Commodity Prices and the Kina

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Exchange rate movements matter

- Exchange rate influences macroeconomic dynamics in the Papua New Guinea economy - balance of payments, international reserves, inflation, government revenue, etc.
- It is therefore important for policy makers to understand the causes of movements in the kina exchange rate.
- Important for:
  - Monetary policy – strong pass through from exchange rate to inflation (Sampson et al. 2006);
  - Fiscal policy – government revenue, value of foreign currency debt;
  - Export and employment growth – depreciation may spur agricultural exports (NZIER 2006);
  - Security – exchange rate crisis may precipitate financial crisis and/or domestic unrest (e.g. East Asian crisis 1997-98, PNG in 1998).
Overview

- PNG is a small, open primary commodity dependent economy.
- Recent work finds x-rates of commodity exporting economies affected by international commodity prices (Chen & Rogoff 2003) - “commodity currency”
- Test if commodity prices affect nominal USD/Kina exchange rate.
- Find significant, large and robust effect.
Figure 1: Kina/US Dollar Exchange Rate
Figure 2 - Commodity prices and the exchange rate

Index - Base 1998

- All commodity exports price
- Kina/US dollar exchange rate
Exchange rate models

- Many theoretical models of determinants of exchange rates. Despite vast amount of work in the last 30 yrs no consensus on the best model to explain behaviour of exchange rate.
- Against this backdrop we do not estimate a model that is not solely theoretical but a model that has variables because of their prominence in xrate lit as well as those that are cited as being important in influencing exchange rate.
- Often include: interest rate; money supply; fiscal deficit.
- Chen and Rogoff (2003) show international commodity prices are an important cause of exchange rate movements in small, open, primary commodity dependent economies.
- We look at nominal x-rate and use only post-float data: 1995-2005
- No previous rigorous empirical study of the floating kina.
Exchange rate models (cont)

• Cashin, Cespedes & Sahay examined the determinants of RER by developing a model comprising
  • (i) two-sectors for domestic economy – one producing exportable primary commodity, the other producing a nontradable good
  • (ii) domestic consumers that supply labour inelastically and consume a nontraded good and a tradable good
  • (iii) foreign production and consumption- with 3 sectors; a nontraded sector producing nontraded good suing labour only as input and the good is consumed by the foreigners themselves, an intermediate sector producing an intermediate good and a final good sector using the intermediate good and the foreign primary export commodity.
The Estimated Model

Eventually, the paper estimates this model

\[ s_t = \beta_0 + \beta_1 (i_t - i_{t*}) + \beta_2 g_t + B(L)z_t + \varepsilon_t \]

Where:
- \( s \) is the logarithm of the nominal kina/US dollar exchange rate,
- \( i \) is the nominal interest rate in PNG,
- \( i^{*} \) is the nominal interest rate in the US,
- \( g \) is a measure of the fiscal position of the PNG government,
- \( z \) is the logarithm of the real US dollar price of PNG's commodity exports,
- \( B(L) \) is a polynomial in the lag operator,
- \( \varepsilon \) is an error term and
- \( t \) indexes the period.

Only the US dollar exchange rate is considered because
- the exchange rate of the kina with currencies other than the US dollar is determined by developments in international currency markets
- Working only with the US dollar exchange rate avoids the need to model behaviour in foreign exchange markets outside of PNG
The Estimated Model (continue)

To avoid any risk of spurious inference the first difference of all variables will be used. The baseline specification will be:

$$\Delta s_t = \beta_0 + \beta_1 \Delta (i_t - i_t^*) + \beta_2 \Delta g_t + B(L) \Delta z_t + \varepsilon_t$$

(To test the robustness of the results to the alternative hypothesis that the interest rate differential and the fiscal variables are I(0) the model is also be estimated with these variables expressed in level form).
Regression analysis

• Constructed index of the real international price of PNG’s commodity exports.
• Regressed changes in the USD/Kina exchange rate on changes in this index.
• Also included: PNG-US interest rate differential and borrowing by Government of PNG.
### Table 1 – Commodity price index weights.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Weight (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocoa</td>
<td>2.4</td>
</tr>
<tr>
<td>Coffee</td>
<td>6.7</td>
</tr>
<tr>
<td>Tea</td>
<td>0.3</td>
</tr>
<tr>
<td>Copra</td>
<td>0.8</td>
</tr>
<tr>
<td>Copra Oil</td>
<td>1.2</td>
</tr>
<tr>
<td>Palm Oil</td>
<td>5.9</td>
</tr>
<tr>
<td>Rubber</td>
<td>0.1</td>
</tr>
<tr>
<td>Forest products</td>
<td>8.3</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>27.1</td>
</tr>
<tr>
<td>Gold</td>
<td>32.3</td>
</tr>
<tr>
<td>Copper</td>
<td>14.8</td>
</tr>
<tr>
<td><strong>Non-mineral (aggregate)</strong></td>
<td><strong>25.8</strong></td>
</tr>
<tr>
<td><strong>Mineral (aggregate)</strong></td>
<td><strong>74.2</strong></td>
</tr>
</tbody>
</table>

Each commodity’s weight is given by the average of its annual shares from 1995-2004 of PNG’s exports of the eleven commodities shown. Export volume index constructed using the same weights.
<table>
<thead>
<tr>
<th></th>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
<th>(e)</th>
<th>(f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Commodity price</td>
<td>0.47***</td>
<td>0.43***</td>
<td>0.43***</td>
<td>0.41***</td>
<td>0.34***</td>
<td>0.41***</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.10)</td>
<td>(0.10)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Δ Commodity price (lag 1)</td>
<td>0.016</td>
<td>-0.049</td>
<td>0.022</td>
<td>-0.017</td>
<td>-0.039</td>
<td>-0.030</td>
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<tr>
<td></td>
<td>(0.17)</td>
<td>(0.16)</td>
<td>(0.16)</td>
<td>(0.15)</td>
<td>(0.14)</td>
<td>(0.17)</td>
</tr>
<tr>
<td>Δ Commodity price (lag 2)</td>
<td>0.58**</td>
<td>0.53**</td>
<td>0.50**</td>
<td>0.56***</td>
<td>0.52**</td>
<td>0.63**</td>
</tr>
<tr>
<td></td>
<td>(0.21)</td>
<td>(0.20)</td>
<td>(0.19)</td>
<td>(0.19)</td>
<td>(0.20)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>Δ Commodity price (lag 3)</td>
<td>-0.11</td>
<td>-0.20</td>
<td>-0.11</td>
<td>-0.098</td>
<td>-0.073</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.38)</td>
<td>(0.36)</td>
<td>(0.39)</td>
<td>(0.35)</td>
<td>(0.25)</td>
</tr>
<tr>
<td>Δ Commodity price (lag 4)</td>
<td>0.065</td>
<td>-0.51</td>
<td>-0.38</td>
<td>-0.32</td>
<td>0.26</td>
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<tr>
<td></td>
<td>(0.20)</td>
<td>(0.62)</td>
<td>(0.61)</td>
<td>(0.55)</td>
<td>(0.41)</td>
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<tr>
<td>Δ Fiscal deficit</td>
<td></td>
<td>-0.051</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>(0.092)</td>
<td></td>
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<tr>
<td>Southern Oscillation Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.00097</td>
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<td></td>
<td>(0.00087)</td>
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<tr>
<td>Ok Tedi closed</td>
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<td></td>
<td></td>
<td></td>
<td>-0.050*</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.027)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.025***</td>
<td>-0.024***</td>
<td>-0.023***</td>
<td>-0.022***</td>
<td>-0.019**</td>
<td>-0.022</td>
</tr>
<tr>
<td></td>
<td>(0.0063)</td>
<td>(0.0072)</td>
<td>(0.0067)</td>
<td>(0.0079)</td>
<td>(0.0078)</td>
<td>(0.00980)</td>
</tr>
<tr>
<td>R²</td>
<td>0.39</td>
<td>0.38</td>
<td>0.37</td>
<td>0.39</td>
<td>0.41</td>
<td>0.36</td>
</tr>
<tr>
<td>N</td>
<td>39</td>
<td>41</td>
<td>41</td>
<td>41</td>
<td>41</td>
<td>29</td>
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<td>2005 Q4</td>
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<td>2005 Q4</td>
<td>2005 Q4</td>
<td>2005 Q4</td>
<td>2005 Q4</td>
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</table>

Dependent variable is first difference of kina/US dollar exchange rate. Newey-West standard errors, allowing for serial correlation of up to order four, in parentheses. '*' indicates significance at the 10 percent level, '**' significance at the 5 percent level and '***' significance at the one percent level.
Results – Commodity prices

• Commodity prices have a strong impact on the kina.
• 10% increase in commodity prices estimated to cause kina to appreciate by 4% this quarter and by a further 6% in two quarters time.
• Effect is highly robust across different specifications.
• Decomposing export prices into mineral and non-mineral prices shows:
  ▪ Non-mineral prices affect kina in present quarter;
  ▪ Mineral prices affect kina with two quarters lag.
Decomposing Mineral & Non-Mineral Prices (cont)

• Use of offshore accounts by mineral companies

• Regression results show non-mineral prices have a significant impact on the exchange rate for the current qtr while mineral prices have marginal effect in the current qtr and highly significant impact in 2 qtr lag
Results – Other variables

• Find some evidence that:
  ▪ Higher domestic interest rate causes kina to appreciate;
  ▪ Borrowing by Government of PNG from domestic banking system causes kina to depreciate.

• But these effects not robust across specifications.

• Money supply and volume of commodity exports do not affect value of kina.
Implications

• Kina is a commodity currency.
• PNG is highly vulnerable to external commodity price shocks. We have demonstrated exchange rate channel, but also:
  ▪ Export revenues
  ▪ Fiscal revenues
• Strong link between changes in commodity prices leads kina, exchange rates changes and domestic prices. High commodity – good times, Low commodity-bad times. It happened in the 1990s. Another angle to the economic survey.
• Since 2002 PNG has benefited from huge positive commodity price shock. This has laid the foundations for the current macro stability in the economy.
• The current Govt and the Bank of PNG have frequently been credited with restoring macroeconomic stability starting in 2003 (after the 2002 election). Prudent fiscal and monetary policies have assisted but the main factor for the stability is commodity prices
• An alternative hypothesis is they/the country have/has simply been the beneficiaries/ry of a fortuitous rise in commodity prices.
• But prices can’t keep rising or stay high forever …
Implications

• Bank of PNG has often, in the recent past years presented in seminars and Chamber of Commerce breakfast series that while there is macroeconomic stability, micro agents must play their part in building the economy for growth and improved delivery of goods and services to the rural people. Micro improvements will lead to benefits of macro stability flowing through.

• When the tide changes, and it is changing now, more resources and effort will be diverted to restoring macroeconomic stability as we saw in the 1990s.

• When there is money, we cry – capacity constraints, untimely disbursements of funds, funds not directed to where they are supposed to.

• When the tide changes- we cry not enough funds.

• Save for the rainy days must be seen to happen. Put trust account funds to where it matters or for the projects they are intended for. For productive/developmental expenditure.
Future directions

• Policy questions:
  - Can PNG monetary and fiscal authorities stabilise effects of commodity price shocks?
  - Should they?
  - Case for risk reduction by diversifying export base?

• Exchange rate questions:
  - Do interest rate and Government borrowing matter – more work needed.
  - Real exchange rate dynamics – does purchasing power parity hold?
  - Effect of exchange rate changes on real economy – exports, output, etc.
THANK YOU