# Copper booms and regional growth in Chile: shared at first, concentrated later

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**Abstract**

This letter studies how copper price shocks spread across Chilean regions. Using annual real GDP for 13 regions over 2005–2025, spliced across three national accounts bases, and panel local projections, I compare regions with different pre-sample mining intensity. An unanticipated 10% rise in the copper price raises output by about 0.5–0.9% in both mining and non-mining regions during the first two years. The gains then fade in non-mining regions but persist and grow in mining regions, where output is 1.4% higher after four years. A one-standard-deviation higher mining share implies a response 0.3–0.5 percentage points larger three to four years after the shock. The pattern survives excluding the pandemic years, dropping Antofagasta and controlling for gold price shocks. Copper windfalls are shared nationally in the short run, but their medium-run gains concentrate where copper is mined.

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## 1 Introduction

Chile is the world's largest copper producer, and copper drives a large share of its exports, investment and fiscal revenue. Mining activity, however, is concentrated in a few northern regions. This raises a simple question with direct implications for regional policy: when the copper price rises, who gains? The answer is not obvious. Local studies of resource booms find sizeable effects on nearby communities (Aragón and Rud, 2013; Allcott and Keniston, 2018), and evidence for Chilean municipalities shows higher wages and employment where metal mining is concentrated (Fernández, 2021; Chávez and Rodríguez-Puello, 2022). At the same time, copper income reaches the whole country through fiscal spending governed by a structural balance rule (Frankel, 2011), the exchange rate and aggregate demand, and it shapes investment decisions with long lags (Fornero, Kirchner, and Yany, 2015).

This letter measures the timing of these channels with regional national accounts. I splice annual regional GDP from three bases of the Central Bank of Chile into a consistent panel of 13 regions and estimate panel local projections (Jordà, 2005) of regional output on copper price surprises, comparing regions by their pre-sample mining share. The main finding is that copper booms are shared at first and concentrated later: during the first two years the output response is similar across mining and non-mining regions, but from the third year onwards it persists only where mining is important.

## 2 Data and methods

*Regional output.* I use annual real GDP by region from the 2003, 2013 and 2018 bases of the national accounts, all from the Central Bank of Chile. Series are spliced by growth rates (2004–2008 from base 2003, 2009–2013 from base 2013 and 2014–2025 from base 2018). To keep borders constant, regions created after 2007 are merged back into their original regions, which yields 13 regions. Growth rates in overlapping years are highly correlated across bases (0.82).

*Mining exposure.* Exposure is the average mining share of regional GDP in 2003–2005, measured before the estimation sample. Three regions have shares above 20% and are classified as mining regions: Tarapacá (36%), Antofagasta (61%) and Atacama (42%). The cross-regional standard deviation of the share is 19.3 percentage points.

*Copper shock.* The shock $S_t$ is the residual of an AR(1) model for the annual log change in the London Metal Exchange copper price, estimated over 1981–2025 and scaled so that $S_t = 1$ is a 10% surprise. Its standard deviation over 2005–2025 is 21.6%. The copper price is set in world markets and driven mainly by global demand, so it is plausibly exogenous to output in individual Chilean regions.

*Specification.* For horizons $h = 0, \dots, 4$, the differential response is estimated from

$$y_{i,t+h} - y_{i,t-1} = \alpha_i^h + \delta_t^h + \beta_h \, S_t z_i + \gamma_h \, S_{t-1} z_i + \phi_h \, \Delta y_{i,t-1} + \varepsilon_{i,t+h}, \tag{1}$$

where $y_{i,t}$ is 100 times log real GDP of region $i$, $z_i$ is the standardised mining share, and region and year fixed effects absorb all national shocks. $\beta_h$ measures how much more a region with a one-standard-deviation higher mining share grows after the shock. To recover levels, I also estimate

$$y_{i,t+h} - y_{i,t-1} = \alpha_i^h + \theta_h \, S_t + \lambda_h \, S_t M_i + \mathbf{x}_{i,t}' \boldsymbol{\psi}_h + u_{i,t+h}, \tag{2}$$

where $M_i$ indicates a mining region and $\mathbf{x}_{i,t}$ contains $S_{t-1}$, lagged regional and national growth and a 2020–21 dummy. Standard errors follow Driscoll and Kraay (1998) with $h+1$ lags. The sample is 2005–2025. The specification, the exposure measure and the robustness checks (excluding 2020–21, dropping Antofagasta and using gold price shocks) were fixed before estimation.

## 3 Results

Figure 1 and panel A of Table 1 show the response by group. On impact, a 10% copper surprise raises output by 0.57% in mining regions and 0.54% in non-mining regions. Over the first two years the responses are statistically indistinguishable, and in non-mining regions output is still 0.87% higher after two years. From year three the paths diverge: the effect vanishes in non-mining regions (−0.04% and 0.17%) but keeps growing in mining regions, reaching 1.36% after four years.

Panel B confirms this pattern with the continuous exposure measure and year fixed effects. The differential response is close to zero in years 0–2 and becomes positive and significant in years 3 and 4 (0.34 and 0.49 percentage points per standard deviation of mining share). Figure 2 shows that the result holds when windows overlapping 2020–21 are excluded (0.37 and 0.60) and when Antofagasta, the most mining-intensive region, is dropped (0.60 and 0.82).

Gold, which is also mined in northern Chile and whose price shocks are correlated with copper shocks (0.35), shows a differential response only at the four-year horizon. When both shocks enter jointly, the copper differential remains significant (0.29 and 0.37) and the gold differential does not. The medium-run concentration is therefore specific to copper rather than to northern regions in general. This joint specification was not part of the pre-specified design and is reported as an additional check.

## 4 Discussion

The results point to two distinct phases in the regional transmission of copper booms. In the short run, windfalls spread across the country, consistent with national channels such as higher disposable income, fiscal spending and aggregate demand. In the medium run, gains persist only where copper is produced, consistent with investment and capacity expansion that take several years to raise mining output and local activity.

Two implications follow. First, the short-run regional incidence of copper cycles is broad, so copper downturns are not only a problem for mining regions. Second, the lasting output gains accrue to mining regions, which supports regional transfer mechanisms, such as the recent earmarking of mining revenue for regions, if the aim is to share the benefits of the

**Table 1:** Regional GDP responses to a 10% copper price shock

| | $h=0$ | $h=1$ | $h=2$ | $h=3$ | $h=4$ |
|---|---|---|---|---|---|
| *A. Response by group* | | | | | |
| Mining regions | 0.57*** | 0.65** | 0.70* | 0.82*** | 1.36*** |
| | (0.15) | (0.30) | (0.39) | (0.22) | (0.48) |
| Non-mining regions | 0.54*** | 0.88** | 0.87** | -0.04 | 0.17 |
| | (0.19) | (0.36) | (0.40) | (0.40) | (0.45) |
| *B. Differential response (shock × mining share)* | | | | | |
| Baseline | -0.04 | -0.20 | -0.07 | 0.34*** | 0.49*** |
| | (0.11) | (0.29) | (0.17) | (0.12) | (0.19) |
| Excluding 2020–21 windows | 0.01 | -0.12 | -0.02 | 0.37*** | 0.60*** |
| | (0.11) | (0.32) | (0.20) | (0.13) | (0.22) |
| Excluding Antofagasta | 0.22 | 0.05 | 0.01 | 0.60*** | 0.82*** |
| | (0.16) | (0.35) | (0.35) | (0.22) | (0.31) |
| Gold price shock instead of copper | 0.18 | 0.09 | 0.04 | 0.24 | 0.84** |
| | (0.26) | (0.48) | (0.37) | (0.36) | (0.41) |
| Copper, controlling for gold shock | -0.08 | -0.26 | -0.10 | 0.29** | 0.37** |
| | (0.12) | (0.28) | (0.17) | (0.13) | (0.15) |
| Observations (baseline) | 273 | 260 | 247 | 234 | 221 |

*Notes:* Cumulative change in 100 times log real GDP between $t-1$ and $t+h$. Panel A: response of mining regions (mining share $\geq$ 20%) and non-mining regions, from equation (2). Panel B: coefficient on the shock interacted with the standardised 2003–2005 mining share, from equation (1), with region and year fixed effects. Driscoll–Kraay standard errors in parentheses. $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

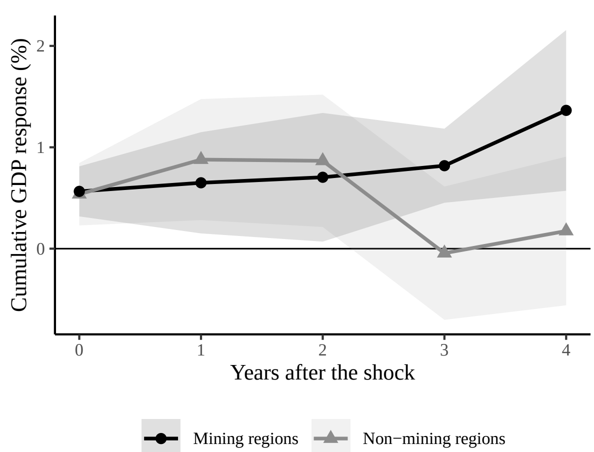


**Figure 1:** Cumulative GDP response to a 10% copper price shock in mining and non-mining regions
*Notes:* Shaded areas are 90% confidence bands.

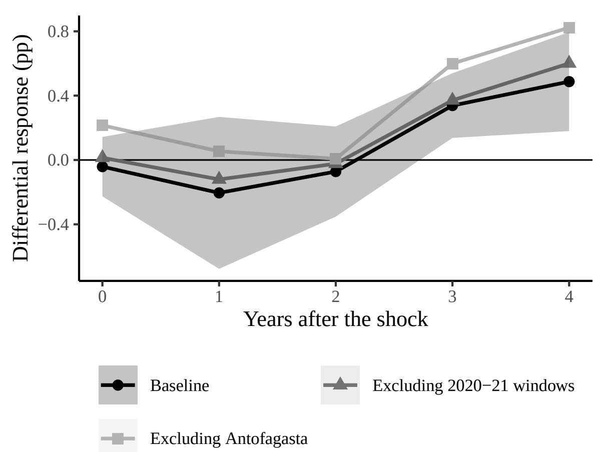


**Figure 2:** Differential response per standard deviation of the 2003–2005 mining share
*Notes:* The shaded area is the 90% confidence band for the baseline.

resource. The evidence has limitations: the panel has 13 regions and 21 years, the splice across bases adds measurement error, and the design identifies relative rather than aggregate effects. Longer regional series and data on regional employment and investment would help pin down the mechanisms.

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The author reports that there are no competing interests to declare.


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## Data availability statement

All data are publicly available from the Central Bank of Chile Statistical Database (https://si3.bcentral.cl/siete). Replication code in R and Stata is available from the author upon request.

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