The Impact of Commodity Price Movements on the New Zealand Economy

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NON-TECHNICAL SUMMARY

We estimate the macroeconomic effects of changes in commodity prices on the New Zealand economy. Our analysis suggests that an increase in commodity prices has similar characteristics to demand driven macroeconomic fluctuations. GDP expenditure subcomponents such as consumption and investment tend to rise in response to higher commodity prices. Business investment appears to respond more than consumption, highlighting its importance in the transmission of a commodity price movements. In line with higher demand pressures, non-tradable inflation is estimated to increase persistently. We find that the real exchange rate appreciates, and tradable inflation decreases accordingly. Possibly due to the divergent patterns of tradable and non-tradable inflation, the interest rate does not respond to higher commodity prices in the very short-run but is estimated to increase over longer horizons.
1 INTRODUCTION

The recent falls in dairy prices and broader measures of commodity prices illustrate the degree of volatility in commodity markets. Given that New Zealand is a commodity exporting economy, it is important to understand the effects of commodity price movements. In this Note we quantify the macroeconomic effects of unexpected commodity price increases on the New Zealand economy. While we mainly focus on aggregate commodity export prices, our investigation also sheds some light on the effects of unanticipated changes in the prices of our dairy exports, a key sector of the New Zealand economy. Changes in commodity prices can be attributed to, among other reasons, changes in demand from emerging markets like China and India (Osborn and Vehbi, 2015) and supply factors such as adverse weather conditions (Kamber, McDonald, and Price, 2013). While distinguishing between different causes of commodity price changes can be a useful exercise in its own right, we will adopt a more narrow focus to study the consequences of a generic unexpected commodity price changes on the New Zealand economy.

Most analyses of commodity prices tend to be centred on the effects of oil price shocks and are often U.S.-centric (eg, Kilian, 2008, and references within). Our analysis differs to the extent that we consider commodity price shocks to a small commodity price exporting country like New Zealand. In this respect, our work is more closely related to work by Bjørnland and Thorsrud (2015) who study the effects of commodity price shocks on Australia and Norway, two small commodity exporting economies.

In this analysis we aim to evaluate the impact of exogenous changes in commodity export prices. We do this using movements in the ANZ commodity price index, which reflect price changes in a variety of underlying commodities. While the sub-components of the index are commodities representing New Zealand’s main exports, such price changes may be partially driven by fluctuations in commodity import prices. For example, although oil prices are not part of the index, a change in global oil prices may create movements in agricultural commodity prices, given oil’s dominance in the production of agricultural commodities.¹ It is therefore

¹Oil prices are highly correlated with a broad set of non-energy commodity prices (West and Wong, 2014). In particular, the correlation coefficient between ANZ commodities and oil prices for the 1986Q1-2015Q2 period is 0.48.
desirable to isolate movements of the ANZ index that are independent from fluctuations in oil prices. To derive this ex-oil measure of commodity prices, which we interpret as independent from oil prices, we regress ANZ commodity prices against oil prices. We then use the residuals of this regression as our commodity price index.\textsuperscript{2}

Using this commodity price index and a structural vector autoregression (SVAR) model, we then study the effects of movements in commodity prices on other macroeconomic variables.

\section{The model}

We quantify the macroeconomic effects of commodity price shocks via the structural vector autoregression model described by equation (1):

\begin{equation}
B_0X_t = \sum_{i=1}^{p} B_i X_{t-i} + \epsilon_t
\end{equation}

where \(X_t\) is a vector of variables which include the ex-oil ANZ commodity price index, private consumption, business investment, the real exchange rate, the 90-day interest rate, net trade and CPI inflation, which has been split into tradable and non-tradable components. The structural shocks \(\epsilon_t\) are assumed to be independent of each other. Definitions of our data are available in the appendix.\textsuperscript{3}

\textbf{Estimation and identification.} Equation (1) is estimated with 4 lags using maximum likelihood. We use quarterly data from 1986Q1 to 2015Q2, with 1986Q1 being the first observation available for the commodity price index. The sample does include other policy regimes prior to the introduction of inflation targeting in 1989. We will address this issue in the robustness

\textsuperscript{2}We estimate the following regression: \(P_{t}^{COM} = -0.024 + 0.157 P_{t}^{OIL} + \epsilon_t\), where \(P_{t}^{COM}\) is the log-level of real commodity prices, and \(P_{t}^{OIL}\) is the log-level of real oil prices.

\textsuperscript{3}Consumption and investment enter the model as log-levels allowing us to (indirectly) account for any possible cointegration between the two. As a robustness check, we considered alternative specifications where we i) include a deterministic linear trend, and ii) model consumption and investment in growth rates. While we do not show the results from these specifications, the effects of commodity price shocks were similar to our baseline results.
section using a shorter sample, but for now note that our results remain broadly unchanged compared to our baseline results (see Figure 2).

To identify structural commodity price shocks, we assume commodity prices are pre-determined to the rest of the economy. We defend our identifying restrictions on two grounds. First, New Zealand is a small open economy which makes pre-determined commodity prices a natural identifying assumption. Second, one may argue that New Zealand is a large dairy producer, and thus a commodity price index that includes dairy may not be exogenous. Even so, we only require a weaker working assumption where the short-run supply curve of commodity production in New Zealand is perfectly inelastic only within the quarter. Pre-determined commodity prices imply the model in (1) can be estimated with $B_0$ being lower triangular with the commodity variable ordered first in the matrix $X$. We do not attempt to interpret any other structural shocks, so assuming commodity prices are pre-determined is sufficient to identify the commodity price shock.

3 Results

The estimated macroeconomic effects of a commodity price shock are reported in Figure 1. We calculate the responses of our variables to a temporary 5 percent increase in the ANZ commodity price index. The effect of the shock on commodity prices is estimated to be somewhat persistent. The initial increase in commodity prices dies out only 9 quarters later, with the shock having a half-life well above a year.

An unexpected increase of 5 percent in commodity prices has a positive and significant impact on real economic activity. This is likely the result of domestic demand pressures supported by the extra income generated by the shock. The peak short-run response of investment is above 2 percent, while that of consumption is about 0.3 percent, both occurring within a year after the shock. Business investment appears to respond more than consumption to a commodity price shock, highlighting its importance in the transmission of a commodity price shock. Further, the investment response remains statistically significant for four quarters, compared to only two quarters for consumption. The Net trade-to-GDP ratio increases initially due to higher

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4 Given the linearity of the model, the impact of positive and negative shocks are symmetric.
commodity prices. Perhaps due to the higher exchange rate, the terms of trade deteriorates over the medium term.

Following a commodity price shock, the real exchange rate goes up by 1 percent on impact. This is in line with the well documented relationship between the New Zealand dollar and the prices of New Zealand’s main commodities (see for example Chen and Rogoff (2003)). It is usually difficult to establish a priori the reaction of inflation in the tradable sector following a commodity price shock. While the increase in the exchange rate puts downward pressures on tradable inflation, higher commodity prices may put upward pressure on prices of New Zealand commodity imports (Parker and Wong, 2014). The ex-oil measure of commodity prices that we use is meant to control for fluctuations in commodity import prices. As a result, inflation in the tradable sector falls by 0.8 percent, mainly reflecting the impact of the higher real exchange rate. In the non-tradable sector, the commodity price shock translates into higher inflation on impact, reflecting stronger economic activity. In the medium-term, overall inflation (tradable and non-tradable) is estimated to increase.

Given the divergent patterns of tradable and non-tradable inflation on impact, the 90-day interest rate does not respond to the shock in the very short-run. The gradual increase over longer horizons is in line with systematic monetary policy responding to inflationary pressures under an inflation-targeting regime. Importantly, under the assumption of a policy reaction function that abstracts from the exchange rate, the commodity price shock in our scenario does not lead to any trade-off for monetary policy, as real activity and inflation both increase.

To summarize, in the very short-run commodity price shocks mainly affect inflation and the exchange rate, whereas strong positive real effects on output take place in the medium-term, particularly through an increase in real business investment. The effect of a commodity price shock resembles one of a demand shock, reflecting the extra income from higher commodities prices. In response to higher commodity prices, expenditure components (consumption and investment) and non-tradable inflation all rise. As a result, the interest rate eventually increases to offset higher inflationary pressure.
Figure 1: Macroeconomic effects of commodity price shocks

Note: Impulse responses to a one standard deviation shock to commodity prices, calculated with the baseline SVAR model, and rescaled such that the response of commodity prices on impact is equal to 5%. The response of the exchange rate has been cumulated. The three lines represent the point estimate and 68% confidence bands, based on 2,000 bootstrap replications. All variables are in percentage deviations.

4 Robustness

Our analysis so far has focused on aggregate commodity prices. In particular, the ANZ commodity price index that we use is constructed as a weighted average of prices for a basket of commodities reflecting New Zealand’s main export categories. The weights are based on the contribution of each individual commodity to total merchandise exports, and as such they can vary over time. However, the importance of dairy exports has always been predominant, with dairy prices accounting for most of the fluctuations in the aggregate index (its weight for 2015 is near 50 percent).

Considering the relevance of the dairy industry for New Zealand, we re-estimate our model by substituting the aggregate commodity price index with the dairy price. We then re-compute the
Figure 2: Robustness

Note: Black line: Impulse responses calculated from the baseline SVAR model. Red lines: Impulse responses using dairy prices as the commodity price index. Green lines: Impulse responses using the model estimated over the 1992q1-2015q2 sample. Blue lines: Impulse responses using unadjusted ANZ commodity price index. All variables are in percentage deviations.

responses of the variables to a dairy price shock, which are shown in Figure 2. The size of the dairy commodity price shock corresponds to one standard deviation, as in our baseline analysis. However, dairy prices account for half of the aggregate index. Consistently, we rescale the responses of the variables such that the reaction of dairy prices on impact is equal to 10 percent, which enables us to have comparable results.
shorter sample, which roughly corresponds to the inflation targeting era, i.e., 1992Q1-2015Q2. This shorter sample excludes the high inflation and high volatility that occurred during the late 1980’s. Results remain qualitatively unchanged, despite some impulse responses being quantitatively smaller. We emphasize, however, that working with this sub-sample substantially reduces the number of observations available for estimation and makes some estimates less accurate.

The second robustness check consists of using the overall ANZ commodity price index instead of its ex-oil counterpart. The pattern of all the responses is very similar to the baseline case. The effects on the real exchange rate and inflation are estimated to be slightly stronger. This is somewhat expected as commodity price shocks now potentially includes the effects of oil price movements.

5 Conclusion

We investigate the impact of commodity price shocks to the New Zealand economy. Our results suggest that the impact of commodity price shocks to the New Zealand economy is akin to an impulse to the demand side of the economy. This can be seen through a rise in GDP expenditure subcomponents such as consumption and investment as well as an increase in non-tradable inflation. We find that after a positive commodity price shock, exchange rate appreciates and results in a mitigating one-off fall in tradable inflation. Our results are robust to alternative definitions of the commodity price index or sub-samples.

References


Appendix: Data

The table below reports the variables that we employed in this study along with their definitions and transformations.

Table 1: Data definitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodity price index</td>
<td>Log of the ANZ commodity price index in US dollars deflated using the US Consumer Price Index (CPI), quarterly average</td>
<td>ANZ Bank</td>
</tr>
<tr>
<td>Consumption</td>
<td>Log of private consumption, deflated using the CPI</td>
<td>Statistics NZ</td>
</tr>
<tr>
<td>Investment</td>
<td>Log of business investment, deflated using the CPI</td>
<td>Statistics NZ</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>New Zealand dollar real trade-weighted index (Real TWI-17)</td>
<td>RBNZ</td>
</tr>
<tr>
<td>Interest rate</td>
<td>90-day interbank rate</td>
<td>RBNZ</td>
</tr>
<tr>
<td>Tradable inflation</td>
<td>Annualized log difference of quarterly tradable CPI</td>
<td>Statistics NZ</td>
</tr>
<tr>
<td>Non-tradable inflation</td>
<td>Annualized log difference of quarterly Non-tradable CPI</td>
<td>Statistics NZ</td>
</tr>
<tr>
<td>Net Trade</td>
<td>Nominal exports minus imports divided by nominal GDP</td>
<td>Statistics NZ</td>
</tr>
<tr>
<td>Oil Prices</td>
<td>Crude Oil Prices: West Texas Intermediate (WTI), deflated by US CPI</td>
<td>HAVER</td>
</tr>
</tbody>
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