Discussion of J. Fornaro's and M. Kirchner's "Learning About Commodity Cycles And Saving-Investment Dynamics In A Commodity-Exporting Economy"

Martín Uribe

Columbia University and NBER

May 2014

Summary of the Paper

• Between 2000 and 2012, the price of copper experienced enormous growth (about 400%).
• At the same time, the Chilean current account displayed a surplus during the first half of the 2000s and a deficit during the second half.
• Goal: Explain this pattern of comovement.
• **Hypothesis:** Agents interpreted changes in the price of copper as temporary during the first half of the 2000s, and as more permanent during the second half.
• **Main Result:** Embedding this hypothesis into an intertemporal model of the current account delivers the desired comovement pattern.

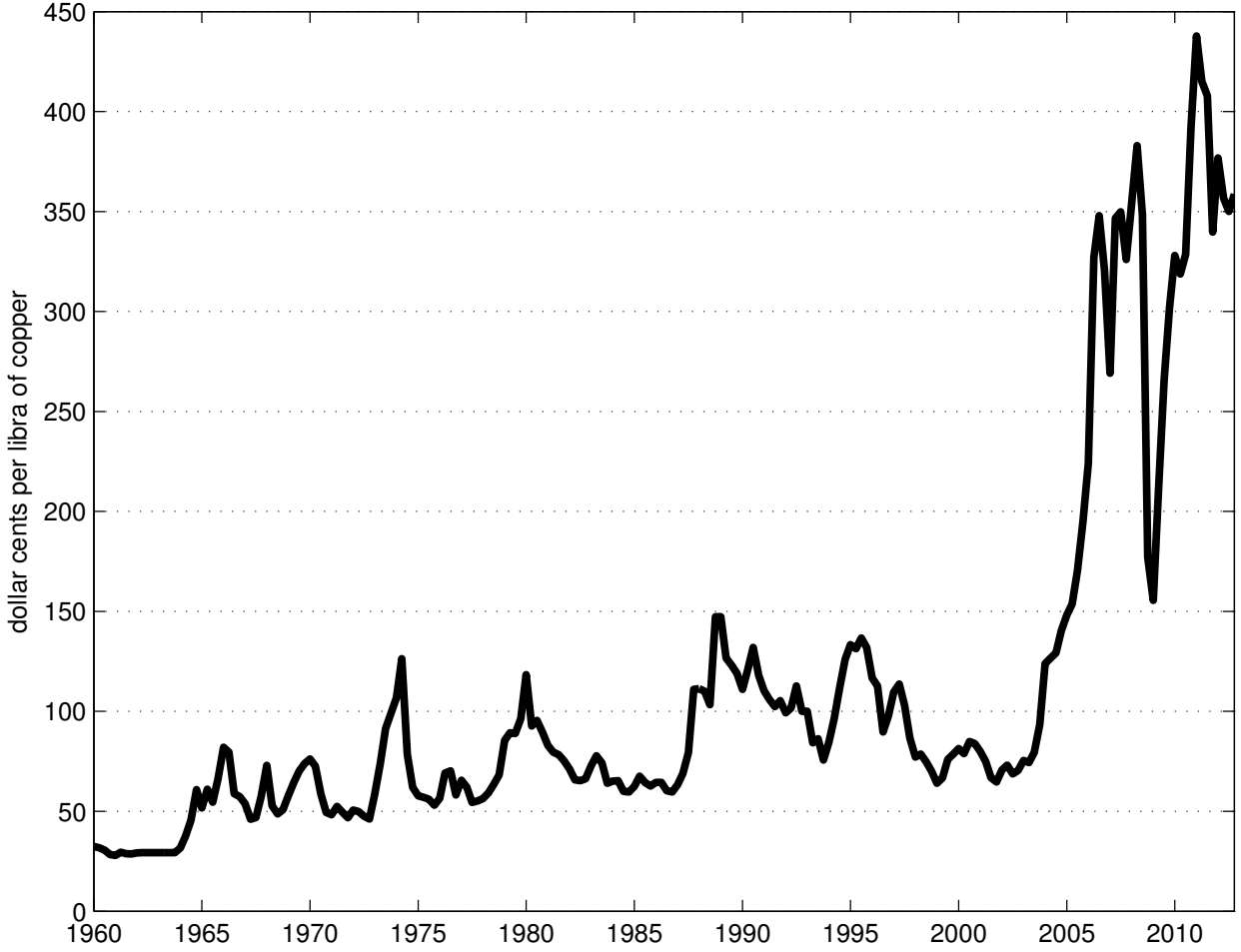
Overall Assessment

• The literature on the aggregate effects of changes in commodity prices or, more generally, in the terms of trade is surprisingly thin.

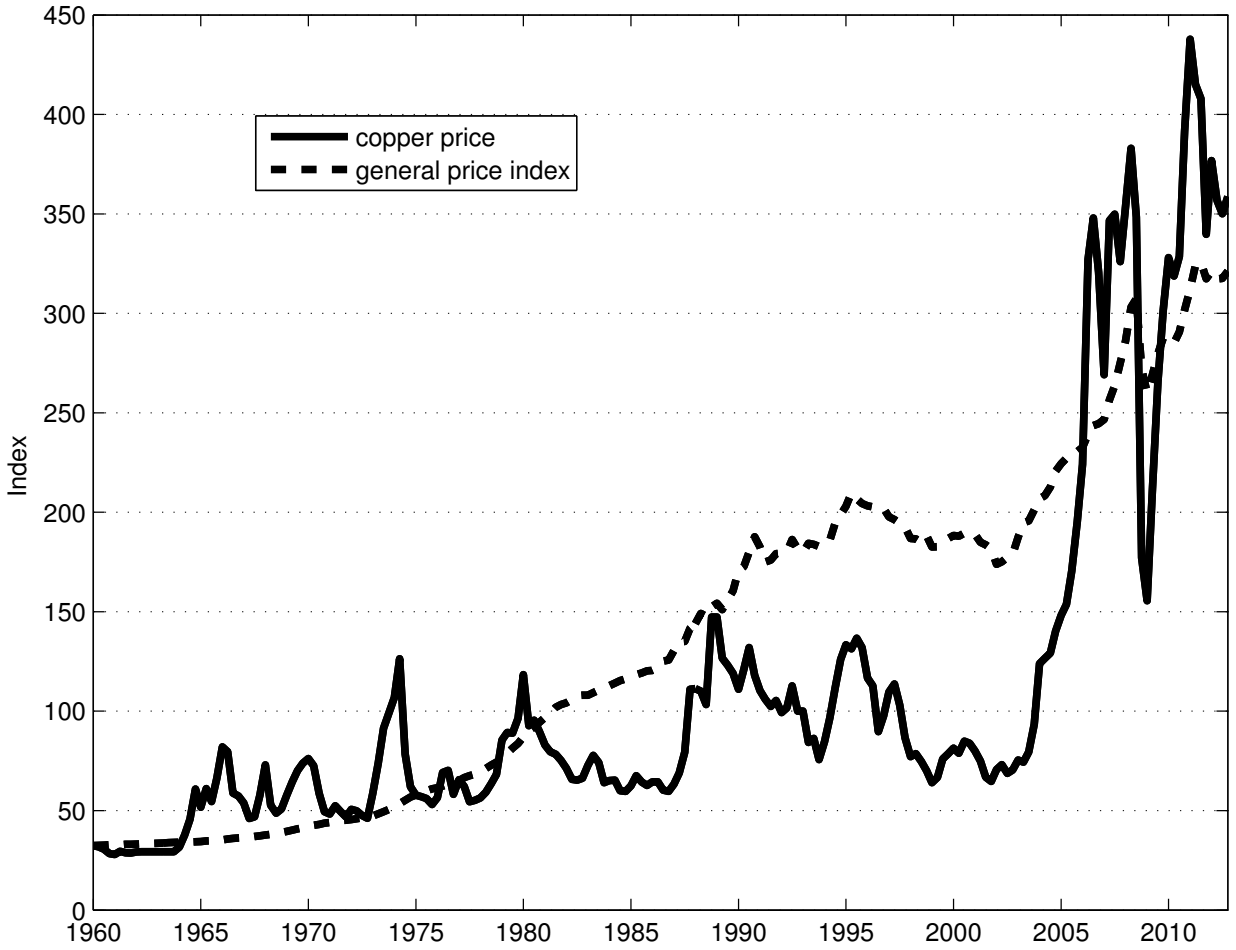
• The present paper proposes a valuable propagation mechanism that has the potential to shed much needed light on the behavior of the current account and other aggregates in emerging economies.

• **Main Concern:** The identification of the transitory and persistent components of the commodity price process is ad-hoc and requires significant improvement. Much of my discussion provides suggestions on how to go about accomplishing this.

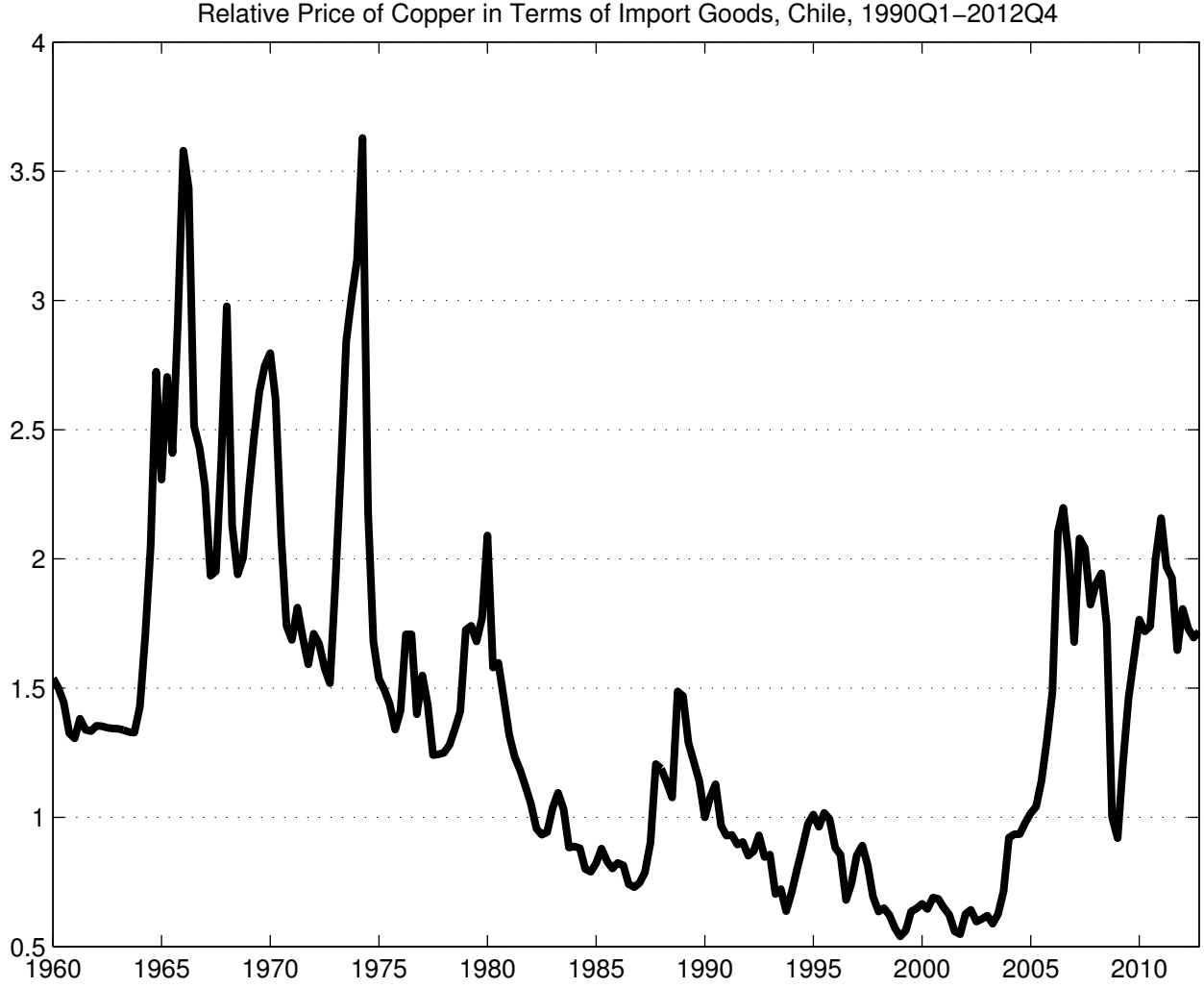
The Nominal Price of Copper 1960 to 2012



The Nominal Price of Copper and Consumer Prices 1960 to 2012



The Real Price of Copper 1960 to 2012



Estimating Commodity-Price Process

The (log of the real) price of copper is assumed to obey the law of motion

$$p_t = a_t + b_t$$

$$a_t = \sigma_a \epsilon_t$$

$$b_t = \rho b_{t-1} + \sigma_u u_t$$

The price p_t is observable, but a_t and b_t are latent variables.

Estimating σ_a, σ_u, and ρ: The authors state that "these three parameters are not separately identified." They then proceed to fixing one parameter of the Kalman filter at an arbitrary value. Let's revisit issue of identification.

Identifiability of σ_a, σ_u, and ρ

Recall the price process:

$$p_t = a_t + b_t; \quad a_t = \sigma_a \epsilon_t; \quad b_t = \rho b_{t-1} + \sigma_u u_t$$

Let $\theta \equiv [\sigma_a \, \sigma_u \, \rho]'$ and let the data be a vector of price observations $Y = [p_1 \, p_2 \, \ldots \, p_T]'$. Then, it is straightforward to show that the Likelihood of Y given θ is the density function of $N(\emptyset, \Omega)$ evaluated at Y, where

$$\Omega_{ij} = \begin{cases} \sigma_a^2 + \frac{\sigma_u^2}{(1-\rho^2)} & \text{for } i = j \\ \\ \frac{\rho^{|i-j|}\sigma_u^2}{(1-\rho^2)} & \text{for } i \neq j \end{cases}$$

for $i, j = 1, \ldots, T$, which is in general full rank. The log-likelihood function takes the form

$$L(Y, \theta) = \text{constant} + \ln |\Omega^{-1}| - \frac{1}{2} Y' \Omega^{-1} Y,$$

which is clearly not HD0 in σ_a and σ_u.

Maximum Likelihood Estimate

σ_a	σ_u	ρ	$L(Y,\theta)$
0.01	0.12	0.96	144.0

Compare to the estimate reported in the paper

σ_a	σ_u	ρ	$L(Y,\theta)$
0.20	0.04	0.98	24.3

Result: Under the correct estimation, the variance of the temporary component, σ_a^2, drops virtually to zero.

Key Implication: Under the correct estimation, virtually all movements in the price of copper will beinterpreted as persistent

$\Rightarrow$ Model will have a hard time explaining the behavior of the current account.

Model Fit and Implications

	std(p_t)	corr(p_t, p_{t-1})	var(a_t)/var(p_t)
Data	45%	0.96	
ML Estimate	43%	0.96	0.05%
Reported Estimate	28%	0.49	45.00%

The ML estimate fits the data significantly better than the reported estimate.

Identifiability: A Monte Carlo Experiment

(1) Draw an artificial time series of length 212 from the process reported in the paper, that is, from

$$p_t = a_t + b_t; \quad a_t = 0.2\epsilon_t; \quad b_t = 0.98b_{t-1} + 0.04u_t$$

(2) Estimate by ML σ_a, σ_u, and ρ by ML.
(3) Repeat (1) and (2) 750 times and report the median of the estimated values
Result: $\sigma_a = 0.2; \quad \sigma_u = 0.05; \quad \rho = 0.96$
Implication: All three parameters are well identified.
Recall ML estimate actual data:
$\sigma_a = 0.01; \quad \sigma_u = 0.12; \quad \rho = 0.96$
Implication: This outcome would be highly unlikely if the true parameters were the ones reported in the paper.

A Nonstationary Model of the Price of Copper

Suppose now that the the price of copper, P_t, is driven by a nonstationary variable, X_t, and a stationary variable, z_t :

$$P_t = X_t e^{z_t} \Rightarrow g_t^p = g_t^x + z_t - z_{t-1}$$

$$g_t^x = \rho_x g_{t-1}^x + \sigma_x \epsilon_t^x$$

$$z_t = \rho_z z_{t-1} + \sigma_z \epsilon_t^z$$

Note, the growth rate of X_t, $g_t^x \equiv \ln(X_t/X_{t-1})$ is stationary. So the growth rate of P_t, g_t^p, is also stationary.

Maximum Likelihood Estimate

σ_z	ρ_z	σ_x	ρ_x
0.04	0.48	0.11	0.26

Model Fit and Implications

	std(g_t^p)	corr(g_t^p, g_{t-1}^p)	var(g_t^x)/var(g_t^p)
Data	12%	0.21	
ML Estimate	12%	0.17	84%

Key Implication: The empirical model fits the data well, but the stationary component is quite small. Agents will tend to attribute the majority of movements in the price of copper to the permanent component.

Comments Not Involving The Price Process

(I) Simplification

• The model structure is quite complex, as it features many sectors, goods, and nominal and real frictions.

• It would be of use to illustrate how the proposed mechanism works in a highly stylized model, such as the standard SOE neo-classical model.

• Many of the intricacies of the model stem from the assumption of nominal rigidities. However, monetary policy does not seem to affect much the response of the current account to commodity-pprice shocks.

(II) Why Lump-Sum Taxation? This choice is a bit surprising given the highly detailed structure of the model.

(IIII) Market Power In Commodity Markets: Chile generates 1/3 of the world production of copper. Nonetheless, the paper assumes that Chile is a price taker in world markets. Is this assumption realistic?

(IV) Estimation Period 2001-2012: Seems too short for a model with so many parameters. Typical cycle in emerging countries is 7 years. So model estimated on less than 2 cycles of data.

Conclusion

This paper proposes a relevant propagation mechanism that has the potential to significantly enhance our understanding of how the current account and other macro aggregates of interest respond to movements in commodity prices and the terms of trade.

A version of this paper featuring a simpler model structure and a more careful estimation is likely to become a valuable reference in the related literature.

EXTRAS

The Labor Supply of Non-Ricardian Households

• **Assumpiton:** These households set a wage rate equal to the average wage of Ricardian households. It would be of interest to provide some justification.

• **Claim:** Hours worked by non-Ricardian households equals the average numeber of hours worked by Ricardian houesholds. This is not true in general, because the labor supply depends not only on the wage rate but also on the marginal utility of wealth (wealth effects). In this model, the labor supply takes the form (ignoring habits):

$$h^{NR} = \left[\frac{W/P}{\psi C^{NR}}\right]^{1/\sigma}.$$

To the extent that C^{NR} is not equal to the average of C^{R}, the claim will not hold.