Seminario de microeconomía aplicada 25: A Microeconometric Dynamic Structural Model of Copper Mining Decisions

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Resumen: This paper proposes and estimates a dynamic structural model of the operation of copper mines using a unique dataset with rich information at the mine level from 330 mines that account for more than 85% of the world production during 1992-2010. Descriptive analysis of the data reveals several aspects of this industry that have been often neglected by previous econometric models using data at a more aggregate level. First, there is a substantial number of mines that adjust their production at the extensive margin, i.e., temporary mine closings and re-openings that may last several years. Second, there is very large heterogeneity across mines in their unit costs. This heterogeneity is mainly explained by differences across mines in ore grades (i.e., the degree of concentration of copper in the rock) though differences in capacity and input prices have also relevant contributions. Third, at the mine level, ore grade is not constant over time and it evolves endogenously. Ore grade declines with the depletion of the mine reserves, and it may increase as a result of (lumpy) investment in exploration. Fourth, for some copper mines, output from sub-products (e.g., gold, silver, nickel) represents a substantial fraction of their revenue. Fifth, there is high concentration of market shares in very few mines, and evidence of market power and strategic behavior. We propose and estimate a dynamic structural model that incorporates these features of the industry. Our estimates show that the proposed extensions of the standard model contribute to explain the observed departures from Hotelling's rule. We use the estimated model to study the short-run and long-run dynamics of prices and output under different types of changes in demand, costs, and policies.