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Opinion paper

Environmental impacts of coal subsidies in Turkey: A general equilibrium analysis

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HIGHLIGHTS

- Turkey supports the coal sector providing both production and investment subsidies.
- Eliminating production subsidies leads to a 2.5% decline in total CO2(eq) by 2030.
- Additionally, removal of regional investment subsidies reduces CO2(eq) by 5.4%.
- The macro-effects of both scenarios are found to be quite small.
- Coal subsidies could be transferred to the financing of green policy alternatives.

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ABSTRACT

In this study we aim at providing an analytical framework for Turkey to study the macroeconomics and environmental impacts of the existing coal subsidization scheme. To this end we develop a regionally differentiated applied general equilibrium model spanning over 2015–2030. Our analytical apparatus focuses exclusively on the fiscal implications as well as the environmental repercussions of the removal of the subsidies on greenhouse gas emissions. With the aid of a set of alternative policy scenarios against a "business as usual" path, we study the regional and sectorial performances of growth, employment, investment and capital accumulation, consumption/welfare and trade balance. Our results indicate that by simple elimination of the coal subsidization scheme, Turkey can reduce its aggregate gaseous emissions by as much as 5% without a significant loss in its GDP.

1. Introduction

As a developing middle-income country, Turkey is facing increased demand for electricity and utilization of primary energy sources. The Ministry of Energy and Natural Resources (MENR) estimates indicate that per capita energy use rose from 1276 kgoe (kilograms of oil equivalent) in 2005 to 1663 kgoe in 2013. Total energy demand currently stands at 135.3 millions toe (tons of oil equivalent). These signal a significant projected expansion of energy demand in the next decade. Official figures project substantial pressures for continued increase in energy demand, with installed capacity expected to grow from 64 GW in 2014 to approximately 120 GW in 2023 (Acar et al., 2015). The implication of these expectations is that Turkey has not attained stability with respect to its energy demand per capita. Supporting the expected level of growth in demand is in itself a challenge, requiring significant investments in generation capacity and energy infrastructure, as well as continuation of the energy market reforms initiated in the 2000s. However, Turkey is also grappling with the challenges of ensuring a cost-competitive energy supply for its population and the industrial sectors, attaining energy security, and realizing emissions reduction.

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Our proposed analysis looks at how current policy meets these challenges, focusing on plans for expansion of coal-fired power and renewable energy generation, and asking what role the existing coal subsidies play in the broad policy mix. Available rudimentary data reveal that subsidies to coal mining and coal-fired electricity generation amount to 730 million USD in 2013, or 11 USD per MWh of generation (Acar et al., 2015). This corresponds roughly to 0.1% of the aggregate GDP. By contrast, subsidies to renewable energy sources are dwarfed against the coal subsidization programme.

In this study we investigate the macroeconomic and environmental effects of Turkey's existing coal subsidies using an applied general equilibrium model of the computable general equilibrium (CGE) variety. Prospecting on the 2015–2030 macroeconomic path of the Turkish economy, our analytical apparatus focuses on the direct and indirect incentivization of coal mining, exploration, and power generation. With the aid of a set of alternative policy scenarios against a business as usual path, we evaluate the environmental gains of abatement through the removal of these subsidies, and study the regional and sectorial performances of growth, employment, investment and capital accumulation, consumption/welfare, trade balance, and emissions.

The paper is organized as follows: as a continuation of this section, we document the extent and characteristics of Turkey's energy policy, the subsidization of coal in particular. In Section 2, we introduce the salient features of the algebraic equations of the CGE model along with the data sources in Section 3. Next, we report and discuss the results of our policy analysis, using the CGE apparatus as a social laboratory in Section 4, while Section 5 concludes.

1.1. Aspects of Turkey's energy policy and CO2 emissions

Turkey has been experiencing a dramatic structural change with respect to its escalated utilization of electricity and primary energy sources. In line with its growing population and GDP, it has been facing increased energy demand in the recent decades. In 2013, installed electricity capacity reached a level of 64,000 MW, more than 12-times the 1980 capacity level (TEIAS, 2013). The bulk of electricity generation stems from the utilization of fossil fuels, comprised of mainly natural gas and coal. In 2013, gross electricity generation was composed of 44% natural gas, 27% hard coal and lignite, 25% hydro, 3% wind, and a negligible share of geothermal power. Since the country does not own any significant oil or gas reserves, it is highly dependent on energy imports. IEA (2014) reports that, in 2012, energy imports accounted for more than 80% of total primary energy supply. Within this composition, 99% of total gas demand, 93% of oil and 55% of coal were imported from various countries.

In order to decrease the reliance on foreign energy sources, ensure energy security, and meet the growing energy demand, Turkey has pursued strong commitment to utilization of all the domestic coal resources, together with its plans to install three nuclear power plants in the near future. On the other hand, the potential of renewable resources such as solar, geothermal, and wind remains hugely untapped in producing energy. The focus on coal has gone so far as to announce the year 2012 as “the year of coal”. In all the ten-year development plans as well as strategy documents of the Ministry of Energy and Natural Resources (MENR), boosting coal mining and coal-fired electricity generation appears to be among the priorities of the country, with a strong emphasis on the need to increase investments, extend exploration and rehabilitation budgets, and introduce new incentives to the coal sector. For instance, in the 2015–2019 Strategic Plan of the MENR, coal resources are targeted to be utilized to the most efficient extent possible and generation of electricity from domestic coal is aimed to reach an annual level of 60 billion kWh by the end of the plan period. In order to attain these targets, investments in the sector will be accelerated and new reserves will have to be explored. Similarly, in the *Tenth Development Plan*, the desire to intensify the efforts to explore new lignite reserves (as well as oil and gas) is repeated. As part of the program, available coal fields that are ready to be operated will be transferred to the private sector via the “royalty tender system”, public coal-fired power plants will be rehabilitated and investments to build new coal-fired power plants will be facilitated (p. 196).

Coal is still a widely used energy source in the international arena. Data from IEA (2014) reveal that the share of coal in world electricity production rose from 37.4% in 1990 to 40.3% in 2012. Some of this production owes to the availability of generous subsidies provided by governments to the coal sector in many countries. These subsidies are usually designed in order to lower the cost of coal-fired electricity production, increase the price received by energy producers, or decrease the price paid by energy consumers. They take several forms ranging from direct financial transfers and tax exemptions to market price support and provision of services below market rates (provision of land, water, infrastructure, permissions, etc.) based on the WTO definition (WTO, 1994). The cost of fossil fuel subsidies, covering oil, gas and coal subsidies, globally totalled US$ 548 billion, which was four times more than renewable energy subsidies in 2013 according to IEA (2014).

Fossil fuel subsidies in Turkey are mainly comprised of coal subsidies. The most substantial of producer subsidies to coal is direct transfers from the Undersecretariat of Treasury to the hard coal sector in the form of capital and duty loss payments. These transfers are provided with the aims of subsidizing local employment in the hard coal mining regions and amounted up to around US$ 300 million in 2013. Besides, the government supports the coal sector with R&D expenditures, funding for the rehabilitation of hard coal mines and coal power stations, exploration budgets, funding of new coal power plants and investment guarantees to some coal power plants as well as distribution of free coal to poor families as part of its social policy program. Yet, some of the support measures remain unquantifiable since they are not purely financial transfer mechanisms. For instance, exemptions from environmental regulation including temporary exemptions for existing coal plants and permissive environmental impact assessment procedures enable most of the coal projects to be implemented although they are harmful to the environment (Acar et al., 2015, pp. 8–11). Furthermore, Turkey introduced a new investment incentive scheme in 2012, which is comprised of various instruments, ranging from VAT and customs duty exemption, income or corporate tax reduction to social security premium support to the employer, interest support and land allocation. Defined as “priority areas”, new coal mining and power generation projects are subsidized within the regional investment incentive scheme with the most generous measures of Regions V and VI.

Using the data for quantifiable incentives in 2013, Acar et al. (2015) estimate a producer subsidy for coal of around US$0.01 per kWh, which increases to US$0.02 per kWh when coal aid to consumers is included. In 2013, total amount of subsidies to the coal sector reached 0.1% of GDP. Needless to say, these figures serve as an underestimate of the total subsidy amount since they do not cover incentives such as investment guarantees, ease of access to credit, exemption from value-added tax and import duties (within the regional investment incentive scheme), or any of the other subsidies identified, which are expected to be significant. Moreover, based purely on production costs, coal is currently only marginally cheaper than onshore wind and significantly cheaper than solar PV. Yet, adding the identified subsidies and the external costs (such as health and environmental damages), coal becomes