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Contribution of Lae Port to Papua New Guinea's participation in regional value chains

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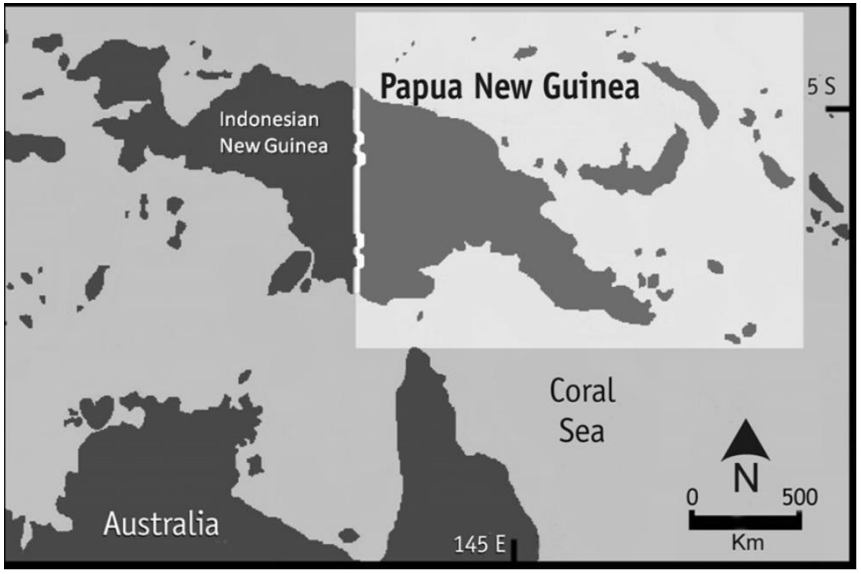
Background

- Global Value Chains (GVCs) have become the paradigm of production of most goods and services around the world.
  - Different stages of production are carried out in specialized plants in different parts of the world.
  - But studies have shown that GVCs are regionally oriented:
    - Global linkages to concentrate in North America, the European Union, and East Asia
    - Other countries, e.g. in Africa, Caribbean and the Pacific, mostly remain on the sidelines
- Yet, the ACP countries do contribute (mostly) raw materials to the international supply chain.
- Given the bulkiness of most ACP countries' exports, seaports, are important for their link to international supply chain(s).
  - Facilitate the movement of goods from exporting to importing countries
- So, a reliable global/regional freight movement (transport) is very essential developing country's participation in the contemporary world economy
- Yet, a few studies (if any) have incorporated the role of most developing countries' seaports in the analysis of GVCs.
  - So, attempt to analyse whether Lae Port is contributing to Papua New Guinea's participation in the GVC regional value chain

The PNG Economy

- PNG's overall economic performance has been good
  - GDP is about US$16.93 billion, a lower-middle income country
  - 8.5% GDP growth, dropped to 5.2%, 4.4% expected in 2019
  - Population of about 8 million, growing at ≃2% per year;
  - Growth in real GDP per capita averaging 4% since mid-2000
  - HDI rising (since 1980) by 1.3% to 0.431 (in 2011)
    - Still very poor, PNG rank 137 out of 169 countries
    - PNG is below regional average (HDI for Asia and Pacific is 0.650)
  - Economy is dominated by mining and energy sectors, contributing approximately 80 percent of total export revenue.
  - But PNG also export raw agricultural, forestry and fisheries products; important part of production processes overseas.

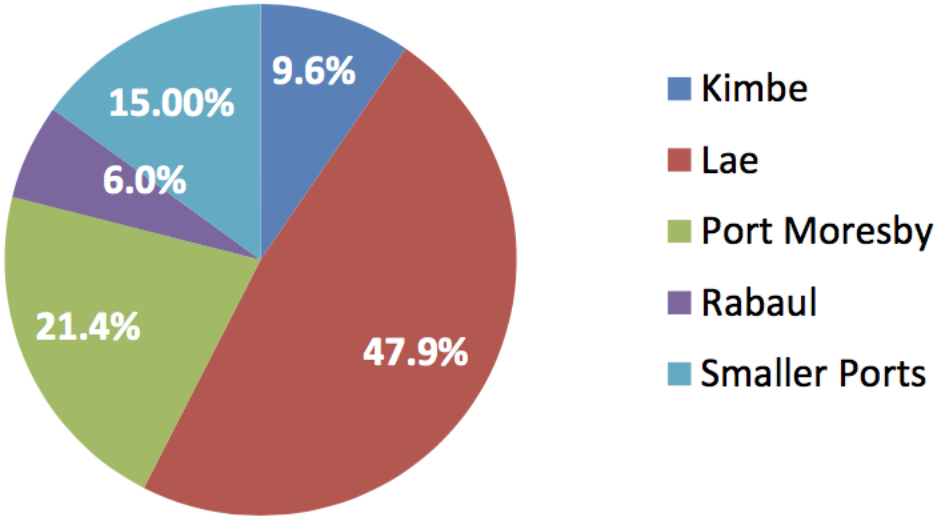
Location of PNG and Lae Port



- PNG share land border with Indonesia
- Has 16 seaports
  - ✓ along the country's 5,150Km long coastline
- Lae Port is largest and busiest
  - located in the country's second largest city of Lae
  - situated on latitude 6.44^0S and longitude 146.59^0E

Significance of Lae Port to PNG

Revenue Tonne Contribution by Ports



- Country's major gateway to international and local trade
- Connected to the Highlands Highway, to the country's hinterland, home to the bulk of the population.

- Share of total trade volume = 48%;
  - 117,639 tonnes, 130,682 TEU containers
- Overseas: Coastal cargo = 65:35
- Imports: Exports = 63:35

- Serves provinces rich in agriculture and mineral resources
- Containerised export of agricultural commodities is significant

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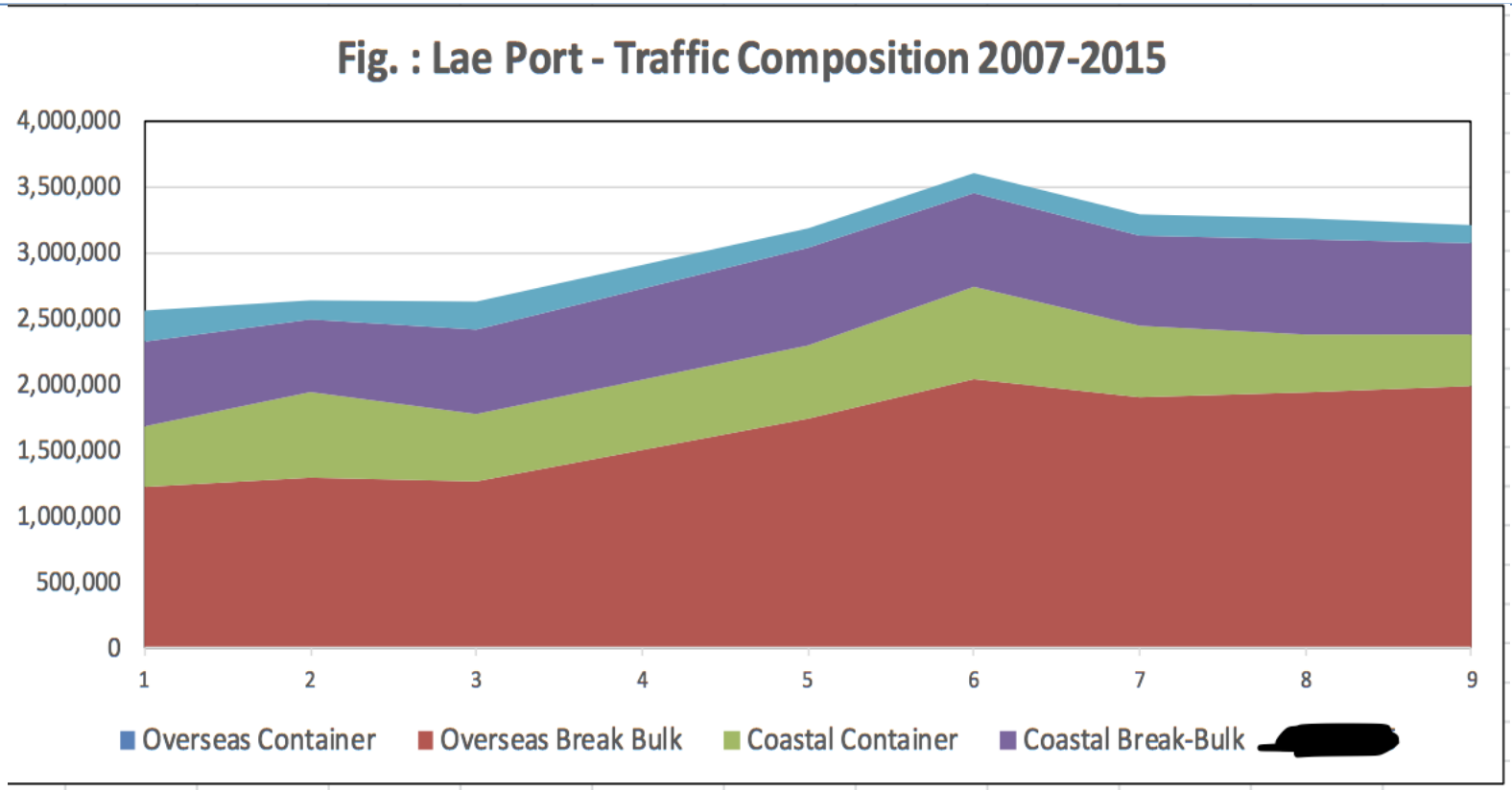
Traffic at Lae Port



Lae Port Redevelopment

- In the past, Lae Port faced a number of challenges
  - including increasing congestion and ship waiting times.
- Redeveloped Lae Port to increase its capacity
  - To meet the growing traffic.
  - Better connection to sea lines
  - Better connection to GVCs, especially in agriculture
- The redevelopment (in 2014) - construction of;
  - ✓ a tidal basin; a berth; and a container facility
  - To better help connect Lae Port to international markets
  - To support efficient freight and supply chain network
  - Support PNG's logistic chain for local and international trade

Linking Lae Port Performance to GVC (Empirical Analysis)

- Use Lae Port weekly overseas vessel berth calls data (provided by PNG Ports) and Import/Export data (provided by PNG Customs)
  - to test whether the common conclusion that "countries that have better seaport connectivity also engage in more trade in value terms" hold for PNG (Estevadeordal et al. 2013; UNCTAD, 1999, 2007;)
    - Could frequent sea connection (ship traffic) of Lae Port to more countries be associated with PNG's participation in GVC?
    - Could efficiency of services (ship turn-around time) at Lae Port be contributing to PNG's participation in GVC?

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Measurement of Variables

- GVC participation
  - Proportion of forward (export) and backward (import) linkages through Lae Port in total PNG exports/imports
- Port Performance (see UNCTAD, 1999, 2007).
  - Throughput: the number of containers (measured in 20-foot equivalent units (TEU) handled each period
    - Alternative: Size of vessels in metres
  - Connectivity: access to regular and frequent sea transport services
    - Number of bilateral backward and forward links between Lae Port and other ports (use vessel identity, its origin and destination)
  - Ship turn-around time: duration of ships stay at the port
    - Duration between time of arrival and time of departure
  - Number of of vessels

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Data Description: Basic Statistics

	Means	SD
LogExport	4.67	2.67
ShipTurnAroundTime	15.08	9.50
No_of_Vessels	6.52	2.45
Average_size/length_of_vessels_(meters)	157.75	23.73
No_of_Forward_&_Backward-Bilatral-Linkages	10.34	3.75

Correlation matrix:

		(1)	(2)	(3)	(4)	(5)
LogExport	(1)	1				
ShipTurnAroundTime	(2)	-0.152	1			
No_of_Vessels	(3)	-0.140	0.717	1		
Average_size/length_of_vessels_(meters)	(4)	-0.050	0.208	0.359	1	
No_of_Forward_&_Backward-Bilatral-Linkages	(5)	-0.028	0.663	0.906	0.411	1

	% variation	% cumulative
PC1	72.06	72.06
PC2	24.88	96.94
PC3	3.06	100

Weights on variables

	PC1
No_of_Vessels	-0.261
Avg. size/length of vessels	-0.018
No. of Bilateral-Linkages	-0.173

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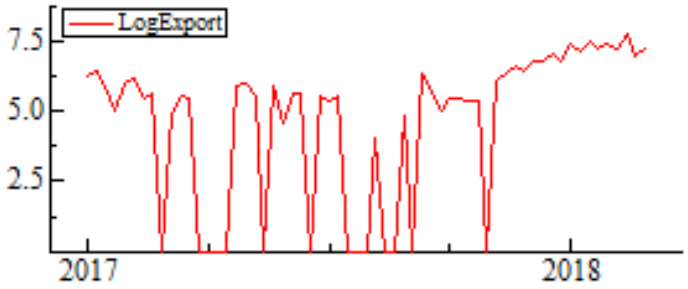
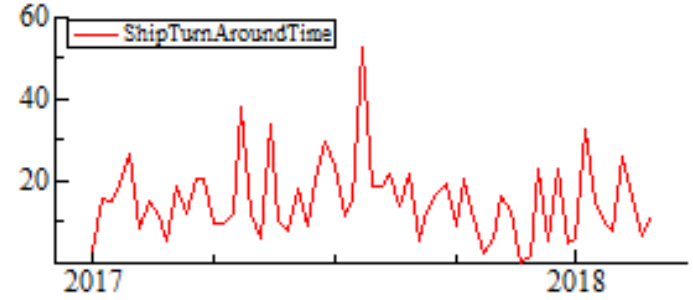
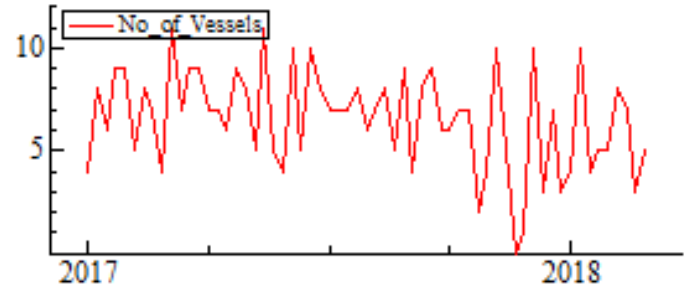
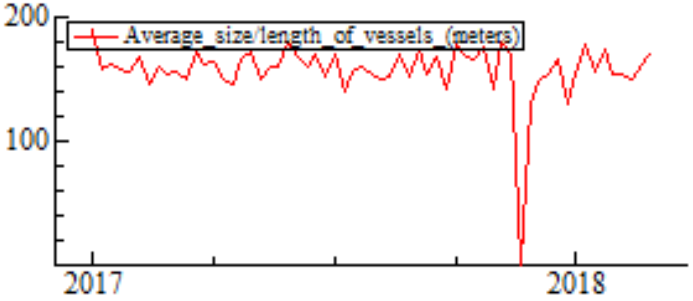
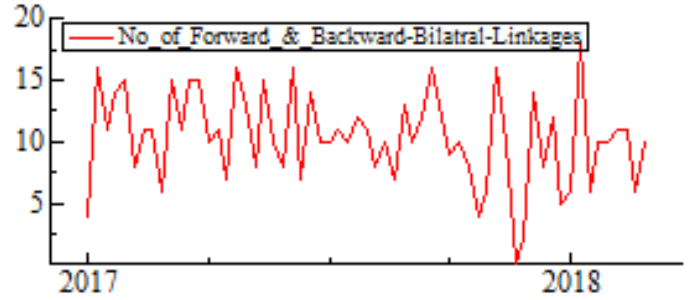
Characteristics of the Variables











Some Observations

- None of the variables are trending up or down
- Hence nonstationarity is less of a concern
- Estimate models using variables in levels

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Empirical Methodology

- Most studies of GVC participation are based on gravity equations.
  - Mostly cross-section analysis. (e.g. Estevadeordal et al. 2013; UNCTAD, 2007)
- For a single country based on time series data;
  - Use General-to-Specific model selection technique (of Doornik & Hendry, 2007)
    - Work better than models solely based on economic theory.
    - Algorithm selects models and empirically relevant variables.
  - But follow UNCTAD (2007) and Hoffman et. al. (2008) and use the method of Principal Components to construct liner connectivity index.

Results 1: General/Unrestricted Model

Dependent variable: Log Exports of raw materials through Lae Port

	Coefficient		t-value
Constant	6.03	**	2.16
LogExport_1	0.34	**	2.56
LogExport_2	0.19		1.34
LogExport_3	-0.03		-0.22
ShipTurnAroundTime_1	-0.01		-0.33
ShipTurnAroundTime_2	0.04		0.86
ShipTurnAroundTime_3	-0.12	***	-2.78
Connectivity_1	0.05		0.17
Connectivity_2	-0.59	**	-2.13
Connectivity_3	0.20		0.70

N = 58; R^2 = 0.39; Adj. R^2 = 0.28
F(9,48) = 3.43 [0.003]**

Results 1: Simple/Specific Model

Dependent variable: Log Exports of raw materials through Lae Port

	Coefficient		t-value
Constant	6.99	***	4.47
LogExport_1	0.39	***	3.52
ShipTurnAroundTime_3	-0.10	***	-3.19
Connectivity_2	-0.42	**	-2.10

N = 58; R^2 = 0.34; Adj. R^2 = 0.31; F(3, 54) = 9.556 [0.000]**

Ship turn-around time:

- Lae Port's contribution to international production value chain decreases with increase in ship turn-around time.
  - i.e. the more ships wait longer to berth or the more it takes longer to load and unload cargo, traders are likely to consider using other ports or alternative modes of transport to export their raw materials.

Connectivity:

- Increasing connectivity appear to have unexpected effect on Lae Port's contribution to the international production value chain.
  - Why is increasing connectivity associated with reduction in export of raw materials?

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Alternative Approach

- Method of principal components is widely used
  - Compress a number of fators in one connectivity index
  - Minimize arbitrariness in aggregation procedure
  - Address latent (unobserved) variable problem
- But principal component approach is criticised
  - As an ad hoc coding procedure
  - Does not consider meaning and significance of each factor
  - There may be nothing common among the factors
  - So a single index could be misleading.
- So, allow every indicator to enter into the equation
  - Use Autometrics algorithm (implemented in PcGive software) to
    - Select appropriate models
    - Select empirically relevant variables

Results 3: General Unrestricted Model

Dependent variable: Log Exports of raw materials through Lae Port

	Coefficient	t-value
Constant	1.991	0.451
LogExport_1	0.301**	2.210
LogExport_2	0.135	0.953
LogExport_3	-0.120	-0.866
ShipTurnAroundTime_1	0.029	0.635
ShipTurnAroundTime_2	0.060	1.310
ShipTurnAroundTime_3	-0.160***	-3.210
No_of_Vessels_1	-0.424	-1.170
No_of_Vessels_2	-0.953***	-2.680
No_of_Vessels_3	-0.067	-0.196
LogSize_of_Vessels_1	1.213	0.959
LogSize_of_Vessels_2	1.688	1.290
LogSize_of_Vessels_3	0.703	0.558
No_of_Forward_&_Backward-Bilatral-Linkages_1	0.047	0.207
No_of_Forward_&_Backward-Bilatral-Linkages_2	0.198	0.937
No_of_Forward_&_Backward-Bilatral-Linkages_3	0.135	0.646

N = 58	R^2 = 0.498	Adj. R^2 = 0.319	F(15,42) = 2.776 [0.01]**
AR 1-4 test: F(4,38) = 3.019 [0.029]*		Normality test: Chi^2(2) = 4.173 [0.124]	

Results 4: Specific/Simplified Model

Dependent variable: Log Exports of raw materials through Lae Port

	Coefficient		t-value	
Constant	6.944	***	5.590	
LogExport_1	0.361	***	3.310	
ShipTurnAroundTime_2	0.060		1.400	
ShipTurnAroundTime_3	-0.110	***	-3.560	
No_of_Vessels_2	-0.490	***	-2.850	
N = 58	R^2 = 0.395;	Adj. R^2 = 0.349;	F(4,53) = 8.64 [0.000]**	
AR 1-4 test: F(4,49) =	1.174 [0.333];	Normality Chi^2(2) = 6.409 [0041]*		

Ship turn-around time:

- Lae Port's contribution to international production value chain increases with reductions in ship turn-around time.

No of Vessels:

- Of the three measures of connectivity, only the number of vessels appear to important. But the direction of its influence is somewhat unconvincing.

Summary and Conclusion

- Test whether PNG engages in more trade in value adding (raw materials) because of better connectivity of Lae Port to overseas ports.
- Frequent sea connection of Lae Port does not lead to increase in exports
  - Could be due to importation of mostly finished products for local consumption.
  - No clear direct connectivity; port of origin and final destination unclear.
- But reducing ship turn-around time at Lae Port is associated with increase in value adding exports
  - It appears the redevelopment of Lae Port is paying-off
  - Improved efficiency of the port activities
  - Has the potential to increase PNG's participation in GVC.
- Data limitations…could improve with longer timeseries

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Thank you

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