Industrialization and the Demand for Mineral Commodities

Martin Stuermer, Federal Reserve Bank of Dallas


Abstract

This paper uses a new data set that begins in 1840 to investigate how industrialization affects the derived demand for mineral commodities. I establish that there is substantial heterogeneity in the long-run effect of manufacturing output on demand across five commodities. A one percent increase in per capita manufacturing output leads to an 1.5 percent increase in aluminum demand and a one percent rise in copper demand. Estimated elasticities for lead, tin, and zinc are below unity.

Results suggest that the experience of Japan’s industrialization, for example, may be used to infer the impact of China’s industrialization on future demand for metals. The results imply substantial differences across commodities with regard to future demand. Equilibrium adjustment takes 7-13 years, which helps explain the long duration of commodity price fluctuations.

Empirical Strategy

I employ an extension of the partial adjustment model, in which I introduce homogeneity of parameters in a stepwise manner following Pesaran et al (1999). I stay a priori agnostic about the commonality of coefficients for the short term and long term relationships. I control for common trends and time fixed effects in a stepwise manner. This allows me to take advantage of the panel structure of the data and to control for a variety of omitted common factors such as technological change in resource efficiency or world wars, which might affect the demand in all countries at the same time. The baseline specification for the pooled mean group estimator is:

\[ \Delta q_{it} = \Psi (q_{i,t-1} - \theta - \alpha_j Y_t - \delta_j P_{it}) + \sum_{j=1}^{J} \theta_j \Delta q_{i,t-j} + \sum_{j=1}^{J} \theta_j \Delta P_{i,t-j} + \epsilon_{it} \]

Result 1: Similar Long-Run Elasticities Across Countries

Kilian (2009) and Stuermer (2018) show that the booms and busts in commodity prices are primarily driven by global demand shocks. For example, China’s rapid industrialization and its recent slowdown strongly affect world commodity prices. Thus, understanding how industrialization affects the derived demand for mineral commodities is important for macroeconomic and fiscal policy making in commodity exporting countries.

Main questions: how does a change in manufacturing output affect the demand for commodities? What is the response of demand to a price change? Can we use experience from past periods of industrialization to infer the impact of China’s industrialization on the future demand for metals?

Introduction

Kilian (2009) and Stuermer (2018) show that the booms and busts in commodity prices are primarily driven by global demand shocks. For example, China’s rapid industrialization and its recent slowdown strongly affect world commodity prices. Thus, understanding how industrialization affects the derived demand for mineral commodities is important for macroeconomic and fiscal policy making in commodity exporting countries.

I assemble a new data set on per capita usage and real prices of aluminum, copper, lead, tin, and zinc, and per capital manufacturing output for the period 1840 to 2010. The five metals have characteristics, such as a substantial track record of industrial use and integrated world markets, which make a long-run analysis possible.

The data set is a sample of 12 industrialized countries: Belgium, Finland, France, Germany, Italy, Japan, South Korea, the Netherlands, Spain, Sweden, the United Kingdom, and the United States, and three currently industrializing countries—China, India, and Brazil.

A New Data Set

I assemble a new data set on per capita usage and real prices of aluminum, copper, lead, tin, and zinc, and per capita manufacturing output for the period 1840 to 2010. The five metals have characteristics, such as a substantial track record of industrial use and integrated world markets, which make a long-run analysis possible.

The data set is a sample of 12 industrialized countries: Belgium, Finland, France, Germany, Italy, Japan, South Korea, the Netherlands, Spain, Sweden, the United Kingdom, and the United States, and three currently industrializing countries—China, India, and Brazil.

Scatter plot of log per capita value added by manufacturing (horizontal axis) and log per capita copper consumption (vertical axis)

References:

Empirical Strategy

I employ an extension of the partial adjustment model, in which I introduce homogeneity of parameters in a stepwise manner following Pesaran et al (1999). I stay a priori agnostic about the commonality of coefficients for the short term and long term relationships. I control for common trends and time fixed effects in a stepwise manner. This allows me to take advantage of the panel structure of the data and to control for a variety of omitted common factors such as technological change in resource efficiency or world wars, which might affect the demand in all countries at the same time. The baseline specification for the pooled mean group estimator is:

\[ \Delta q_{it} = \Psi (q_{i,t-1} - \theta - \alpha_j Y_t - \delta_j P_{it}) + \sum_{j=1}^{J} \theta_j \Delta q_{i,t-j} + \sum_{j=1}^{J} \theta_j \Delta P_{i,t-j} + \epsilon_{it} \]

Result 1: Similar Long-Run Elasticities Across Countries

Kilian (2009) and Stuermer (2018) show that the booms and busts in commodity prices are primarily driven by global demand shocks. For example, China’s rapid industrialization and its recent slowdown strongly affect world commodity prices. Thus, understanding how industrialization affects the derived demand for mineral commodities is important for macroeconomic and fiscal policy making in commodity exporting countries.

Main questions: how does a change in manufacturing output affect the demand for commodities? What is the response of demand to a price change? Can we use experience from past periods of industrialization to infer the impact of China’s industrialization on the future demand for metals?

Introduction

Kilian (2009) and Stuermer (2018) show that the booms and busts in commodity prices are primarily driven by global demand shocks. For example, China’s rapid industrialization and its recent slowdown strongly affect world commodity prices. Thus, understanding how industrialization affects the derived demand for mineral commodities is important for macroeconomic and fiscal policy making in commodity exporting countries.

I assemble a new data set on per capita usage and real prices of aluminum, copper, lead, tin, and zinc, and per capita manufacturing output for the period 1840 to 2010. The five metals have characteristics, such as a substantial track record of industrial use and integrated world markets, which make a long-run analysis possible.

The data set is a sample of 12 industrialized countries: Belgium, Finland, France, Germany, Italy, Japan, South Korea, the Netherlands, Spain, Sweden, the United Kingdom, and the United States, and three currently industrializing countries—China, India, and Brazil.

Scatter plot of log per capita value added by manufacturing (horizontal axis) and log per capita copper consumption (vertical axis)

References:

Empirical Strategy

I employ an extension of the partial adjustment model, in which I introduce homogeneity of parameters in a stepwise manner following Pesaran et al (1999). I stay a priori agnostic about the commonality of coefficients for the short term and long term relationships. I control for common trends and time fixed effects in a stepwise manner. This allows me to take advantage of the panel structure of the data and to control for a variety of omitted common factors such as technological change in resource efficiency or world wars, which might affect the demand in all countries at the same time. The baseline specification for the pooled mean group estimator is:

\[ \Delta q_{it} = \Psi (q_{i,t-1} - \theta - \alpha_j Y_t - \delta_j P_{it}) + \sum_{j=1}^{J} \theta_j \Delta q_{i,t-j} + \sum_{j=1}^{J} \theta_j \Delta P_{i,t-j} + \epsilon_{it} \]

Result 1: Similar Long-Run Elasticities Across Countries

Kilian (2009) and Stuermer (2018) show that the booms and busts in commodity prices are primarily driven by global demand shocks. For example, China’s rapid industrialization and its recent slowdown strongly affect world commodity prices. Thus, understanding how industrialization affects the derived demand for mineral commodities is important for macroeconomic and fiscal policy making in commodity exporting countries.

Main questions: how does a change in manufacturing output affect the demand for commodities? What is the response of demand to a price change? Can we use experience from past periods of industrialization to infer the impact of China’s industrialization on the future demand for metals?

Introduction

Kilian (2009) and Stuermer (2018) show that the booms and busts in commodity prices are primarily driven by global demand shocks. For example, China’s rapid industrialization and its recent slowdown strongly affect world commodity prices. Thus, understanding how industrialization affects the derived demand for mineral commodities is important for macroeconomic and fiscal policy making in commodity exporting countries.

I assemble a new data set on per capita usage and real prices of aluminum, copper, lead, tin, and zinc, and per capita manufacturing output for the period 1840 to 2010. The five metals have characteristics, such as a substantial track record of industrial use and integrated world markets, which make a long-run analysis possible.

The data set is a sample of 12 industrialized countries: Belgium, Finland, France, Germany, Italy, Japan, South Korea, the Netherlands, Spain, Sweden, the United Kingdom, and the United States, and three currently industrializing countries—China, India, and Brazil.

Scatter plot of log per capita value added by manufacturing (horizontal axis) and log per capita copper consumption (vertical axis)

References: