Executive Summary
Factors influencing energy intensity in four Chinese industries

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Since the onset of economic reforms in 1978, China's economy has experienced rapid growth, with GDP (in constant prices) growing at an average annual rate of 9.7% between 1978 and 2006 (He and Wang, 2007). Such robust rates of economic growth generally drive up energy usage. While China is no exception, its energy intensity, defined as total energy consumption in physical quantities over real GDP, has steadily declined over the years. Overall, during 1993-2005, China experienced an annual average decline of 3.6% (He and Wang, 2007).

A key issue in understanding the factors that have achieved improvements in energy efficiency and which are shaping the potential for further gains in energy efficiency is the extent to which sectors and firms within Chinese industry are relatively homogeneous in the sense that they respond to the relevant range of policy instruments, including pricing, technology development, and enterprise restructuring, in a uniform way or, alternatively, if China's industrial sector represents a highly differentiated, heterogeneous collection of sub-sectors and firms that may be highly variable in their responsiveness to the policy instruments available to the Chinese government for the purpose of enhancing industrial energy efficiency. This paper focuses on this key issue concerning the extent to which various sectors of Chinese industry respond in uniform or notably disparate ways to various policy instruments.

Specifically, we investigate the factors explaining the decline in energy intensity in four Chinese industries: pulp and paper; cement; iron and steel; and aluminum. The econometric analysis utilizes a unique set of firm-level data from China's most energy-intensive large- and medium-size industrial enterprises in each of these four industries over a six-year period, 1999–2004. We test the extent to which various policies, programs, and development trends specific to the industry or common across industries have contributed to the decline in energy intensity within each of these industries. Among the potential

contributing factors included in the analysis are changes in energy prices, technology development expenditures, firm scale, ownership restructuring, and regional differences.

We find rising energy prices to be the most significant and consistent factor explaining the decline in energy intensity in these industries over our period of study. Scale economies, encouraged by the shut-down of small-scale polluting factories and enterprise restructuring programs, such as "grasping the large, letting go of the small," is another important factor explaining the decline in energy intensity within each industry in varying degrees. However, by comparison, whereas pricing and scale effects impact all four industries, technology development, trade openness, and ownership differences exhibit robust impacts within only one or two of the four industries. Additionally, regional differences exhibit surprisingly different effects. In the case of pulp and paper, firms in the Northern and Eastern regions of China have lower energy intensity than firms in the South. In the cement industry, the energy intensities of firms in the North, East, and South are less than firms in the Southwest. In the iron and steel industry, energy intensity of firms in the South and Southwest is less than firms in the North and East. We explore some possible explanations for these differences.

This paper is unique in a number of ways. First, unlike past studies that examine policies, programs, and development trends either specific to the industry or common across industries, we consider both. Second, existing studies that focus specifically on Chinese industry (e.g., Wei, Liao, and Fan, 2007; Garbaccio, Ho, and Jorgenson, 1999; Ma and Stern, 2008; Zheng, Qi, and Chen, 2011) employ industry – not firm-level data – and are therefore unable to examine the drivers of changing energy efficiency at the firm-level. By employing firm-level data, this study is able to identify these drivers.