Papua New Guinea Global Trade Potential: Evidence from the Gravity Model Analysis.

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Background and Introduction

- Papua New Guinea (PNG) is the largest country and economy in the Pacific, representing 80% of the Pacific's economy and population.
- PNG's economy is expected to grow by 4.0 per cent in 2023, with non-resources and resources growth at 4.6 per cent and 2.0 per cent respectively.
- With the expansion of their mineral and energy exports from the last decade, they are expected to experience significant growth in total export values in coming years.
- There is a long historical background on the theories supporting the connections between trade and economic growth. (Romer, 1986; Lucas, 1988; Solow, 1994) all supported the theory that openness to trade propelled economic growth.
- The question that we attempt to answer is whether PNG can take advantage of their trade potential as they enter post-COVID with a promising mineral and energy sector. Using an augmented Gravity Model with OLS we attempt to investigate PNG's trade potential between 31 countries using cross section data.

Papua New Guinea Trade Overview (WTO 2021)

- PNG is a low-income country (2021) (USD):
 - GDP \$26,937
 - Per Capita GDP \$2,898
 - CA Balance (% of GDP) 22.0%
 - Trade (% of GDP) 28.2%
- It is the largest country by geography, population and GDP in the Pacific with an estimated population of 10.1m in 2022. According to Lowly Institute, the population estimates varies between 9 to 12 million.

Trade:

- In 2021, PNG registered a trade-to-GDP ratio of 54.5%, and merchandise trade accounted for 92.9% of Papua New Guinea's total trade. (merchandise exports grew by 5.5% from 2017-2021)
- The services trade share of total trade by Papua New Guinea amounted to 7.1% in 2021 (services exports contracted by 3.7%, following a year of 68.1% decline in 2020).

Papua New Guinea Trade Overview (WTO 2021)

	2021	2010-2021	2020	2021
Million USD	Value	(Annual	% change	e)
Merchandise Exports f.ob	10, 433	6	-19	12
Merchandise Imports f.ob	3, 024	-1	-19	-8
Commercial Service Exports	98	-9	-68	-4
Commercial Service Imports	935	-9	-15	-32

Papua New Guinea Trade Overview (WTO 2021)

Top Exported Products	Value	% of Total Exports
	(USD)	
Mineral fuels including oil	5.9 b	50
Gems, precious metals	\$1.8 b	14.9
Ores, slag, ash	\$1.1 b	9.2
Animal/vegetable fats, oils, waxes	\$955.3 m	8.0
Nickel	\$665.5 m	5.6
Wood	\$627.4 m	5.3
Meat/seafood preparations	\$246.1 m	2.1
Coffee, tea, spices	\$206.2 m	1.7
Fish	\$165.1 m	1.4
Сосоа	\$93.8 m	0.8

Papua New Guinea Trade Balances (ADB 2021)

	2015	2016	2017	2018	2019	2020	2021
Papua New Guinea	5,876	5,861	6,408	7,032	7,904	6,701	8,866
The Pacific	3,600	3,620	4,059	4,325	5,305	4,480	6,489
Southeast Asia	135,668	133,110	138,299	110,844	123,462	114,862	113,116
Developing Asia	711,968	631,437	576,948	443,011	539,086	488,739	508,892
Fiji	-912	-996	-1,093	-1,320	-1,122	-967	-920

Papua New Guinea Trade Overview

Major Trade Partners (2021):	Year	PNG Trade to the World	Growth
• China - 25% of its exports and 24.7% of i	ts 2000	1092.21	-3.81%
imports.	2001	989.24	-9.43%
	2002	1055.76	6.72%
 Japan - 25.4% of exports and 4.3% of 	2003	1200.71	13.73%
imports by value were traded with	2004	1425.82	18.75%
imports by value were traded with.	2005	1800.49	26.28%
Australia:	2006	2098.09	16.53%
	2007	2640.20	25.84%
Singapore:	2008	3112.58	17.89%
	2009	3457.91	11.09%
Taiwan, China:	2010	4568.47	32.12%
	2011	6416.84	40.46%
 The Republic of Korea; 	2012	8110.53	26.39%
	2013	6253.27	-22.90%
 The Netherlands; 	2014	5585.54	-10.68%
,	2015	4988.73	-10.69%
Malaysia;	2016	4419.46	-11.41%
	2017	4544.15	2.82%
 India; and 	2018	4793.11	5.48%
	2019	4760.34	-0.68%
 Indonesia. 	2020	4144.20	-12.94%

What are they doing?

PNG's top 10 trading partners (2010-2020, cumulated)

- Medium Term Development Plan III (2018-2022) - \$7.8b investment plan.
- Trade policy review.
- Refocusing on the fiscal consolidation.
- Legal and Regulatory Framework.
- Investment and Competition Policy.
- Good Governance.
- Trade Related Infrastructure.

		2010-2020 (USD million)	2010-2020 (%)	2011	2015	2020
1	Australia	20,528.86	-26.63	27.15	-34.39	-22.34
2	China	7,589.86	161.77	28.4	55.45	15.12
3	Singapore	7,322.22	-29.87	55.49	-25.64	-30.73
4	Malaysia	4,565.50	11.97	167.05	-17.82	-30.16
5	Japan	2,536.24	-46.55	10.47	-4.7	8.01
6	Indonesia	2,027.27	-9.56	98.95	27.14	-9.11
7	United States	1,881.70	-67.40	58.6	44.86	-34.4
8	Thailand	1,767.96	-9.85	44.14	8.8	-17.27
9	New Zealand	1,626.15	-17.61	21.48	-15.86	-13.27
10	Italy	681.38	40.79	447.08	-24.18	-46.87
	The World	58,584.64	-9.29	40.46	-10.69	-12.94

Survey of Literature.

- There is a wide range of applied research where the Gravity Model is used to examine the bilateral trade patterns and trade relationships.
 - Bergstrand 1985 and 1989,
 - Oguledo and Macphee 1994
 - Frankel 1997
 - Karemera et al. 1999
 - Mathur 1999, and
 - Sharma and Chua 2000,
- The Gravity Model were all used by the above authors to determine the aggregate bilateral trade and the product level trade.
- Other areas such as trade costs, non-tariffs barriers, regional integration etc were covered by these authors.

Survey of Literature.

Other trade related areas were covered by these authors:

- Trade Costs:
 - (Rose, 2000),
 - (Harrigan, 2001;
 - Wilson *et al.,* 2005;
 - Djankov *et al.,* 2006;
 - Baier and Bergstrand, 2007;
 - Jacks et al., 2008),
- International Borders:
 - (Anderson and Wincoop, 2003;
 - Gorodnichenko and Tesar, 2009)
- For methodological issues:
 - (Egger, 2002;
 - Baldwin and Taglioni, 2006;
 - Silva and Tenreyro, 2006;
 - Helpman *et al.,* 2008).

Survey of Literature.

While the gravity model has been increasingly used in international trade to estimate trade potential; very little work has been done to determine factors of PNG global trade potential.

This project could be the first empirical initiative to determine and provide such analysis.

Theoretical Justification.

- The gravity equation has long been an institutionalized topic of research in economics and there has been a great deal of studies on the gravity model itself.
- The properties of econometric estimations and methodologies make the gravity theory an interesting topic of research and inquiry.
- > The developments of the gravity model can be discussed systematically in several developmental phases:
 - 1885-1962: The Historical Roots of The Gravity Equation.
 - Linder (1961) and Samuelson (1948, 1949)
 - 1962-1966: The Beginning of the Traditional Gravity Model
 - Pöyhönen (1963); Pulliainen (1963) and Linnemann (1966)
 - 1966-2003: The Theoretical Foundations of the Gravity Model
 - Bergstrand, (1990a) and Bergstrand, 1985, 1989)
 - 2003- 2017: The Revival of the Gravity Model.
 - Olivero and Yotov, (2012) and Anderson and Yotov, (2017)

The Model.

- For estimation of the gravity model, we have followed Frankel (1997), Sharma and Chua (2000) and Batra (2006).
- With adjustment to suit our needs the model is "augmented" in the sense that several conditioning variables that may affect trade have been included.
- Thus the gravity model of trade in this study is:

 $ln(X_{ij}) = \beta_0 + \beta_1 \ln GDP_{ijt} + \beta_2 \ln PCGDP_{ijt} + \beta_3 \ln TRGDP_{ijt} + \beta_4 \ln REMOTE_{ij} + \beta_5 LANG + \beta_6 lnPOP_{ijt} + \beta_7 RTA + \varepsilon_{ijt}$

An alterative to the above will take care of the per capita GDP differential as a variable instead of per capita GDP. (Will be discussed in the final paper).

The Model.

- The variables are explained as follow:
- *ln*(*X*_{*ij*}) denoted natural log of total trade it includes net exports and imports of country i to country j in the US \$. Independent variables are:
- *GDP_{ijt}* the log of GDP of *i* country and *j* in US\$.
- PCGDP_{ijt} is the log of the Per Capita GDP Differential between *i* country and *j* in US\$.
- In *TRGDP*_{ijt} is the log of Trade as a percentage of GDP between country *i* and *j*
- *REMOTE_{ijt}* is the assessment of the remoteness between country i and j.
- LANG_{ijt} is common language between country i to country j (dummy variable).
- *RTA* is regional trading agreement (dummy variable)
- *lnPOP_{ijt}* is the log of Population of country *i* and country *j*
- And " ϵ " is the error term and "t" denotes time duration whereas' β s are the parameters.



a formula that measures a country's average weighted distance from its trading partners (Head, 2003), where weights are the partner countries' shares of world GDP (denoted by GDPW).

Data, Methodology and Model Configuration.

- We will follow two step estimation strategies to explore PNG's global trade potential.
- In the first stage we have to estimate the initial model and the Per Capita GDP Differential using OLS estimation technique with cross section data for the year 2000 and 2019 covering 31 countries including PNG.
- The dependent variable is the value of total bilateral trade (export value plus import value will be in US dollar million) of country i (PNG) and country j (PNG's trading partner).
- The coefficients thus obtained in the first stage will then be used in the second stage to calculate the predicted bilateral trade of PNG with its 31 trading partners around the globe. These predicted trade values will then be analyzed and compared with the actual trade values to explore PNG's global trade potential.
- Econometric issues such Endogeneity, Multicollinearity, Heteroscadasticity will be taken care of as per econometrical process.

Descriptive Statistics Regression Results

Variable	Obs	Mean	Std. Dev.	Min	Max
LNGDP	1116	49.236	2.927	40.837	55.549
LNPCGDP	1071	9.731	1.430	3.884	11.542
LNTRGDP	1116	4.266	.6432	2.741	6.092
LNPOP	1116	32.784	2.343	27.091	37.448
LNREMOTE	1116	-22.842	.8022	-25.304	-21.362
LANG	1116	.4166	.4932	0	1
RTA	1116	.2222	.4159	0	1

Variable	Model 4
INCOD	0.3475***
LINODI	(0.0092)
INPCGDP	-0.2427***
LINICODI	(0.11)
INTRODE	0.1213**
LIVIKODI	(0.0144)
I NREMOTE	-0.3998***
	(0.0136)
	-0.2817***
LINIOI	(0.1048)
РТΔ	-0.2205***
KIA	(0.0262)
LANG	-0.1136
LANO	(0.0176)
R ²	0.83

Estimates

- As per the theory, if the partner countries' GDP increases by 1%, it brings a significant positive impact on PNG's total trade which will increase by 0.34%.
- LNREMOTE is the assessment of the remoteness between partner countries; states that the further away a partner country is to PNG, trade will decrease by .39%.
- The coefficient value of the Per Capita GDP Differential is negative (-.2427). This reinforces other work in the body of literature that support the Linder hypothesis (Linder, 1961) that similar countries with similar Per Capita GDP seems to trade more in relative to dissimilar ones.
- The coefficient of RTA is depicted at –.2205 any new RTA will not be beneficial to PNG because it will reduce trade by .22%

Trade Potential

The gravity model was employed to predict future trade flows and capacity of PNG.

The equation that formulates this simulation is as follows:

 $TP_i = \frac{Estimated \ Trade_{ij}}{Actual \ Trade_i}$

The study has estimated the total trade potentials of PNG with 31 partner countries.

Trade Potential

Trade Exhausted

	Actual value of ln_TRADE_ij	Predicted value of ln_TRADE_ij	Estimated to actual trade ratio
Australia	21.206	20.082	.947
Singapore	19.474	19.352	.993
China	19.526	17.960	.920
Japan	20.085	19.062	.949
United Kingdom	18.806	18.322	.974
Switzerland	16.915	16.062	.950
India	19.134	15.346	.802
Sri Lanka	13.975	12.67	.907

Trade Potential

	Actual value of ln_TRADE_ij	Predicted value of ln_TRADE_ij	Estimated to actual trade ratio
Fiji	14.062	15.697	1.116
New Zealand	15.999	17.484	1.093
Vanuatu	13.127	14.688	1.119
Sweden	14.668	15.282	1.042
Malaysia	17.889	18.437	1.031
Thailand	17.117	17.535	1.024
Bulgaria	13.549	14.165	1.045
Finland	12.521	15.225	1.216
France	15.531	15.882	1.023
Vietnam	15.996	16.09	1.006
Indonesia	17.461	17.866	1.023
Hong Kong SAR, China	16.578	16.827	1.015
Russian Federation	15.524	16.663	1.073

Conclusion

- Our first conclusion would be that since the coefficient of GDP is positive and highly significant as expected, <u>this implies PNG tends to trade more with larger economies</u> <u>irrespective of distance</u>.
- Since the coefficient for RTA is negative, we are of the view that <u>PNG's involvement in</u> <u>her current RTA membership is creating a trade diversion</u>.
- Given their growth trajectory and abundant resource potential, they provide a strong platform for greater economic engagement with Asia whom they have trade potential.
- Answering to our earlier question whether PNG can take advantage of their potential; we are of the view that this could be possible given that they have <u>not fully exhausted</u> <u>their natural resources</u> and most of <u>the trade potential are with countries close by like</u> <u>the Asian countries</u>, the Pacific and Europe.

Policy Suggestions

- Based on the findings, this study recommends that:
 - PNG is to embark on the expansion of their mineral energy exports to new potential markets.
 - This export revenue should help them in developing and diversifying their industries especially Agriculture
 - Apart from the NTMs the government recently raised the provision of higher tariff for domestic importcompeting industry.
 - This may have an <u>adverse effect</u> on their exports if their trading partners responded negatively.
 - PNG has trade potential with six (6) Asian countries within her reach.
 - The PNG government should strategically position herself in the northern segment of the South Pacific to bring these Asian countries closer in terms of trade and making them a gateway for the Pacific to these Asian economies.
 - On the positive side, due to PNG's non reliance on tourism like most of the PICs and their positive trade balance, there is hope that they will achieve the revised economic growth from 3% to 3.7% as projected by IMF.
 - Finally, PNG should push for <u>economic transformation</u> in the industries that have the potential to increase their international trade; this will have to be backed up with good governance, good environmental practices, international labor standards and a resilience policy that will sustain them during natural disasters.

Thank You for Listening