



# Commodity prices and fiscal policy in a commodity exporting economy<sup>☆</sup>



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## ABSTRACT

This paper analyzes the macroeconomic effects of commodity price shocks on a commodity exporting country. In doing so, we use a DSGE model developed to describe the business cycle in Chile, a copper exporting country. We compare the effects of commodity-price shocks under different fiscal rules. The results show that if the fiscal policy is conducted in a way such that the government saves most of the extra revenues from the higher commodity price, then the macroeconomic effects of a commodity price increase of 10% are an expansion of output below 0.2% and a real exchange appreciation of 0.5%. In contrast, when fiscal policy is highly expansive, the same commodity price increase implies an output expansion above 0.5% and a real exchange rate appreciation of 0.8%. With our model, we also analyze the effects of persistent reduction in the commodity price, the relevance of exchange rate flexibility and the role of imperfect credibility of the fiscal rule.

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## 1. Introduction

Terms of trade fluctuations are an important source of volatility in most emerging market economies. The recent boom and bust cycle in commodity prices has evidenced their relevance in the economic performance of commodity exporters.<sup>1</sup> In the case of Chile, business cycles have been historically associated to fluctuations in the price of copper, a commodity that represents approximately 40% of total exports and about 15% of public revenues.<sup>2</sup> Given the importance of copper price movements on the volatility of fiscal revenues, and potentially on output fluctuations, the fiscal authority introduced in

2001 a new fiscal rule to isolate government expenditure from these movements.

In this paper we analyze the effects copper price shocks on different macroeconomic variables from a general equilibrium perspective, with particular emphasis on the role played by the fiscal rule currently in place in Chile. There are several potential mechanisms through which a shock to the copper price may affect the business cycle and variables such as the real exchange rate and inflation. To encompass different first and second round effects, we use a dynamic stochastic general equilibrium (DSGE) model tailored to the Chilean economy (Medina and Soto, 2007). We analyze the impulse response functions to a copper price shock, comparing the results under different fiscal rules. In one case, the government consumes all the extra revenues from the higher copper price. In a second case, we assume the government transfers the extra revenues to the domestic private sector by reducing taxes. Finally, we consider the effects under the *structural balance fiscal rule* introduced in Chile in 2001. This fiscal rule, based on a target for the structural balance as percentage of GDP, is an attempt to compromising and signaling the fiscal policy over a medium-term horizon. The rule allows automatic stabilizers to work uninhibited, while avoiding fine-tuning the fiscal policy to the phases of the cycle.

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<sup>1</sup> See IMF (2012) and IMF (2015) for a cross-country analysis of the effects of commodity price swings in commodity exporters.

<sup>2</sup> See Spilimbergo (2002) and Caballero (2001), among others.

We consider that a fraction of households do not have access to the capital market. These households consume their disposable income period by period (non-Ricardian households).<sup>3</sup>

The results show that when the fiscal policy is highly expansive in response to a transitory shock, and if an important fraction of households are non-Ricardian, then an increase in the copper price of 10% implies an output expansion above 0.5%. The real exchange rate appreciates about 0.8% and inflation slightly falls. The size of the GDP expansion is similar to the one found in other studies. For instance, Drexler et al. (2001) report that an increase in the copper price by 10% increases Chile's non-mineral GDP in about 0.5%. In a more recent work, Schmitt-Grohé and Uribe (2015) estimate country-specific SVARs using data from 38 poor and emerging countries. They find that a terms of trade shock of 10% causes a median increase of 0.4% in GDP.

In contrast, if the fiscal policy is conducted in a way such that the government saves most of the extra revenues from the higher copper price (such as the *structural balance* rule), then output would increase between 0.1 and 0.2%. The real appreciation of the exchange rate would also be moderated around 0.5%. Our simulations also show that this type of fiscal policy reduces the adjustment costs of the economy after a persistent decline in copper price.

We show that the adoption of a flexible exchange rate regime also contributes to isolate output and the real exchange rate from copper price shocks. Therefore, the adoption of both the *structural balance* fiscal rule and a flexible exchange rate regime have contributed to reduce the sensitivity of the Chilean GDP to copper price shocks. Although the Chilean economy is not fully immune to copper price fluctuations, these two policies have helped to reduce the vulnerability of the economy to this type of fluctuations.

Our analysis also highlights that imperfect credibility about the *structural balance* fiscal policy would tend to amplify the effects of the copper price shocks on GDP, consumption, and the real exchange rate. However, investment would respond by less under imperfect credibility. Since investment has inertia, it depends heavily on the expected path of the interest rate in the future. Thus, it increases by less in response to a copper price increase due to an expected tighter path for the monetary policy stance under imperfect credibility regarding fiscal policy.

The rest of the paper is organized as follows. The next section reviews related literature. The third section summarizes the main recent developments regarding the fiscal policy in Chile. The fourth section describes the model. Then, the fifth section discusses the solution and parametrization of the model. The sixth section presents and discusses the impulse-response function of shocks to the copper price under different regimes for fiscal and monetary policies. Finally, section seventh concludes.

## 2. Literature review

Commodity exporting countries have typically experienced more volatile business cycles than other countries due, in part, to the inherent volatility of commodity prices. Several models and estimation approaches have been proposed to understand the relevance of commodity prices in the business cycles of small open economies. Many of these economies tend to have procyclical macroeconomic policies, that exacerbate the sensitivity of the business cycles to commodity price fluctuations.<sup>4</sup>

<sup>3</sup> Alternatively, we could think of different behavioral rules for different households. For example, we could just assume that a fraction of households do not intertemporally optimize and just consume their disposable income ("rule of thumb" behavior for these agents). Nonetheless, the results would be identical.

<sup>4</sup> See Frankel et al. (2013) for evidence on the procyclicality of fiscal policy and Vegh and Vuletin (2013) for the procyclicality of monetary policy.

Pieschacón (2012), analyzing Mexico and Norway, argues that business cycle vulnerability to oil price shocks is related to fiscal policy. Mexico has a higher exposure to oil price fluctuations due to a procyclical fiscal policy while in Norway fiscal policy has been designed to insulate business cycles from oil price shocks. García et al. (2011) have arrived to similar conclusions. They also find that an acyclical fiscal rule unambiguously benefits credit-constrained consumers, but reduces welfare of non-constrained consumers. A recent work for Colombia (Ojeda et al., 2016) illustrates the potential benefits of a countercyclical fiscal rule in an emerging economy that exports oil. Kumhof and Laxton (2010) also suggest the significance of fiscal policy to attenuate the sensitivity of an economy to commodity price fluctuations.

Our work is also related to the research on how commodity price booms generate Dutch Disease effects and how policies can deal with them. For instance, Van Wijnbergen (1984), Krugman (1987), Caballero and Lorenzoni (2014), Lama and Medina (2012), and García-Cicco and Kawamura (2015) evaluate alternative policy responses and instruments in the context of Dutch disease episodes. Although it is possible to consider different instruments to deal with commodity price fluctuations such as exchange interventions, capital control and macro-prudential regulations, our focus in this work is mainly on fiscal policy.

Despite developing economies have improved the conduct of fiscal and monetary policies as argued by Céspedes and Velasco (2014), Frankel et al. (2013), and Vegh and Vuletin (2013), some concerns prevail regarding how to best manage commodity boom-bust cycles in these countries.<sup>5</sup> In this respect, the case of Chile is interesting because it changed its fiscal and monetary arrangements at the beginning of 2000s with the purpose of achieving better macroeconomic stability. In 1999, Chile adopts a full-fledge inflation targeting regime with a fully flexible exchange rate and, in 2001, it adopts a *structural balance* fiscal rule, making government spending a function of long-term levels of GDP and copper price.

Our major contribution is to make a quantitative analysis in the case of Chile, where a significant fraction of the GDP and fiscal revenues are related to the copper sector. Our model is built to reflect the features of the Chilean economy, the particular role of the copper sector and the specific form for the fiscal and monetary policies in place since 2000.

Finally, it is worth noting that the model developed below is a medium scale model for a small open economy with nominal and real rigidities similar to Adolfson et al. (2007), Altig et al. (2011), Christiano et al. (2005), and Smets and Wouters (2007). We extend this type of models to include a commodity sector that is an endowment that only generates income effects in the economy. Thus, investment in the commodity sector is not considered as in Fornero and Kirchner (2014), Pieschacón (2012), and Ojeda et al. (2016). This is clearly a simplification, but it allows us to quantify the amplifying role of a procyclical fiscal policy by comparing the aggregate effects of a copper price shock when the government spends all current fiscal revenues and when it follows the *structural balance* rule designed in Chile. At the same time, the model includes other complexities as price rigidities, which allow us to analyze the interaction between fiscal and monetary policies.

## 3. Recent developments in the fiscal rule of Chile

As mentioned above, since 2001 the Chilean government has conducted its fiscal policy through a fiscal rule based on a measure of the Government's *structural balance*. Importantly, this policy was

<sup>5</sup> See Adler and Magud (2015) and IMF (2015).

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