

A PERMIT TRADING SCHEME TO FACILITATE ENERGY TRANSITION: AN APPLICATION TO CHINA'S COAL CAPACITY CONTROL

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Overview

Fossil fuel transition of the energy transition often includes a cap concept but little attention has been paid to introduce a permit trading scheme to minimize its transition costs. China's is a salient example to study fossil fuel transition because coal is the dominant energy source, which symbolizing the urgency of transition and the government is putting a cap on coal production and energy consumption, which is a perfect cap scenario for further study of permit trading schemes. Despite policy intentions are justifiable, the current command and control implementation mechanism, however, is not economically efficient and could be improved.

Following the practice in fishery and emission trading schemes, we innovatively propose to implement a permit trade scheme including tradable Individual Capacity Permits (ICPs), to minimize efficiency loss in cap the total production capacity. Since China accounts of more than a half of the global coal and steel production and consumption, minimizing costs for the capacity control (including cap and cut) policies in China's coal and steel industries will have a global significance.

The first major contribution of this paper is applying the well-established market mechanism (cap and trade scheme) to a brand new area. The second contribution is quantitatively demonstrating the potential gains of such a market instrument with real firm level data. This firm level was matched with rated mine capacity data and thus become unique. Third, permit trading scheme can also be applied to other areas that has a similar cap concept.

Methods

In this paper, we estimate the potential gains from some CAP scenarios in China's coal mining industry with a nonparametric frontier method. The benefit of QTS trading is measured as the difference between trading and non-trading scenarios. Non-trading scenario is the current practice and serves as the baseline scenarios for further scenario analysis. Considering the political policy reality, we further consider three alternative scenarios, defined by the different levels of governance (prefectural-, province- and nationwide permit trading). In the prefectural trading scenario, ICPs are only used to support capacity expansion within the mine groups, or traded among enterprises within the same prefecture where there were generated. In Chongqing provincial city, since there is no prefectural level, counties are treated as the Prefectures. We also estimated provincial trading scenario and national trading scenario, in which cases ICPs can be traded provincial wide and national wide, respectively. We expect the larger the trading area, the higher the total benefits since in a large trading area, quotas can be further allocated to higher performance companies and thus increase the total value of the production capacity.

The models for estimating the cost savings from rated capacity trading in this study are derived from the original method proposed by Brännlund et al. (1998) and (Färe et al., 2013), and further utilized in (Wang et al., 2016a, 2016b), which seek to identify the potential gains or unrealized gains from emissions trading of environmental pollutions and CO₂ in Swedish, United States and China. These models are linear programming optimization models whose objective functions aim to maximize the output of each entity that included in the emissions trading scheme.

Because the purpose of this study is to identify the potential cost savings from capacity trading in capacity cap, we adjust the objective function in above mentioned model to minimize the inputs of each entity while keep the sum of the outputs of all entities unchanged within the rated capacity trading scheme.

The data used here, other than the rated capacity data and coal prices data, are from the survey of the National Bureau of Statistics (NBS) of China in 2014. The surveyed mining enterprises have two categories: all independent accounting coal firms in the state sector; and coal enterprises in the non-state sector but have a gross output of more

than 5 million yuan. The aggregation of these data is reported as the ‘industry’ sector in the China Statistical Yearbook (Jefferson et al., 2008).

The price data are used to convert the output from monetary terms to physical terms. The price data by major coal producing bases, are sourced from China Coal Industry Association.

We further match the NSB surveyed firm with those capacity data gazetted by the NEA. To support the effort of cut overcapacity, the NEA has started to gazette capacity data for coal mines from October 2014 (NEA, 2017). By the end of September 2017, NEA has gazetted 12 times and some coal mines was gazetted twice with their capacity reduced in the second time.

Results

To control the impact of regulation breach, we need to consolidate a baseline where there is no regulation breach, that is, the total output will not be more than the total rate capacity. The command and control regulation scheme represented by Model (1) is firstly applied which provides the estimations on the efficiencies of all 1,223 enterprises and the minimum inputs of each of the enterprise could shrink to if the technical inefficiency of coal production of an enterprise is eliminated (i.e., technical efficiency increase) given its current coal production fixed and there is no capacity permit trading among enterprises. Then, according to the technical efficiency scores, we gradually eliminate 696 enterprises with relatively low efficiency scores until the sum of actual coal production from the remaining enterprises with relatively high efficiency scores (approximately) reach the total rated capacity. By the end of this process, there remains 527 enterprises whose total coal production is 91,635•104 tonne. This volume is extremely close to the total rated capacity announced by NEA for all 1,223 enterprises and thus is utilized for further comparison.

Our results show that capacity permits would be exported from net exporting province to net importing province (Liaoning and Hebei) and the permit trading would generate significant benefits. The direct cost of overcapacity cutting (revenue loss) of the coal mining enterprises would decrease by 7% for all 15 provinces when rated capacity is nationwide tradable; and there would also be significant decrease in indirect costs (unemployment and depreciation) associate with nationwide capacity trading. Furthermore, such relocation of capacity is economically beneficial as it will reduce transportation cost of coal (which is not productive).

Overall, our estimating results above verify the existence of efficiency advantage of a market-based policy instrument over command and control policies in China’s effort on overcapacity cutting in coal mining industry, since the trading of capacities among enterprises nationwide would eliminate the suboptimal spatial allocation of rated capacity and thus significantly reduce both the direct and indirect costs associated with the implementation of capacity cutting policy.

Conclusions

China, which faces the compelling need to cap, or even reduction production capacity and energy consumption, are still use traditional command and control approach. Such a cap policy does not have the well development permit trading component will cause significant economic inefficiency and welfare loss. In this paper, we propose to apply a permit trade scheme to minimize the costs of production capacity cap. A design of such policy is illustrated with China’s coal industry as an example. The paper further demonstrates the benefits of such a permit trade scheme by the estimated efficiency gains compared to the traditional command and control methods using a nonparametric frontier method on a sample of China’s coal enterprises in 2013.

Based on these results, the following policy implications could be drawing: 1) the capacity permits should be allowed trade to minimize compliance cost. The permit trading scheme provides a feasible solution to improve the economic efficiency and feasibility of China’s ongoing policies on the capacity cut; 2) large scope of trading is preferred to smaller ones and a national wide permit trading scheme is strongly preferred.

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