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How does administrative pricing affect energy consumption and CO_2 emissions in China?

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Despite reforms, China still largely applies the cost plus pricing mechanism for the energy sector. Government administrative energy pricing leads to energy price distortions, which could result in not only the excessive and wasteful energy consumption, but also environmental deterioration, thereby undermining energy conservation and emission abatement. Using fossil-fuel subsidies as a proxy for the level of energy price distortions, this paper estimates the subsidy of 22 Chinese departments during the period 2006–2010, and adopts the price-gap approach to analyze the impacts of subsidy removal on energy consumption and CO_2 emissions for the various sectors and energy types. The results demonstrate that removing energy subsidies would reduce energy consumption and emissions by 3.77% and 2.85%, respectively, but the effects vary across sectors. The transport, storage and post sector and the electricity, gas and water supply sector are much more affected by energy subsidies removal than other sectors. With respect to energy types, fuel oil and natural gas are sensitive to subsidies, indicating the magnitude of their consumption. This suggests that removing subsidies on these fuel types could significantly reduce CO_2 emissions. Finally, we comprehensively discuss relevant policy issues on energy price formation reform.

Contents

1. Introduction

China is the world's largest energy consumer and CO_2 emitter [1], and the international community has paid considerable attention to her energy conservation and emission abatement

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efforts. Since 2006, the government has set obligatory targets for energy-saving and emission-reduction in the Five Year Plan (FYP). Some measures, such as the objective responsibility system, industrial structure adjustment, and technological progress, are introduced to ensure constant and steady reduction of energy consumption and CO_2 emissions per unit of GDP (i.e., energy intensity and carbon intensity, respectively). It is often argued that technological progress is a key solution for energy conservation and emission abatement. However, in addition to technological solutions that can increase supply, China will also need to find ways to reduce demand [2]. Energy price reform, which is an important element of market economy, frequently appears in government's policy documents, and is currently believed to be a core and key economic policy for energy-saving and emission-reduction. The goal is to develop an energy pricing mechanism which balances scarcity of resources, market supply and demand and environmental costs. Thus, energy price subsidies, which are the main cause of energy price distortions, become the focus of China's energy reform.

China has concluded the 11th FYP (2006–2010), and is currently in the 12th FYP period (2011–2015). In the 11th FYP, the process of energy price reform was slow. Fossil-fuel subsidies scale in China was equivalent to 1.84–3.31% of GDP during 2006–2010 period, and this greatly distorts energy market [3]. It is commonly recognized that energy price distortions will promote energy-intensive products use and will hinder the promotion of energy-saving technologies, thereby resulting in over-consumption and waste of energy as well as environmental deterioration. In the light of this, a key question to ask is: did China's energy price distortions increase energy consumption and CO_2 emissions during the 11th FYP period? In other words, what is the magnitude of energy-savings and CO_2 emissions-abatement under "real" and "effective" energy prices or after energy subsidies removal in this period? The answers to these questions will help to understand the relationship between energy-saving, emission-reduction and energy price reform. It will also provide new evidences for energy price reform with respect to the promotion of energy savings.

Many studies have confirmed the vital role of energy price in energy savings [4–11]. The main mechanism is that energy prices changes will affect energy costs, and inspires technological progress in the long term, which is conducive to energy conservation and emission abatements. According to Lin and Du [12], the energy loss contributed to factor market distortions is accounting for 24.9–33.1% of the total energy loss, and eliminating the factor market distortions can increase energy efficiency by 10% and reduce energy consumption by 145 Mtce per year. This suggests that the "real" and "effective" energy prices play important roles in energy conservation. For example, after implementing rising block tariff (RBT) in July 2012, China's residential electricity price become more reasonable and effective, and about 26.5% household tend to save electricity and improve electricity efficiency [13]. He et al. [14] also proved that the optimization of the electricity price mechanism could achieve energy-savings and the maximum total social surplus.

In China, about 46% of coal and 80% of oil consumption are priced under government regulation in the 1990s [15]. Most of the government regulations has been eliminated since 1999, after which energy prices are mainly controlled by state-owned enterprises [16]. Therefore, energy price fluctuation is also due to the changes in national policies, which means energy prices distortions still widely exist. In theory, fossil-fuel subsidies are the primary means for ensuring energy access for low-income families, and the original intentions are to promote economic growth and alleviate energy poverty [17]. However, with the increasing use of modern energy, energy poverty has been basically eliminated in China, thereby highlighting the drawbacks of the policy. First, according to estimated results from previous studies, China's fossil-fuel subsidies are substantial that they incur heavy burden on government expenditure. Second, this policy creates inequality among various income groups, as the high-income groups benefits more than the low-income groups due to the "free rider" effect [18]. For example, the high-income groups with cars gets more oil subsidies while the low-income groups without cars gets little.

In order to measure the level of energy price distortions, or the magnitude of energy price subsidies, IEA [19] introduced a price-gap approach, which is calculated as the difference between end-use prices and reference prices. The former are observed in the energy market and incorporate price subsidies, while the later are the "efficient" prices that would prevail in the absence of subsidies. According to the latest data released by IEA, the average rate of China's fossil-fuel subsidies was 3.4%, and equivalent to 0.3% of GDP in 2012. The majority of subsidies were directed to oil products, with a scale of about $12.9 billion. This was followed by electricity, coal and natural gas at $10.2 billion, $3.3 billion and $500 million, respectively.[1]

There are numerous literatures that confirm the negative impacts of energy price subsidies or distortions on energy conservation. For example, Nwachukwu and Chike [20] proved that fossil-fuel subsidy encouraged wasteful consumption. Even worse, fossil-fuel subsidy decreases the external costs of energy use [21], and inhibits or postpones energy consumption structure improvement [22,23], thereby disadvantage to emission abatement. Thus, reform of inefficient subsidies will conducive to energy conservation and emission abatement [24]. IEA [19] found that eight non-OECD countries' energy consumption and CO_2 emissions would decrease by 13% and 16% respectively as a result of energy subsidies removal. This is equivalent to 3.5% and 5% of the world's energy consumption and CO_2 emissions, respectively. Wang et al. [25] suggested that government-regulated electricity pricing discouraged energy conservation and efficiency improvement.

The first research on China's fossil-fuel subsidies was conducted by Larsen and Shah [26]. They found that China has the second highest level of energy subsidies (after the former Soviet Union), which accounted for 5.49–6.12% of the total world fossil-fuel subsidies during 1985–1992. After removing subsidies, China's CO_2 reductions would account for 9.36–13.21% of the world's total emission reductions. Lin and Jiang [27] found that China's fossil-fuel subsidies stand at 356.73 billion CNY in 2007, which equivalent to 1.43% of GDP in the year. They also found that subsidies for oil products consumption were the largest, followed by electricity and coal consumption. According to the research, removing energy subsidies would be beneficial for energy saving and emissions reduction, but would also have negative impacts on macroeconomic variables. The results of Liu and Li [23] showed that China's total fossil-fuel subsidies was 386.4 billion CNY in 2007, accounting for 9.67% of China's total fiscal expenditure and equal about 4.1 times the environmental protection expenditure in 2007. Ouyang and Lin [28] indicated that the scale of fossil-fuel subsidies (including external costs) was 1.24 trillion CNY in 2010, accounting for 3.10% of the GDP in that year. Adopting a CGE model, Lin and Li [29] found that removing fossil-fuel subsidies was conducive for energy savings, but the effects varied among different sectors and families. Jiang and Tan [30] showed that China's fossil-fuel subsidies was 1214.2 billion CNY in 2008, which is equivalent of 4.04% of GDP in the year. The majority of the subsidies go to oil products consumption, followed by coal and electricity consumption. They also found that energy subsidies removal had significant negative impacts on energy-intensive industries, with oil subsidy

[1] ⟨http://www.iea.org/subsidy/index.html⟩.