

The Comeback of Coal in the First Decade of the 21st Century

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Overview

The first decade of the 21st century was characterized by a strong growth in emerging markets, accompanied by a gradual and persistent increase in crude oil prices. This increase in oil prices was a reflection of relative slow growth in crude oil production and rapid demand growth. However, these years were characterized by a relative abundance of energy from coal and, to some extent, natural gas.

This relative abundance of energy from coal and natural gas could explain why the increase in oil prices did not have as negative an impact on the global economy as many expected. On the contrary, the increase in the supply of coal and, to a lesser extent, natural gas could be one of the reasons that explains the acceleration in global economic growth in the period 2000-2007.

The surge in coal consumption appears to have impacted negatively on energy productivity growth, as coal use is less efficient than oil or natural gas from a technical perspective. More energy from coal is required to achieve the same economic and calorific yield as is derived from oil. Despite an increase in energy productivity in key countries, the first years of the 21st century saw global energy productivity growing more slowly than in the past. One reason for this is that emerging economies, which were less productive from an energy perspective, grew faster than advanced economies and increased their weight in the global average before their energy productivity had reached OECD levels

Methods

Firstly and in order to evaluate the role of coal in the global economy, we have developed a global database encompassing fossil fuel consumptions and prices from 1970 to 2012, although we focus our analysis in the period 1991-2012.

We use a standard production function in a competitive environment to provide a quantitative explanation for the evolution of energy supply (and consumption) and its impact on global activity in the first years of the 21st century. The global production function has as inputs labor, capital and energy services and the technology of production is a Cobb Douglas.

In the energy sector we assume that there are two competitive and representative firms both producing a non-primary energy product. The first firm produces an energy product labelled *intermediate energy* (*electricity but not only*) using as inputs coal and natural gas. In addition, we assume that there is another energy product that we define as *energy services*. *Energy services* are generated using two inputs, crude oil and *intermediate energy*.

Both production functions have a CES with constant returns to scale technology of production.

Results

1. A relevant fact revealed by the database is that, despite the decrease of oil in the world energy mix, crude oil represented 60% of the total expenditure in 2012, asserting that it is still the main source of potential economic disruptions.
2. The interfuel elasticity of substitution plays a critical role assessing the impact of each primary fuel in economic growth.

3. The contribution of *energy services* to GDP growth almost doubled in the period 2000–2007, compared with 1992-1999. It seems that there is no evidence of a restriction in energy supply in the period 2000 – 2007, despite the strong increase in oil prices in the same period of time.
4. These results supports the idea that coal was the main source of “additional” energy during 2000– 2007.
5. We think that the shift in the energy mix towards coal is one of the reasons behind the apparent stagnation in global energy productivity in those years.

Conclusions

Energy markets during the first decade of the 21st century were characterized by two intriguing observations: a sharp increase in oil prices without the expected negative impact on global growth and a slower rate of growth of energy productivity. In addition, coal consumption increased around 60% between 2001 and 2012.

This sharp rise in coal consumption, and to a lesser extent, in natural gas consumption, could be one of the factors that explains why the strong increase in oil prices did not have the expected negative impact on economic growth. On the contrary, we suggest that the strong rise of coal production provided enough energy to accelerate global growth.

However, coal seems to be less efficient –from a technical and economic perspective- than crude oil or natural gas. This means that, in order to achieve a similar impact on economic activity, the world needs to consume substantially more coal than oil. As result, global energy productivity could be growing at a slower pace. This observation is coherent with an increase in energy productivity in key countries, like China, the US, Japan, India, France or Germany. Emerging economies, that –in general terms – are less efficient from an energy productivity perspective, are leading global growth but also braking energy productivity growth.

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