Copper Super Cycle Impact on the Chilean Economy
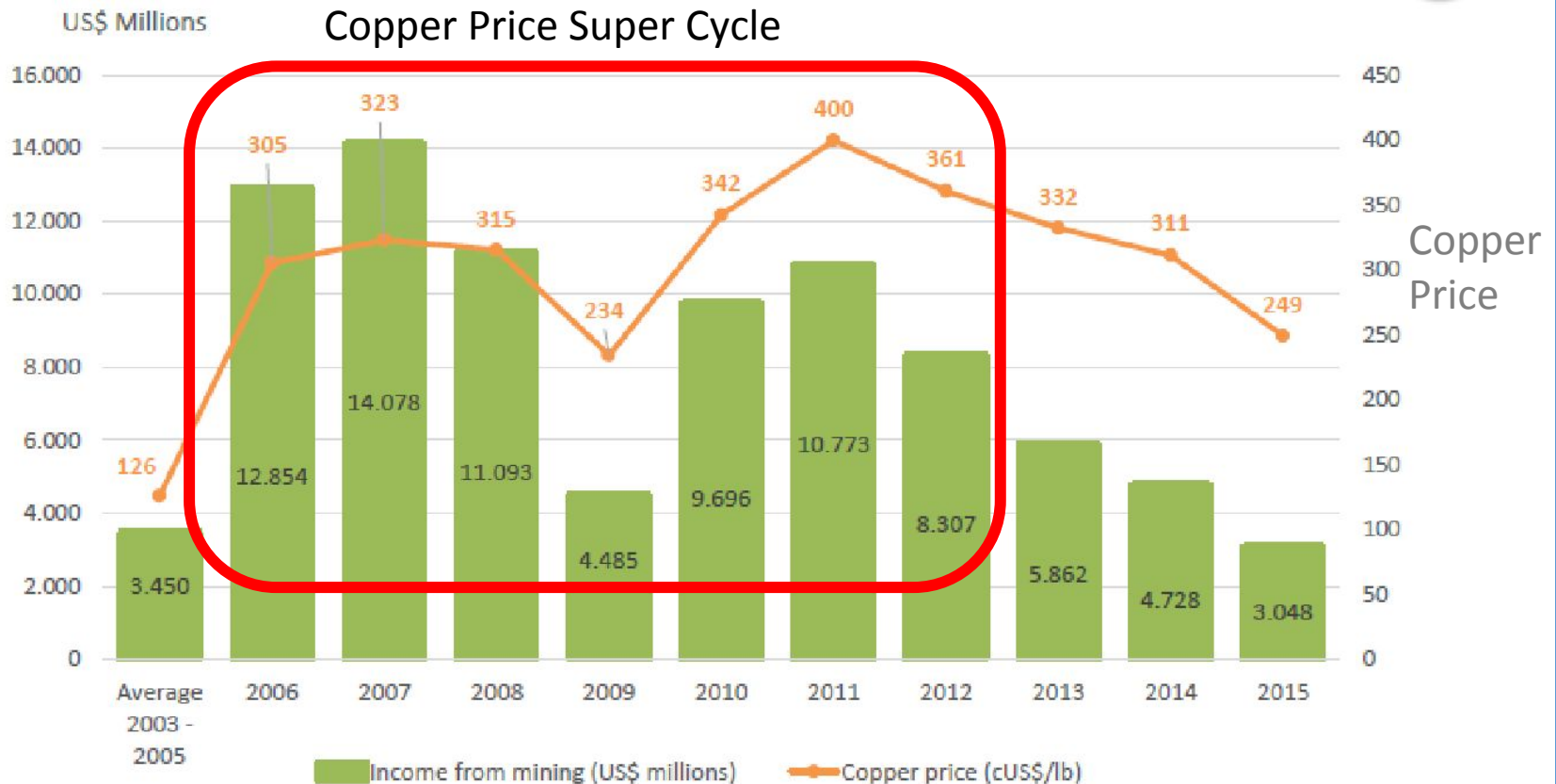
By

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Outline

- Motivation
  - There was a Copper Price Super Cycle

  - How big was the impact on the Chilean Ecomy

Importance of Mining in Chile:
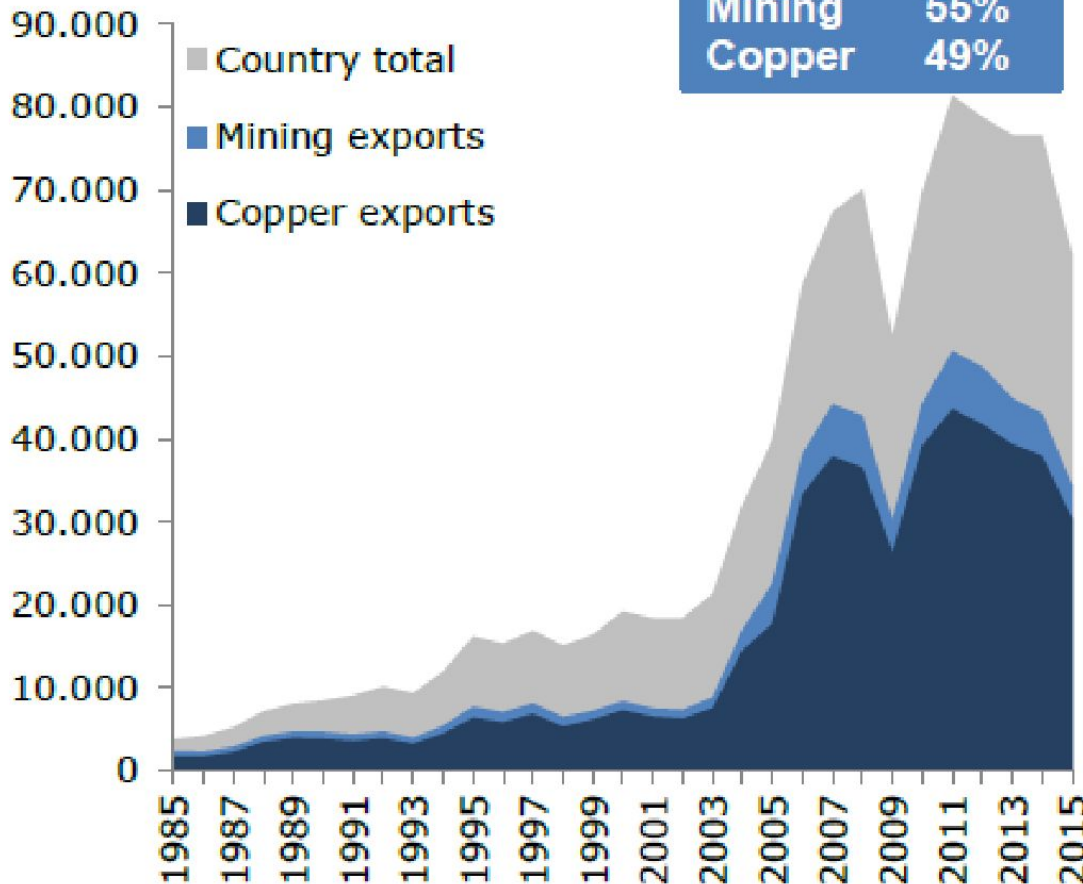# Tax collection plus CODELCO profits

Copper Price Super Cycle

US$ Millions

Copper Price

Income from mining (US$ millions) — Copper price (cUS$/lb)

Source: USGS Mineral Commodity Summaries (2015)

Importance of Mining in Chile: Exports

News from 2016

Economic context and mining investment

Latest news for mineral commodities

The New York Times

ENERGY & ENVIRONMENT

Oil Price Falls as Global Growth Anxiety Weighs on Markets

The Economist

Everything's under control

China, the yuan and the markets

Mining Ready for M&A Revival, Producers Fight for Survival

World / Europe

Glencore seeks to refinance credit facility

THE WALL STREET JOURNAL.

U.S. Industrial Production Dropped on Declines in Mining, Utilities

Industries pulled back 0.4% in December; capacity utilization for utilities fell to lowest level since 1972

Oil Prices: What's Behind the Drop? Simple Economics

Mining Ministry| COCHILCO

Importance of Chile in Mining
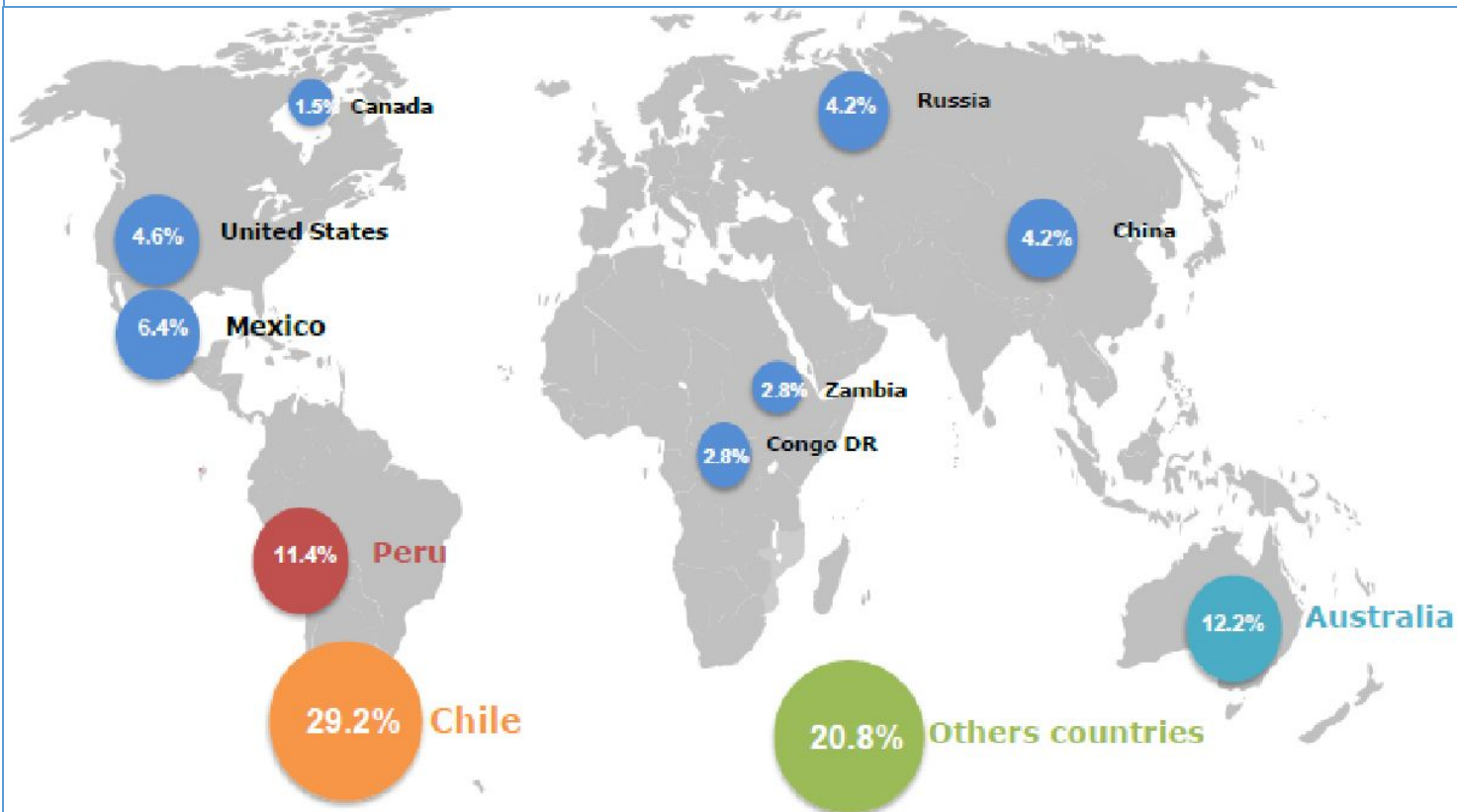
Source: USGS Mineral Commodity Summaries (2015)

Methodology

- How to measure the impact?
  - Leontief model from Miller and Blair (2009)

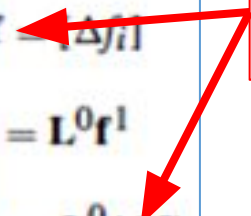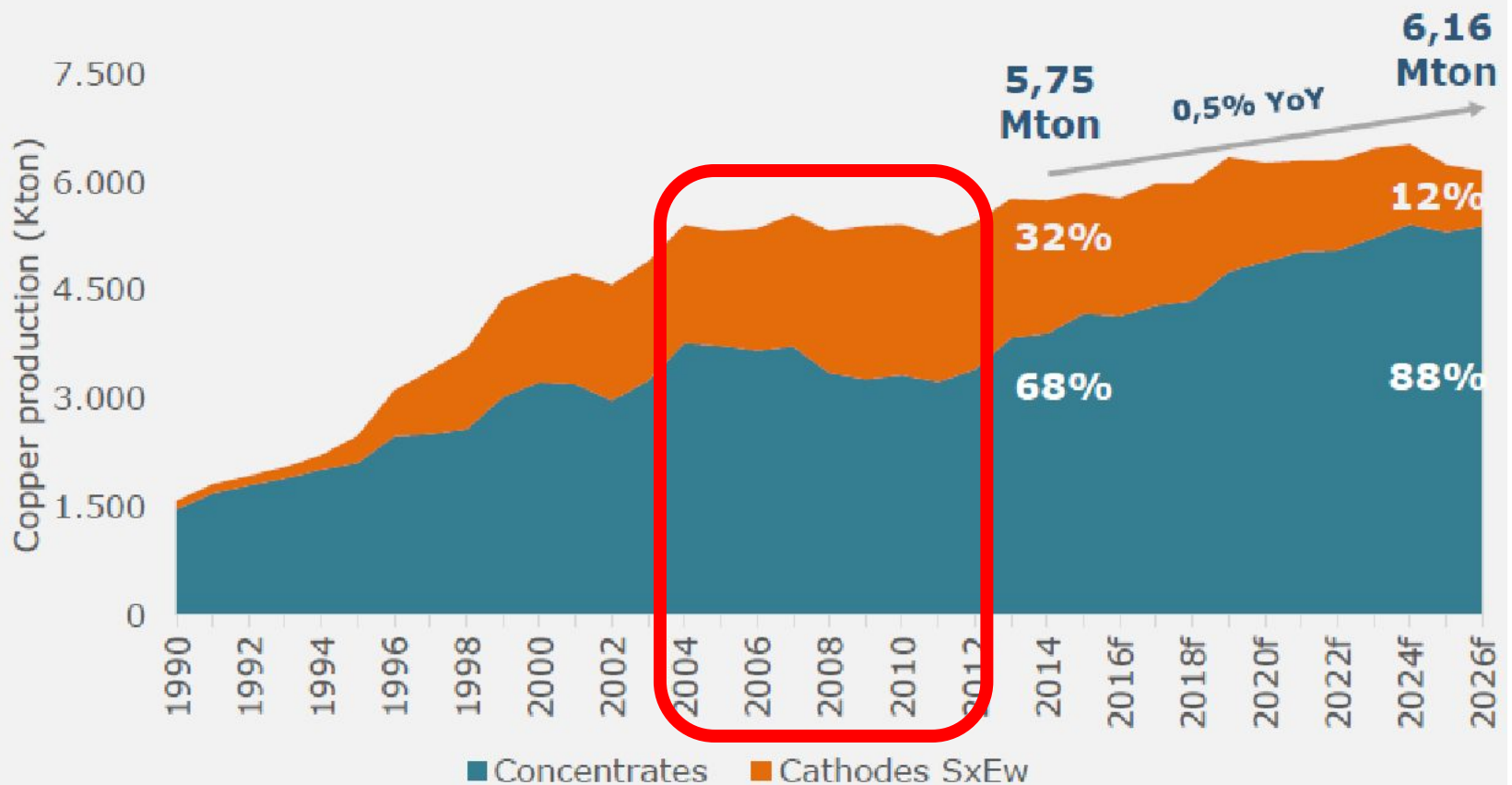| Leontief Quantity Model (Demand-pull) [Prices fixed; quantities change]	Exogenous Variables	$\mathbf{f}^1 = [f_i^1]$ or $\Delta\mathbf{f} = [\Delta f_i]$
	Endogenous Variables	$\mathbf{x}^1 = \mathbf{L}^0\mathbf{f}^1$ or $\Delta\mathbf{x} = \mathbf{L}^0(\Delta\mathbf{f})$

Variation in Exports

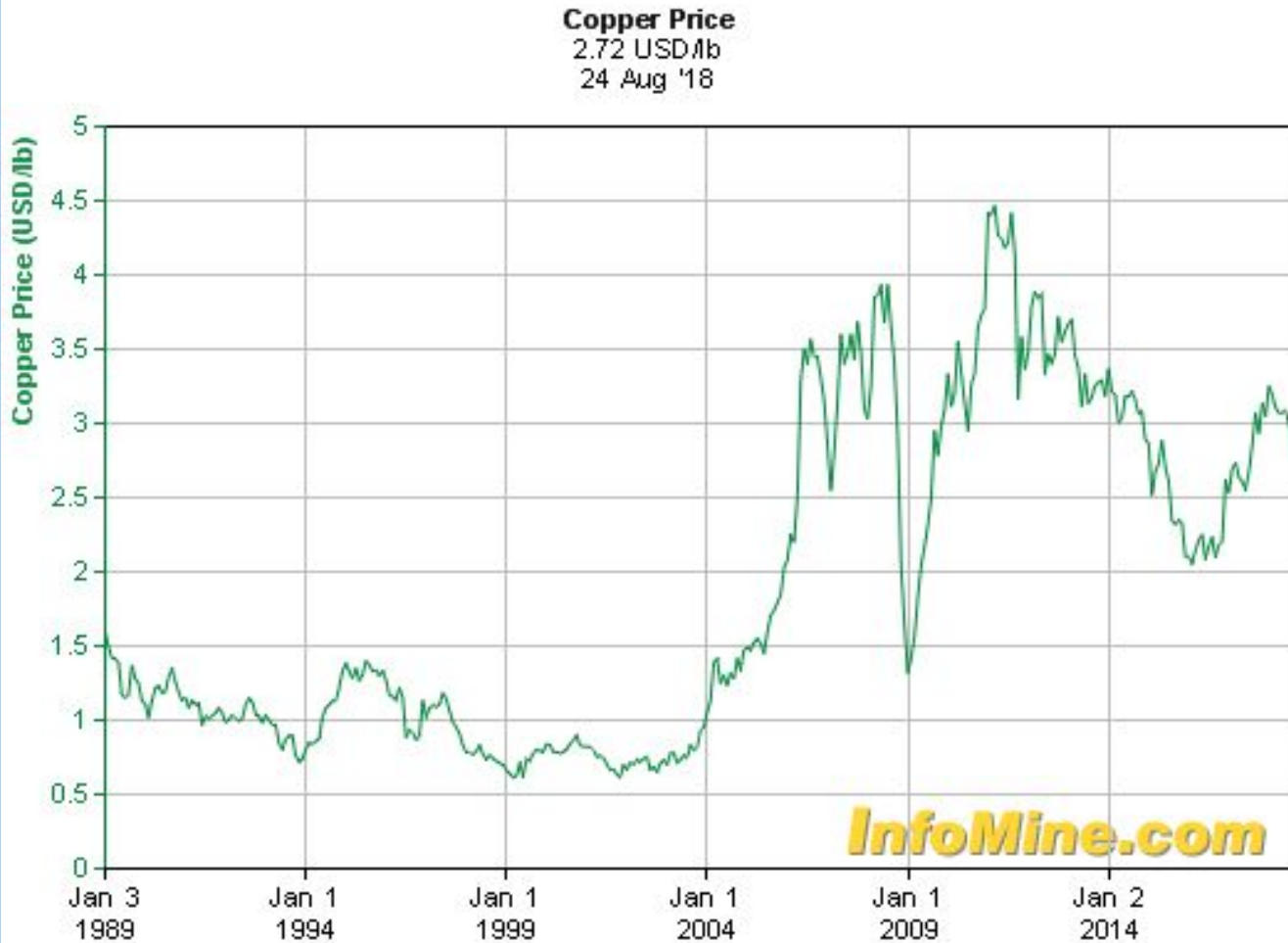# Did quantity change?

Chilean expected copper production

Source: COCHILCO.

Is copper price constant?

Methodology

- How to measure the impact?
  - Leontief model from Miller and Blair (2009)

Leontief Price Model
(Cost-push)
[Quantities fixed; prices change]

Exogenous Variables

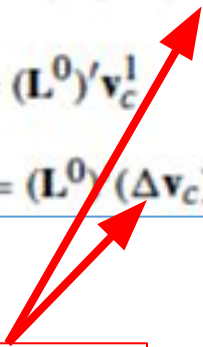$$\mathbf{v}_c^1 = (\hat{\mathbf{x}}^0)^{-1}\mathbf{v}^1 = [v_j^1/x_j^0]$$
or
$$\Delta\mathbf{v}_c = (\hat{\mathbf{x}}^0)^{-1}(\Delta\mathbf{v}) = [\Delta v_j/x_j^0]$$

Endogenous Variables

$$\bar{\mathbf{p}}^1 = (\mathbf{L}^0)'\mathbf{v}_c^1$$
or
$$\Delta\bar{\mathbf{p}} = (\mathbf{L}^0)'(\Delta\mathbf{v}_c)$$

Variation in Price

Methodology

Using an IO table, the j column can be represented by:

$$x_j = \sum_{i=1}^{n} z_{ij} + v_j$$

In matrix form, summing columns of IO table:
$$\mathbf{x}' = \mathbf{i}'\mathbf{Z} + \mathbf{v}'$$

Methodology

By definition $\mathbf{Z} = \mathbf{A}\hat{\boldsymbol{x}}$, therefore $\mathbf{x}' = \mathbf{i}'\mathbf{A}\hat{\boldsymbol{x}}$ and post-multiplying by $\hat{\mathbf{x}}^{-1}$,

$$\mathbf{x}'\hat{\mathbf{x}}^{-1} = \mathbf{i}'\mathbf{A}\hat{\mathbf{x}}\hat{\mathbf{x}}^{-1} + \mathbf{v}'\hat{\mathbf{x}}^{-1}$$

$$\mathbf{i}' = \mathbf{i}'\mathbf{A} + \mathbf{v}'\hat{\mathbf{x}}^{-1} = \mathbf{i}'\mathbf{A} + \mathbf{v}'_c$$

Price decomposition

According to Miller and Blair (2009), "this illustrates the unique measurement units in the base year table – amounts that can be purchased for \$1. "

Methodology

- Denoting base year index prices by $\bar{p}_j$ so $\bar{\mathbf{p}}' = [\bar{p}_1, \ldots, \bar{p}_n]$, then the input–output price model is:

$$\bar{\mathbf{p}}' = \bar{\mathbf{p}}'\mathbf{A} + \mathbf{v}_c'$$

Which lead to:

$$\bar{\mathbf{p}}' = \mathbf{v}_c'(\mathbf{I} - \mathbf{A})^{-1} = \mathbf{v}_c'L$$

Transposing and expressing in column vector:

$$\bar{\mathbf{p}} = (\mathbf{I} - \mathbf{A}')^{-1}\mathbf{v_c} = L'\mathbf{v_c}$$ ← Markup Model

This is a mark-up price model, where the output price is determined by input prices plus the cost of labor per unit of output and the margin per unit.
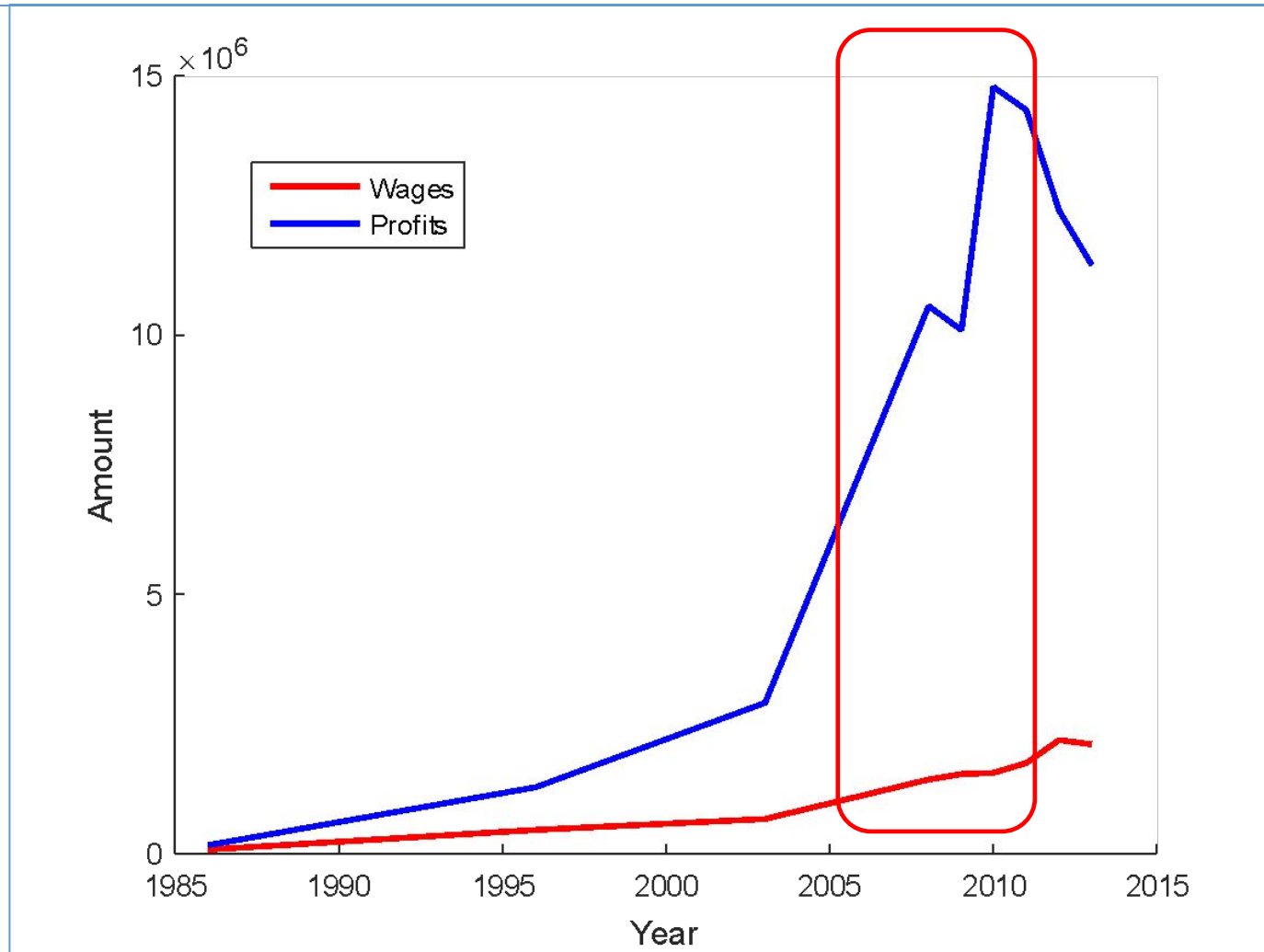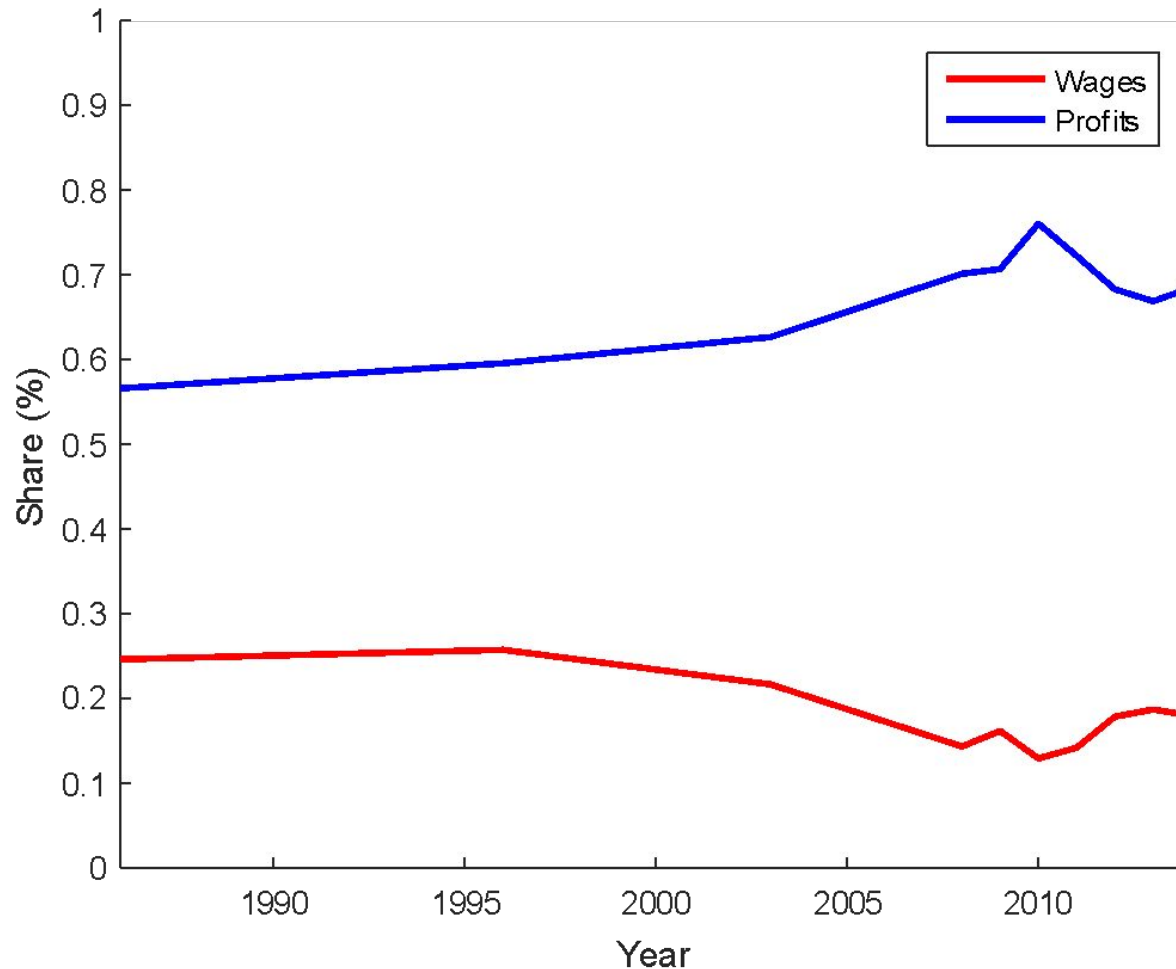
Results

Price
$$\bar{\mathbf{p}} = (\mathbf{I} - \mathbf{A}')^{-1}\mathbf{v_c} = L'^*[wage\ profits]$$

Where wage and profits are the share of wage and profits on the total buys by the sectors.

Wage and Profits in the Copper Sector

Results: wage and profits share participation on copper price

Next step

- Split the impact among domestic and foreign ownership

- Determine how those share are affected by the price cycle,

Conclusion

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