Commodity Prices and Monetary Policy
The Chilean Experience

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Introduction

• Fluctuations in commodity prices play a key role in Inflation Targeting monetary policy frameworks.
• This role is often-times complex.
• Commodity price fluctuations affect:
  • Inflation through direct effects.
  • Aggregate demand through income effects on households and firms.
  • Aggregate supply through measured productivity and cost structures.
Introduction

• Commodity price fluctuations can have different degrees of transience/persistence.
• The implications for monetary policy are therefore non-trivial, and more complex than for instance simple aggregate demand shocks.
• In what follows I will present how some of these different issues have been addressed over time by the Central Bank of Chile.
• Seminal work is DSGE framework in Medina and Soto (2007).
Commodity prices have experienced significant swings over the past two decades.

Commodity prices
(index, average 1995–2013 = 100)

(1) Corresponds to the Goldman Sachs aggregate index.
(2) London Metal Exchange (LME) aggregate index.

Source: Bloomberg.
Chile’s trade patterns make the economy sensitive to commodity price shocks.

(1) Agriculture, Fisheries and Forestry.

Source: Central Bank of Chile
The terms of trade and the real exchange rate display significant swings ...
... inducing a significant gap between different nominal price aggregates.

GDP and consumption deflators, and terms of trade
(year-on-year percentage change)

Source: Central Bank of Chile.
Focus at the BCCh

- Since adopting full-fledged IT framework in 1999, the Central Bank’s analytical focus on this issue has been three-fold:
  1) The pass-through of international inflation (esp. food & energy prices) to domestic inflation.
  2) The implications of copper price movements for macroeconomic aggregates.
  3) The effect of higher energy prices on measured productivity and growth.

<table>
<thead>
<tr>
<th>Country</th>
<th>Max</th>
<th>HL (max)</th>
<th>Max</th>
<th>HL (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>8%</td>
<td>9</td>
<td>Iceland</td>
<td>94%</td>
</tr>
<tr>
<td>Denmark</td>
<td>3%</td>
<td>10</td>
<td>Lithuania</td>
<td>14%</td>
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<tr>
<td>France</td>
<td>4%</td>
<td>7</td>
<td>Poland</td>
<td>89%</td>
</tr>
<tr>
<td>Germany</td>
<td>3%</td>
<td>24</td>
<td>Slovenia</td>
<td>49%</td>
</tr>
<tr>
<td>Ireland</td>
<td>17%</td>
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<td>Chile</td>
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</tr>
<tr>
<td>Italy</td>
<td>2%</td>
<td>9</td>
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<td>29%</td>
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<td>Japan</td>
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<td>23</td>
<td>Japan</td>
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<td>USA</td>
<td>8%</td>
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<td>Czech Republic</td>
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<td>21</td>
<td>Russia</td>
<td>34%</td>
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<tr>
<td>Estonia</td>
<td>28%</td>
<td>21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Rigobón (2010).
1) Pass-through from energy to gasoline is similar across developed economies...
1) But much more heterogeneous across emerging economies.
1) Country and sectoral fixed effects play a significant role.

<table>
<thead>
<tr>
<th>Shock</th>
<th>Commodity Prices in Dollars</th>
<th>Max Pass Through</th>
<th>Max Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Country</td>
<td>Sector</td>
<td>Total</td>
</tr>
<tr>
<td>Oil</td>
<td>27.0%</td>
<td>26.8%</td>
<td>53.7%</td>
</tr>
<tr>
<td>Rice</td>
<td>24.7%</td>
<td>22.8%</td>
<td>47.5%</td>
</tr>
<tr>
<td>Maize</td>
<td>55.4%</td>
<td>11.4%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Wheat</td>
<td>56.5%</td>
<td>11.8%</td>
<td>68.3%</td>
</tr>
<tr>
<td>Copper</td>
<td>26.3%</td>
<td>27.1%</td>
<td>53.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>LR Pass Through</th>
<th>LR Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>18.4%</td>
<td>33.4%</td>
</tr>
<tr>
<td>Rice</td>
<td>23.4%</td>
<td>20.8%</td>
</tr>
<tr>
<td>Maize</td>
<td>50.8%</td>
<td>20.1%</td>
</tr>
<tr>
<td>Wheat</td>
<td>51.4%</td>
<td>18.0%</td>
</tr>
<tr>
<td>Copper</td>
<td>23.1%</td>
<td>11.3%</td>
</tr>
</tbody>
</table>

Source: Rigobón (2010).
1) Global factors improve forecasting accuracy.

Source: Pincheira and Gatty (2014).
2) DSGE approach to model commodity price within IT framework.

- Seminal work is DSGE model developed in Medina and Soto (2007): *Modelo de Análisis y Simulación* (MAS)
- Forms an important part of IT forecasting framework since 2008.
- Allows to answer structural questions such as:
  - Imperfect credibility,
  - Terms of trade shocks,
  - The incidence of fiscal and monetary policy rules,
  - Macroeconomic impact of large natural disasters (2010 earthquake and tsunami).
2) DSGE approach to model commodity price within IT framework.

- Supply side considers three sectors: T, N and S (Copper).
- A fraction of agents is Ricardian.
- Persistence is derived from costs of adjustment in investment and habit formation in consumption.
- New Keynesian Phillips curve with inertia.
- Dynamics from labor-leisure choice needs to be carefully examined.
- Risk premium in UIP depends on NFA as % of GDP.
2) Schematic structure of MAS
2) The credibility of the Central Bank determines if oil shocks can be accommodated.

- Credibility that the central bank will not deviate from the target and/or compensate the contractionary effect of oil prices in growth caps inflation expectations and diminishes the contemporaneous effect of oil prices in inflation.
- This therefore limits the need for a monetary policy response to the shock.

Source: Desormeaux et.al. (2010).
2) The copper price boom has been significant, with evolving expected persistence.

(*) Dotted lines indicate projection available in October of each year.
Sources: Central Bank of Chile and CRU Group.
2) The copper price boom has been significant, with evolving expected persistence.

Source: Fornero and Kirchner (2013).
2) This has impacted on the evolution of the saving-investment balance.

Source: Fornero and Kirchner (2013).
2) Particularly with a significant pick-up in mining investment in recent years.

Sources: Central Bank of Chile and Cochilco.
2) Imperfect information and learning allow a better representation of Copper price shocks.

- Extension of MAS considers endogenous supply of copper through sector specific investment, based on long term expectations of the price.
- Spot price of copper is observable, and follows a process that considers persistent and transitory components:
  \[ P^*_s, t = a_t + b_t = \rho b_{t-1} + u_t \quad a_t \sim N(0, \sigma_a^2) \quad u_t \sim N(0, \sigma_u^2) \]
- Agents infer the persistent component through a learning process (Kalman filter):
  \[ \hat{b}_t = \rho \hat{b}_{t-1} + K_t \rho^{-1} (P^*_s, t - \rho \hat{b}_{t-1}) \]
- Using current information agents forecast the expected price of copper over the longer term to base their spending and investment decisions.
2) Imperfect information and learning allow a better representation of Copper price shocks.
2) Learning implies that higher prices are only gradually assessed as persistent.

Source: Fornero and Kirchner (2013).
2) And this has significant macroeconomic implications in the DSGE model with learning.

Figure 9: Impulse responses of savings, investment, and the current account balance (% of GDP) to a persistent commodity price shock of 50 percent.
2) This broadly explains actual dynamics in Chile.

Source: Fornero and Kirchner (2013).
2) Imperfect information on persistence have relevant implications for monetary policy.
2) Fiscal policy response to copper price windfall has also first order effects for monetary policy.

Source: Desormeaux et.al. (2010).
3) There has been a shift in the composition of energy generation.

Contribution of projects built or under construction to the Central Interconnected System (SIC) (*)

(megawatts)

(*) Excludes plant factor of respective technologies.
3) Coupled with international price developments, energy costs have increased.

Energy generation by type of technology and marginal cost
(megawatts, US$/MW)

Sources: Load Economic Dispatch Center – Central Interconnected Electric System (CDEC-SIC) and National Energy Commission (CNE).
3) This has been translated into final prices for households and firms.

Price of electricity
(US$/MW, index 2009 = 100)

Sources: National Energy Commission (CNE) and National Statistics Institute (INE).
3) This has been translated into final prices for households and firms.

Electricity tariffs for firms
(US dollars per Mega Watt)

3) Over the medium term, higher energy prices have affected measured productivity.

\[ Y_t^b = A_t \left[ \gamma^{\frac{1}{\theta}} \left( K_t^\alpha L_t^{1-\alpha} \right)^{\frac{\theta-1}{\theta}} + (1 - \gamma)^{\frac{1}{\theta}} \left( E_{NER_t} \right)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \]

\[ \frac{E_{NER_t}}{K_t^\alpha L_t^{1-\alpha}} = \gamma \left( \frac{P_{E,t}}{P_t} \right)^{-\theta} \]

Source: Echavarría et al. (2009).
Conclusions

• Optimal monetary policy response to commodity price fluctuations is not straightforward.
• It depends on, among other issues:
  • Credibility of monetary policymaking,
  • Expected transience and persistence of shocks,
  • Fiscal policy response,
  • Cost and income effects.
• Thus, for small open economies such as Chile, understanding and monitoring commodity price fluctuations is key for successful Inflation Targeting management.
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