

The Mechanism Research and Empirical Analysis on How Energy Tax Policy Influence Energy Substitution: Concurrently Case Study from China

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Abstract. This document explains and demonstrates how energy tax policy influencing energy substitution in China. As China is trying to seek into the efficient and clean energy substitution, being an important means of Micro-constraints and Macro-regulations, energy tax policies will plays more and more important role in this process. The most important reason of energy substitution progressing slowly is that energy tax policy goals are not clear. Therefore, the tax policies imposed on fossil energy constraint is not enough. On this basis, we propose some recommendations to address these issues.

Introduction

Thirty years after the Implement of the reform and opening-up policy, China's energy industry grows up with the technical progress, the resource utilization improved significantly. As a consequence, China's energy consumption structure is in an adjustment phase, which is mainly manifested as energy substitution. Energy substitution can be divided into internal and external substitution. Internal substitution refers to the adjustment of the energy consumption structure; External substitution means the substitution between labor, capital and energy as important economic growth variables. In this paper, the study is specifically refers to the internal substitution.

How to move towards efficient and clean energy substitution path is a major goal when China's policy makers are formulating the industrial plans and institutions of energy industry. The energy tax policy which designed by economic incentives-oriented can make environmental costs explicit and reduce negative externalities caused by an excess of energy consumption, thus can plays a very important role to achieve this goal. Existing literature did not research on the mechanism and empirics of energy substitution specifically. In this paper, the mechanism and empirics of energy substitution influenced by energy tax policy will be researched in detail.

Mechanism Research

Micro-mechanism

The micro-mechanism of energy tax policy affects energy substitution have been showing in figure 1, from the micro-structure of market's point of view, whether the tax could generate the actual effect depends on a key mechanism that contains prices of energy products, energy companies' income (i.e. return on capital) and the level of taxation reflected by the relative prices and comparative benefit based on the factor of production.

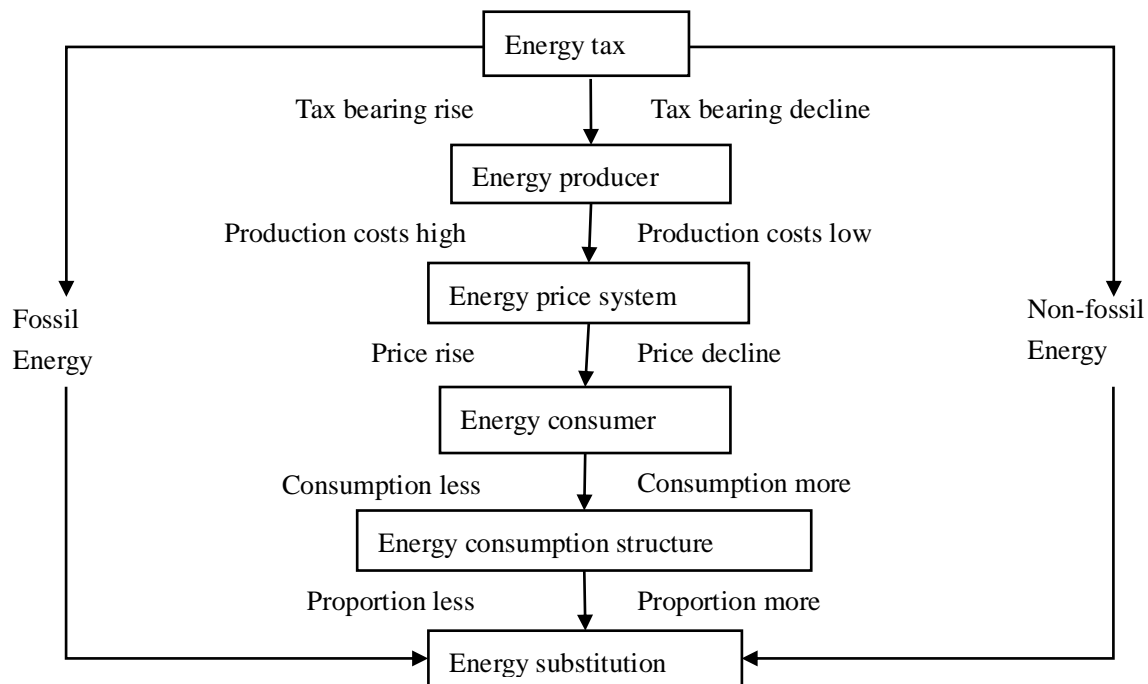


Figure 1 Micro-mechanism

Macro-mechanism

The macro-mechanism of energy tax policy affects energy substitution have been showing in figure 2. Energy is a main input factor in the production process, at the present stage in China energy tax is too low, causing energy price to be underestimated, which makes the return on investment for enterprises on the high side, total output continues to increase. Domestic consumption is difficult to digest the enormous productive capacity, yet in the form of export enterprises will absorb the surplus capacity. China's trade surplus continues to expand, the currency appreciated and the international hot money pouring into China. Resulting in a situation of excess liquidity, asset prices are rising in China, which in turn encourage excessive growth of investment. Existing investment-oriented economic development model is based on the low energy taxation, underestimated of energy and other input factors' prices, which will inevitably hinder China move into the clean and efficient energy substitution path. Therefore, achieving the objective of energy substitution must demand to rationalize energy pricing system, formulate the equilibrium price in the energy market, ensuring that these industries' ROE at a relatively reasonable level of basic stability.

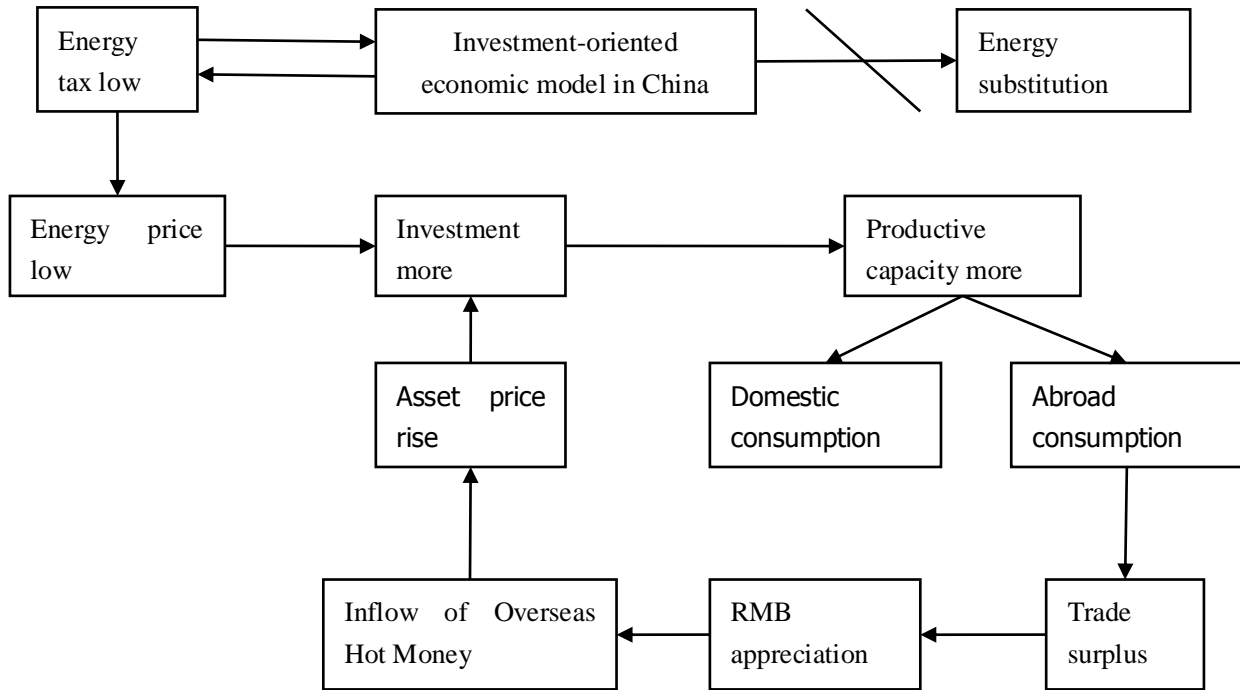


Figure 2 Macro-mechanism

Overall, how energy tax influence energy substitution depends on the combination of micro and macro mechanism, the effect is different according to the stage of economic development, the following will analysis the historical process.

Empirical Analysis

The overall conditions of energy substitution in China

At the present stage in China, energy substitution can be reflected from the change of energy consumption structure, figure 3 is the energy consumption structure in China from 1978 to 2011, table 1 is the development of energy industry in China from 2002 to 2011.

The chart shows that the main characteristic of energy substitution in China can be reflected in three aspects: First of all, energy substitution mainly reflected by the fact that the power represented by secondary energy is alternative to coal and other fossil fuels represented by primary energy. Secondly, in primary energy consumption structure, the internal energy substitution mainly reflected by the fact that the consumption of natural gas experienced a rapid growth in the past ten years, rising in the proportion of primary energy, reflecting the new fossil energy sources such as natural gas is alternative to the traditional fossil energy(i.e. coal and oil). Finally, in the process of energy conversion, the energy substitution mainly reflected by the fact that renewable energy is alternative to non-renewable energy sources. However, from Figure 1 we can know that China's energy consumption structure changes insignificantly since 1978, which also reflects the problem of insufficient energy tax measures.

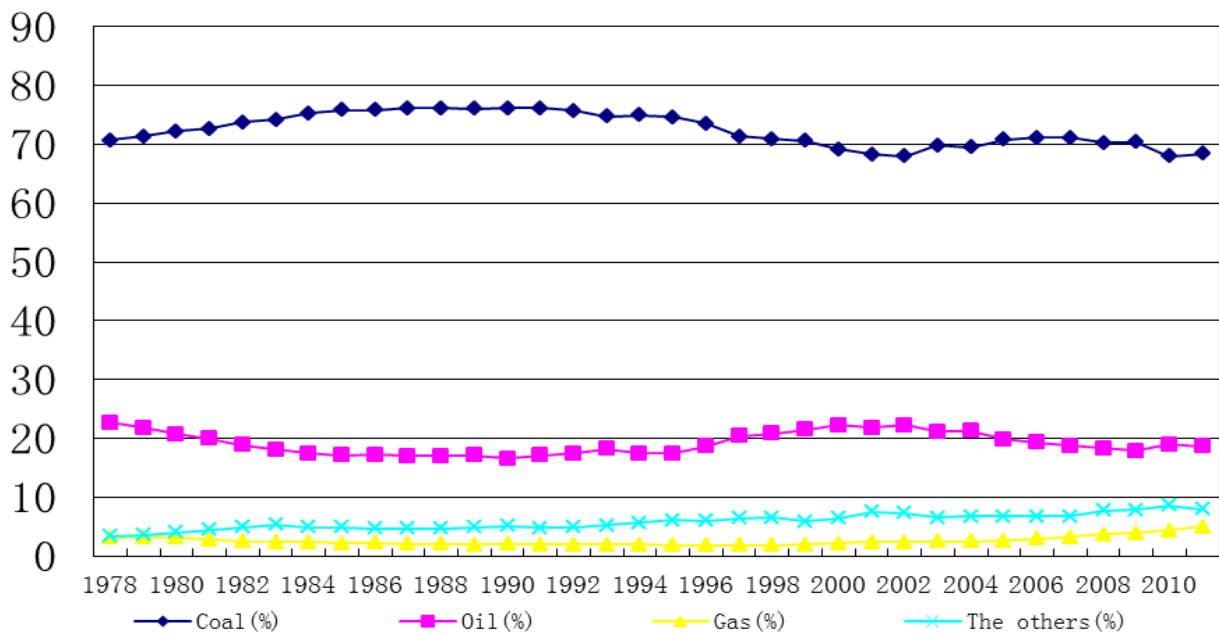


Figure3. the energy consumption structure in China from 1978 to 2011

Table1. the development of energy industry in China from 2002 to 2011

Index	Physical Unit	2002	2011	average annual growth rate(%)
Total Energy Production	Hundred million tons of coal	15.07	31.80	8.56
Coal	Same as above	11.07	24.74	9.25
Oil	Same as above	2.38	2.89	2.17
Gas	Same as above	0.44	1.37	13.37
The others	Same as above	1.18	2.80	10.01
Total Energy Consumption	Same as above	15.94	34.80	8.97
Coal	Same as above	10.84	23.80	9.04
Oil	Same as above	3.56	6.47	6.81
Gas	Same as above	0.38	1.74	18.13
The others	Same as above	1.16	2.78	10.07
Power installed capacity	Hundred million kilowatts	3.57	10.6	12.72

Empirically, the target of energy tax policy is how to affect the energy substitution? In order to answer the problem under this proposition that the energy consumption structure is changing, we try to investigate the process of energy substitution.

The process of energy tax policy affecting energy substitution

In the current China's energy tax policy, the important tax mainly includes resource tax, value-added tax, income tax and consumption tax, existing content and alternative points is shown in Table 2.

Table 2 The current energy tax policy in China

Tax items	The current policy	Alternative points
Resource tax	Resource tax is imposed on coal, oil and gas, specific tax items for: Base oil, 8-30 yuan per ton; Natural gas, 2-15 yuan per thousand cubic meters; Coal, 0.35 yuan per ton.	Non-fossil energy substitute fossil energy
Value-added tax	Imposing the gas, liquefied petroleum gas, and other products for the low rate of 13%; Small hydropower for 6%; Imposing VAT upon the clean energy power is back immediately, retreat, or half way	In the primary energy consumption structure happens the internal substitution of fossil energy; In the process of secondary energy transformation renewable energy is alternative to replace non-renewable energy
Income tax	For the SANXIA power station project and power projects in western China imply a variety of corporate income tax incentives policy.	The electronic power substitute the power from raw coal.
Consumption tax	Significantly increasing the refined oil consumption tax rate 4-7 times, based on displacement rates to set size, encourage the use of fuel-efficient cars and electric vehicles.	In the fuel and power structure, biomass energy and electricity is alternative to oil and other fossil fuel

By influencing each link of the energy supply and consumption, energy tax policy makes a great impact on the energy substitution, the process have shown in Figure 4, the specific analysis is as follows:

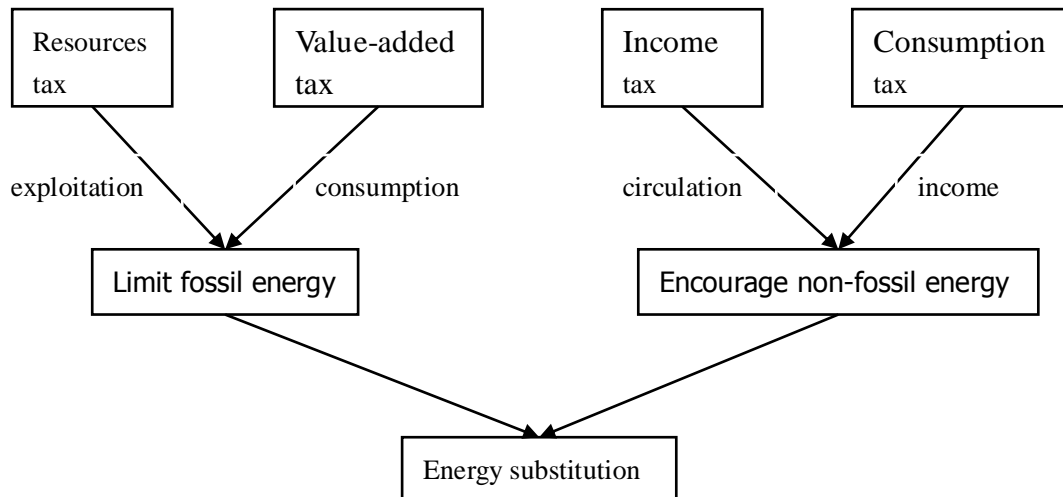


Figure 4 the process of energy substitution influenced by energy tax policy

The first category of energy tax policy: limiting the exploitation and utilization of fossil fuels. By raising the original resource tax rate, energy tax policy can increase the cost of fossil energy in the mining process, reducing the exploitation and use of fossil fuels such as coal. Making different consumption tax rate: raising the cost of fossil energy in the consumer segment according to the principle of "high consumption, high taxes", energy tax can reduce fossil energy consumption such as oil. At present, China's resource tax rate of coal is too low to achieve the purpose of suppressing excessive consumption. The coal resource tax implies by volume method, the main origin is from 3 to 5 yuan/ton, equivalent to 0.5-0.8% of the price of coal. The existence of the above conditions show that the limitation of fossil energy isn't severe enough, it is difficult to achieve goals.

The second category of energy tax policy: encouraging the exploitation and utilization of non-fossil fuels. Through a series of value-added tax preferential measures, it can reduce the cost of new energy power generation enterprises in the circulation links, improving its yield and encouraging new energy power generation. Provisions of energy tax policy such as cancel the export tax rebates of the "high energy-consuming and high resource-dependent" product, explicitly the specific purposes such as raising funds to subsidy new energy and regulate energy consumption structure to achieve the optimal allocation of energy resources, promote non-fossil energy alternative to fossil energy. In the actual operation process, the scope of support for the development of new energy industry in China has certain gap with the requirements of "renewable energy law, China's tax means supporting the new energy development and utilization is still very limited.

The experience of energy substitution which influenced by the energy tax shows that energy tax policy system has failed to effectively promote the energy substitution process in China, the key is that the main goal is not clear, so as to make the limitation of fossil energy not strict, the scope and intensity of measures to encourage non-fossil energy is not enough. In this case, energy consumption enterprises and residents are not enthusiastic to changing the structure of energy consumption.

Policy Suggestions

Learning from foreign energy practice of tax policy, resource, capital, technology and market are the four elements of its success, the reform and improvement of the energy tax policy in China should be carried out around these four elements:

First, strengthen the evaluation of energy resource. In the short term, the coal resource tax will be increased to 5% of the price in two years by step. In the medium term, the government should make effective tax policy, accelerate the resource tax by the transition from the amount levied to the price levied.

Second, formulate preferential tax policies. Expand the applicable scope of the enterprise income tax preferential policies to all products of the new energy industry chain..

Third, encourage the development of unconventional oil and gas resources and the exploitation technologies of non-fossil energy, accelerate production-type VAT transform to consumption-type VAT.

Finally, make research on the relevant characteristics of the energy demand side, regulate systematic tax policies to promote the reform and improvement of consumption tax.

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