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Is economic rebalancing toward consumption "greener"? Evidence from visibility in China, 1984–2006

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ABSTRACT

Li, Zhigang, Yuan, Jia, Song, Frank, and Wei, Shangjin—Is economic rebalancing toward consumption "greener"? Evidence from visibility in China, 1984–2006

The Chinese government has adopted a rebalancing strategy since 2011, shifting from an investment- to consumption-oriented growth model. An aim of this reform is for a "greener" development mode, but relevant empirical evidence is slim. In this study, we propose an innovative methodology to shed light on the environmental externalities of economic rebalancing. First, we use air visibility across China to reflect air quality during 1984–2006. Second, with the daily visibility data, we propose a weekend-effect regression model to difference out city-specific unobserved heterogeneity. Third, we approximate local consumption intensity with the portion of the residential electricity usage in the total electricity usage. To our surprise, the estimates suggest that the pollution intensity of consumption activities has not only been significant, but also exceeded that of production since the mid-1990s. Hence, rebalancing toward consumption is not necessarily more environmentally friendly according to the recent development experience of China. *Journal of Comparative Economics* **42** (4) (2014) 1021–1032. Southwestern University of Economics and Finance, Chengdu, China; University of Macau, Macau, China; University of Hong Kong, Hong Kong Special Administrative Region; Columbia University, USA.

1. Introduction

After over six decades of investment-driven growth, China has become the second largest economy in the world and the most polluted nation, with severe health consequences (Chang et al., 2001; Peng et al., 2002; Brajer and Mead, 2004, 2005; Ebenstein, 2008). In a recent research, Chen et al. (2013) find that the life expectancy of the Chinese in northern China has been reduced by five years due to the severe air pollution. In 2011, Chinese authorities officially announced a rebalancing strategy in its 12th Five-year Development Plan, which marked the start of the transition toward a consumption-driven growth mode. The rationale underlying this reform is to improve the livelihood of people and achieve an environmentally

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friendly growth model. Given the economic scale and the population of China, this change in growth strategy is likely to have profound environmental externalities for China, as well as the rest of the world. However, it is unclear whether consumption-driven growth is necessarily "greener" than the current one.[1] If anything, air quality appears to be a much more serious issue in the major cities of China, especially Beijing and Shanghai, where the economy has effectively rebalanced and is now driven by consumption rather than investment. Unfortunately, relevant empirical evidence is slim.[2]

In this study, we aim to shed light on the environmental externalities of the economic rebalancing. Our evidence cautions the naïve belief of consumption-intensive growth as a "greener" mode. Specifically, two alternative econometric models are considered. The first model estimates a city-year panel-data model of the relationship between air quality and local consumption intensity (approximated by the portion of residential electricity in the total electricity usage). Model estimates suggest that the pollution intensity of consumption activities may have exceeded that of production since the mid-1990s. In other words, rebalancing toward consumption would not alleviate the pollution problem of China. In the second model, we exploit an exogenous variation – people reduce working on the weekend – to utilize the change in the air quality from weekdays to weekends to eliminate city-specific unobserved heterogeneity. The policy change from six-working-day to five-working-day during 1994–1995 further provides another quasi-experimental opportunity to verify the weekend effect model. By exploiting the variations of consumption and production on the weekend, our findings confirm that consumption has been "dirtier" than production in Chinese cities since the mid-1990s. Taken together, the bottom line of the current research findings is that rebalancing is not necessarily environmentally beneficial to China.

Related literature on the pollution of consumption activities is slim, although a large body of studies has examined the association between economic growth and pollution (see Copeland and Taylor, 2004 for a review of the literature). Existing studies have mainly relied on accounting instead of an econometric approach. The Inventory of New York City Greenhouse Gas Emissions (2007) calculated that just under half of the carbon dioxide (CO_2) emissions in New York City are generated by consumption. In North Carolina, between 35% and 54% of the mercury emissions are by-products of consumption, according to the 1998–1999 Division of Air Quality (DAQ) and Local Program Emissions Inventories. Due to data constraints, evidence for other economies is much sparser and cruder. Gopalakrishnan (1997) suggests that consumption generates at least 34% and as much as 52% of the air pollution in Kolkata (Calcutta), India. Munksgaarda et al. (2000) use a decomposition approach to infer that pollution from consumption can explain most of the pollution increase in the Netherlands since 1960. Almond et al. (2009) provide important evidence showing that the Chinese energy consumption of winter heating has been an important source of air pollution in China. The most closely related work to this study is that by Davis (2008), which estimates the effect of driving restrictions (one week day per week) on air quality in Mexico City, but finds little effect.

In the past, a key hindrance to studying the environmental quality in China is the lack of data. Pollution data that are comparable across different cities of China are available at a highly limited scale to the public. Even if data are available for certain cities, the data quality is unclear given the incentive for local governments to manipulate the data. To address this issue, we propose to use an unconventional indicator, which is air visibility, to reflect the aerosol environment of China. Compared with direct measures of air pollution, air visibility is noisier as it is affected by other non-pollution factors, such as weather conditions. Nevertheless, the close link between visibility and airborne pollutants has been well established in the scientific literature (Malm, 1999).[3] Moreover, the use of air visibility has several major advantages, without which our study would be infeasible with the official pollution data available. First, observatories that record visibility are spread across China, and cover all of the major cities. Second, visibility records are available for the whole post-reform period of China. Third, visibility is reported daily, which makes it possible to provide more rigorous estimates by eliminating city-specific unobserved confounding factors. Moreover, daily data also allow us to utilize a natural experiment to achieve identification: the weekend policy changed during 1994–1995, from a six-working-day to a five-working-day week.

The structure of the paper is as follows. In Section 2, we first demonstrate the relevance of visibility to air pollution and the empirical methodology. In Section 3, we summarize the data used in the study and the preliminary empirical patterns. In Section 4, the empirical findings are reported and discussed. The last section concludes.

[1] Studies available mainly estimate the reduced-form linkage between aggregate GDP per capita and pollution, without distinguishing between consumption and production (Groot et al., 2004; Shaw et al., 2004; He, 2005; Shen, 2006).

[2] In theory, consumption- and investment-led growth modes have distinctive environmental implications. Copeland and Taylor (1995) were among the first to point out the importance of distinguishing these two kinds of pollution in economic analysis. They theoretically demonstrate this in a trading context: unlike production, consumption cannot easily migrate to countries with weaker environmental standards. Furthermore, Hatzipanayotou et al. (2007) and Michael et al. (2008) show in theory that the differential pollution intensity of production and consumption affects the design of optimal tax policies. Other relevant studies include that by Perrings and Ansuategi (2000), which study the economic implications of consumption-generated pollution. Abstracting from tax revenue considerations, Beghin et al. (1997) examine the welfare implications of environmental, production, consumption, and trade tax policy reforms. By constructing a reciprocal dumping model with consumption generated pollution, Kayalica and Kayalica (2005) demonstrate that a revenue neutral reform that increases consumption taxes and reduces tariffs is strictly Pareto improving.

[3] Atmospheric researchers have conducted some studies to show the linkage between visibility and air pollutants in several localities of China. Lee and Sequeira (2001) and Wang (2003) provide detailed evidence on the relationship between visibility and airborne pollutants in Hong Kong. Qiu and Yang (2000) examine seasonal patterns of visibility in five cities in north China. Cheung et al. (2005) and Deng et al. (2008) study the relationship between visibility and airborne pollutants in the Pearl River Delta of China. Rosenfeld et al. (2007) use visibility as a proxy for air pollution to study its relationship with precipitation. Du et al. (2013) is another study that uses visibility to reflect air pollution in China.