papua New Guinea

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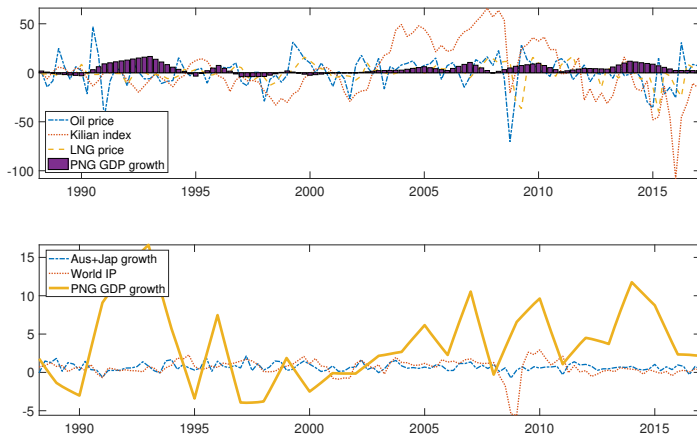
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# Outline of the talk

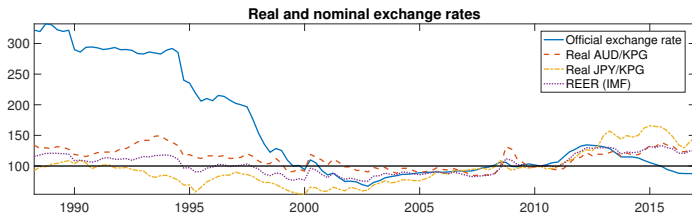
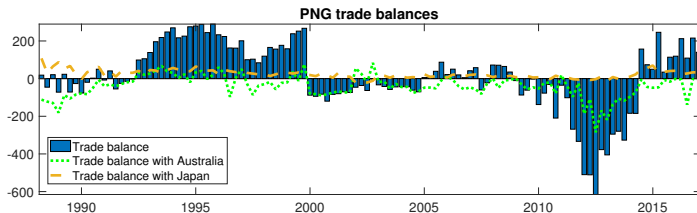
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- 2 Macroeconomic impacts of external and exchange rate shocks
  - Methodology
  - Data
  - Benchmark results
- 3 Sectoral impact of external and domestic resource activity shocks
  - Methodology
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# Stylized fact 1



Source: IMF IFS

# Stylized fact 2

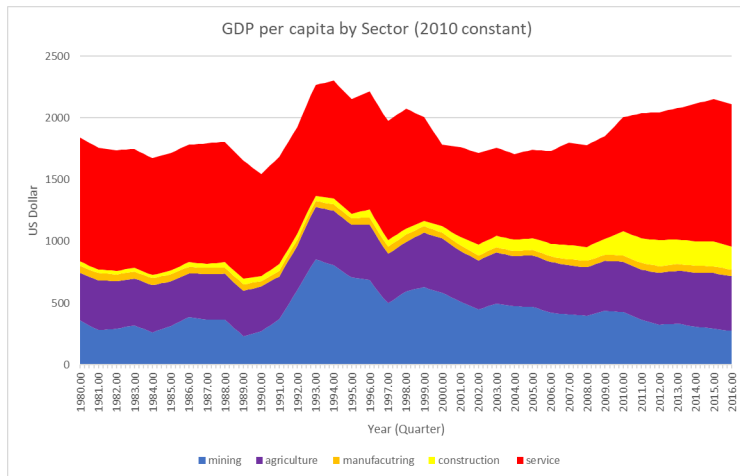


Source: IMF IFS

# Research questions

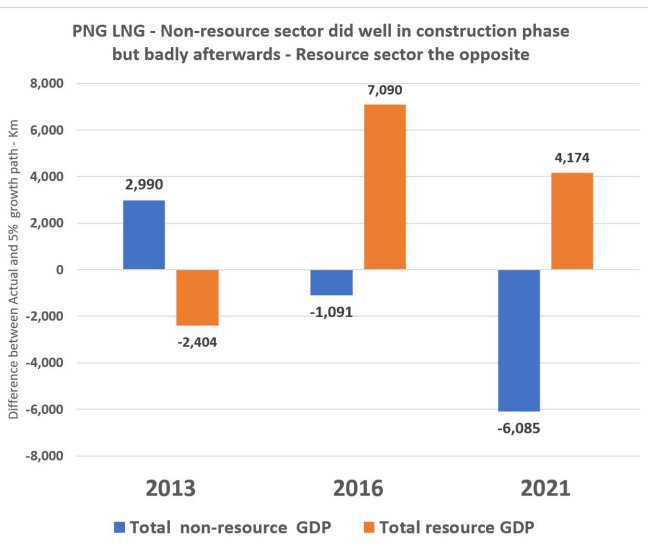
- How does the economy respond to external shocks?
- How does the economy respond to domestic shock, such as supply, demand and real exchange rate shocks?
- Whether exports and imports are sensitive to exchange rate shocks?

# Stylized fact 3



Source: UNTACD

# Stylized fact 4



Source: <http://pngconomics.org/2018/06/png-lng-project-detailed-sectoral-impacts/>

# Research questions

- How do different sectors respond to external and domestic shocks?
- How do these impacts change overtime?



# Effects of Real Exchange Rate and External Shocks on Papua New Guinea's Trade and Output

The structure representation of the vector autoregressive model (SVAR) with  $p$  lag for  $t = (1, \dots, T)$  can be expressed as

$$\mathbf{B}_0 \mathbf{y}_t = \mathbf{b} + \mathbf{B}_1 \mathbf{y}_{t-1} + \dots + \mathbf{B}_p \mathbf{y}_{t-p} + \mathbf{e}_t, \quad \mathbf{e}_t \sim \mathcal{N}(\mathbf{0}, \mathbf{\Omega}), \quad (1)$$

where  $\mathbf{y}_t = (ext_t, \Delta cpi_t, \Delta gdp_t, \Delta rer_t, exp_t, imp_t)'$  be a  $6 \times 1$  vector of observation at time  $t$ .

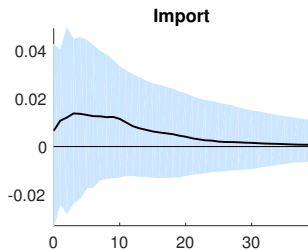
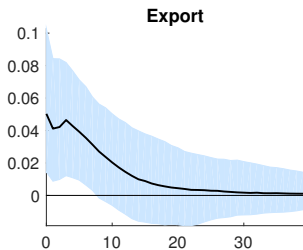
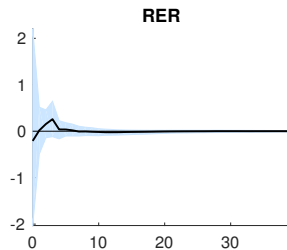
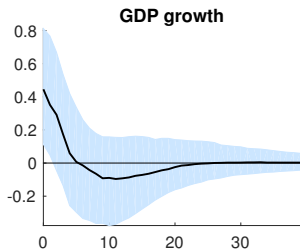
The reduced form of VAR is obtained by premultiplying  $\mathbf{B}_0^{-1}$  to both side of (1) as

$$\mathbf{y}_t = \mathbf{c} + \mathbf{A}_1 \mathbf{y}_{t-1} + \dots + \mathbf{A}_p \mathbf{y}_{t-p} + \boldsymbol{\epsilon}_t, \quad \boldsymbol{\epsilon}_t \sim \mathcal{N}(\mathbf{0}, \mathbf{\Sigma}), \quad (2)$$

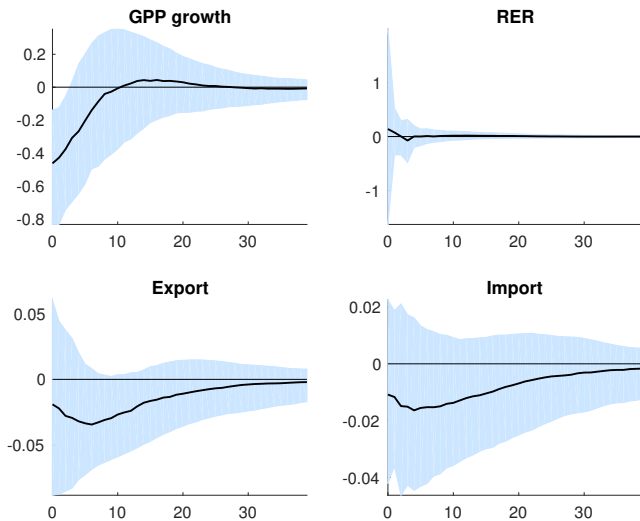


- Country's variables: CIEC Asia database (original sources: IMF, WB).
  - PNG's output: Annual GDP converted to quaterly frequency using the Chow-Lin (1971) method.
  - Real exchange rate: **IMF** and bilateral exchange rates with Japan and Australia (main trade partners)
- Proxies of external economic activity
  - World industrial production, Kilian's real economic activity index, Oil price, LNG price and **Australian + Japan GDP growth**
- Data span: 1988Q2-2017Q1
- Lag length: 4
- Estimation method: Bayesian

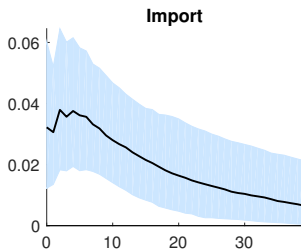
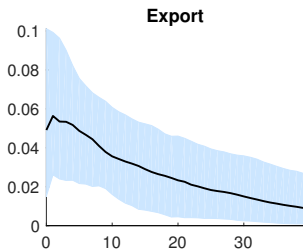
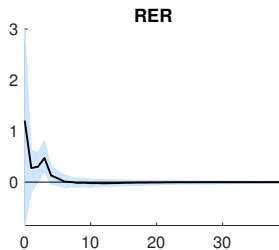
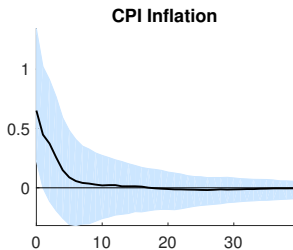
# External shock



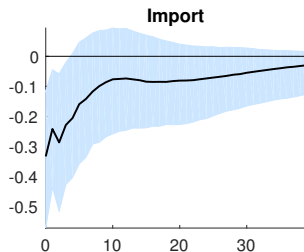
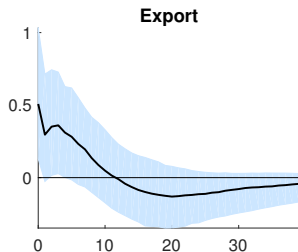
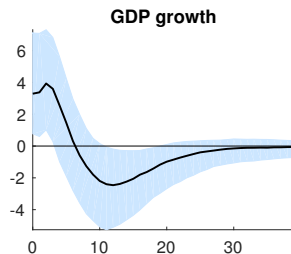
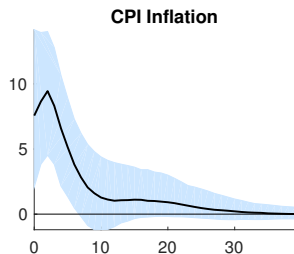
# Domestic supply (inflation) shock



# Domestic demand (output) shock



# RER shock ( 10% devaluation)





- Positive external shock:  $\uparrow$  GDP, exports,  $\downarrow$  imports
- Supply shock:  $\downarrow$  GDP, exports and import
- Demand shock:  $\uparrow$  inflation, exports, import and RER
- RER shock (devaluation):  $\uparrow$  GDP, inflation, export but  $\downarrow$  imports

# The Sectoral Impact of Global and Domestic Resource Shocks

# Methodology: VAR and Local Projections

We employ a trivariate VAR and recursively identify three distinguished shocks: world economic activity, commodity price and domestic resource activity.

$$\text{structural shocks} = \begin{bmatrix} \times & & \\ \times & \times & \\ \times & \times & \times \end{bmatrix} \begin{bmatrix} \text{world economic activity shock} \\ \text{commodity price shock} \\ \text{domestic resource activity shock} \end{bmatrix}$$

We then employ Local Projection Method (Jorda, 2005) to investigate the impact of these shocks on Agriculture, Construction, Manufacturing and Service. This is,

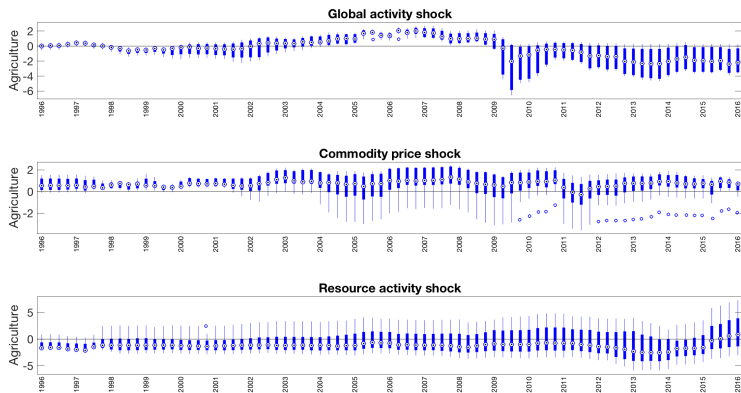
$$\Delta x_t^s = \alpha_j^s + \sum_{i=0}^{12} \phi_{ji}^s \{ \text{structural shock}_{j,t-1} \} + u_{j,t}^s \quad (3)$$

# Methodology: Boxplot and Rolling estimation

- $\phi_{ji}^s$  **are of our interest**. They are the impulse response of the sector  $x^s$  to the structural shock  $j$ . Recap:
  - $s = \{Agriculture, Construction, Manufacturing, Service\}'$
  - $j = \begin{bmatrix} world\ economic\ activity\ shock \\ commodity\ price\ shock \\ domestic\ resource\ activity\ shock \end{bmatrix}$
- To obtain the time varying impact, we utilize the rolling estimation window of 100 observations
- The impulse responses are presented by using boxplot technique.

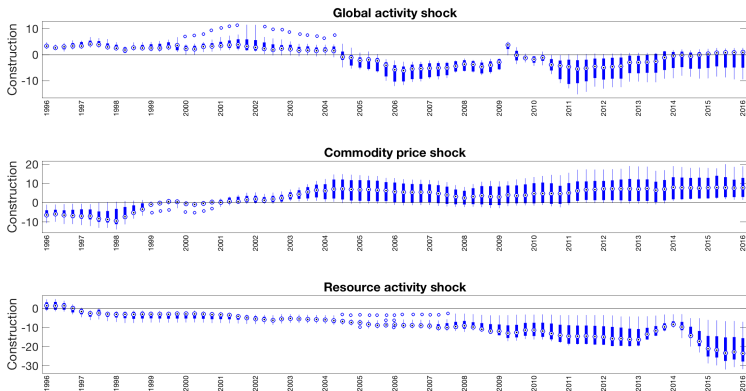
- word economic activity: OECD + 6;
- commodity prices: energy price index and **the price of crude oil**
- country's data (ie. Gross Value Added) are taken from the UNTACD, from 1970 to 2016.
- Quarterly data obtained by using the Chow-Lin (1971) method.

# Agriculture



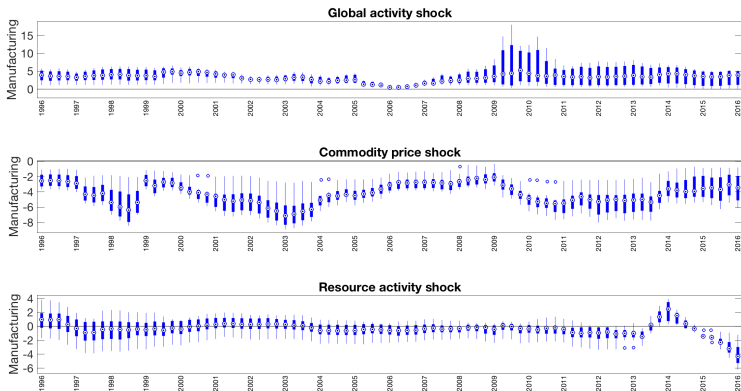
- global economic activity shock has neutral effect on agriculture.
- commodity (oil) price shock has positive effect on agriculture.
- resource activity shock has negligible/ slightly negative effect on agriculture.

# Construction



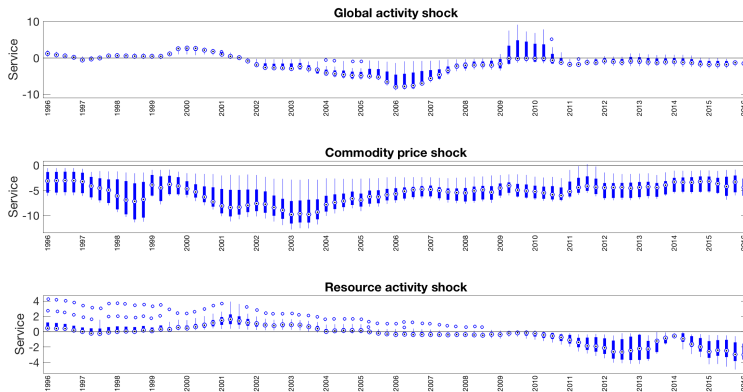
- $\uparrow\downarrow$  global economic activity has neutral effect on construction.
- $\uparrow$  oil price,  $\uparrow$  construction  $\uparrow$  demand for resource-related construction.
- $\uparrow$  domestic resource activity,  $\downarrow$  construction  $\rightarrow$  machines are imported.

# Manufacturing



- $\uparrow$  global economic activity,  $\uparrow$  manufacturing.
- $\uparrow$  oil price,  $\downarrow$  manufacturing (deindustrialisation).
- $\uparrow\downarrow$  domestic resource activity, neutral effect on manufacturing.





- $\uparrow\downarrow$  global economic activity has neutral effect on services.
- $\uparrow$  oil price,  $\downarrow$  service sector (puzzle).
- $\uparrow\downarrow$  resource sector has neutral effect on services. (isolation of rural mine fields).

- The impacts are time varying, recently.
- Global activity shock:  $\uparrow$  manufacturing but has neutral effect on service, agriculture and construction sector.
- Commodity (oil) price shock:  $\downarrow$  manufacturing & service but  $\uparrow$  agriculture & construction sector.
- Domestic resource activity shock:  $\downarrow$  agriculture & construction but has neutral effect on manufacturing and & service sector.

# Conclusion

- Data, data, and data!
- External shocks, e.g global economic activity and commodity prices, have a positive impact on the overall economy but not all sectors.
- It is not clear evidence that resource sector has positive spill over effect on non-resource sector.
- Both exports and imports are sensitive to RER and hence (surprised) devaluation can spur GDP growth but comes with costs (higher inflation).

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