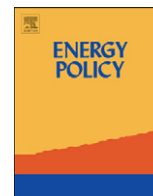




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Potential impacts of electricity price changes on price formation in the economy: a social accounting matrix price modeling analysis for Turkey

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ABSTRACT

Recent reforms in the Turkish electricity sector since 2001 aim to introduce a tariff system that reflects costs. This is expected to affect the production and consumer prices of electricity. The changes in electricity prices are then reflected in production costs in other segments of the economy. Subsequently, producer and consumer prices will be affected. The potential impact of the changes in electricity prices that the ongoing electricity reforms in Turkey will bring about may have important implications on the price formation in economic activities and the cost of living for households. This paper evaluates the potential impacts of changes in electricity prices from a social accounting matrix (SAM) price modeling perspective. It is found that based on the estimated price multipliers that prices in the energy-producing sectors, mining, and iron and steel manufacturing sectors would be affected more severely than the remaining sectors of the economy. Consumer prices are affected slightly less than producer prices.

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1. Introduction

Regulatory reforms in electricity markets have been under way in many countries since the 1980s with an aim to introduce a liberal electricity market. In most cases, state monopolies were deregulated. Following this trend, to create a more competitive market in its electricity industry, which was dominated by a vertically integrated state monopoly, successive governments in Turkey have undertaken various structural reforms after 1984. These reforms were mostly related to ownership and production structure in the electricity industry. As a result of political factors that stood as an obstacle to full liberalization, the regulatory agency, Energy Market Regulatory Authority (EMRA), could be established only in 2001.

Turkey is an emerging economy with an increase in demand for electricity. According to a Turkish Electricity Transmission Company report, electricity demand has increased on average by 6.5% per annum between 2002 and 2008, and official projections estimate the growth of electricity demand for the period 2010–2018 between 6.6% and 7.5% (TEIAS (Turkish Electricity Transmission Company), 2009: 4–13). Based on estimated electricity demand in 2008 at 357.2 billion kWh and the projected capacity increases, electricity demand in 2017 may exceed the supply (TEIAS (Turkish Electricity Transmission Company), 2009: 41). Such expectations and projections for the near future raise a number of questions for the liberalization efforts in the Turkish electricity industry. First, the need for additional investments

calls for attention to funding of such large scale investments. Second, alternative sources of power generation, including the recent plans to build a nuclear power plant and enhancing the use of renewable sources, as demonstrated by recent attempts towards these directions, become an important issue for the policymakers. Finally, efficient running of the deregulation in the electricity market becomes crucially important for ensuring the continuity of electricity supply under such circumstances.

As a response to the stated problems, the government has been pushing for a restructuring in the electricity market, more intensely in particular after the start of the regulatory reforms in 2001. An important aspect of these reforms is the introduction of a tariff system that reflects costs. This is expected to affect the industrial and residential users of electricity through induced changes in prices. Currently, electricity tariffs are prepared by the producers and EMRA, and finally approved by EMRA. The approved tariffs are binding for all producers. For EMRA, consumer protection is highly important for determining tariffs.

As an important input for numerous productive activities, changes in electricity prices undoubtedly have an impact on production and investment decisions of firms and on the aggregate price level and hence inflation. The regulatory reforms and the restructuring efforts in the electricity sector will unquestionably have an impact on the prices in other sectors of the economy as well as on households. Previous studies have investigated the impact of such reforms in the electricity markets of some countries on the economy using input–output analysis, social accounting matrix analysis, and general equilibrium analysis. In an earlier study, Han et al. (2004) examined the impact of the rises in electricity prices in the Korean economy and found significant increases in the overall price level in the economy due to

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high electricity dependence of the industries. [Nguyen \(2008\)](#) examined the impact of increasing the electricity prices as envisaged by the government as part of the restructuring in the power sector in Vietnam and found no significant impact on the aggregate price level. [Zhao and You \(2008\)](#) examined the impact of electricity price reforms on the Chinese economy and found that if the electricity prices were increased by 10%, this price shock would affect the agriculture and manufacturing sectors the most. Finally, [Seymore et al. \(2009\)](#) examined the impact of electricity generation tax on the South African economy and found negative impact on demand and employment, but when combined with benefits from pollution abatement, the net effect on the economy turns out positive.

The potential impact of electricity reform on sectoral producer and consumer prices in Turkey is an unexplored area although electricity market reforms in Turkey have been subject to a number of studies. In particular, the extent of inefficiency and the impact of the reforms on efficiency are of utmost importance. [Akkemik \(2009\)](#) found for the electricity generation sector in Turkey that efficiency and technological progress has improved after the regulatory reforms in 2001. [Bagdadioglu et al. \(2007\)](#) found potential production efficiency gains (reduction in input usage by 16%) as a result of mergers among existing firms in the electricity distribution sector during the period 1999–2003 ([Bagdadioglu et al., 2007](#)). These studies imply potential benefits for firms and the sector as a whole from the recent reforms, such as cost reduction and the positive effect on firms' motives of production and profits through change of ownership. In addition, [Bagdadioglu et al. \(2007\)](#) examined the potential impact of electricity reform on different types of households in Turkey, using simulation analyses and data from 2003 Turkish Household Expenditure Survey. Price change scenarios address the mismatch between actual tariffs and long-run marginal costs that may arise from five different cases: (i) reflection of regional network losses, (ii) merger of distribution companies, (iii) a rise in the currently low residential to industrial tariff ratio, (iv) reduction of high taxes on households, and (v) a change in the current flat rate price system to a tariff system, which reflects consumption-related costs. They found that changing the tariffs and tariff structures have different effects on different household types. Their results point to adverse effects on low income households.

The recent regulatory reforms in the Turkish electricity market aims at restructuring the electricity market towards a competitive market. In this regard, privatization and investments to enhance the generation capacity and ensure supply security to meet the forecasted increases in demand are regulated and interim cost-based tariff rates are set by the regulatory agency. According to the regulatory agency, tariff arrangements aim to balance the interests of consumers and suppliers, to encourage competition, encourage economic efficiency, and to ensure the financial viability of the electricity market (EMRA (Energy Market Regulatory Authority), 2003: 52). Since electricity is an important input for production and occupies a certain share of household expenditures, changes in the price of electricity stemming from such reforms have an impact on the economy. On another account, inflation has been an important source of macroeconomic instability for a long time in Turkey and the central bank is implementing an inflation targeting policy. Therefore, a change in aggregate price level due to price increases in important inputs such as electricity bear important policy implications. To address these issues, this paper evaluates the impact of the reforms on price formation for the production sectors and households from a social accounting matrix (SAM) price modeling perspective. In this approach, intersectoral relations are taken into account and the impact of a change in the cost of electricity generation on the price levels in the remaining production sectors of the economy are examined in a disaggregated manner. The SAM price modeling approach allows for an examination of the impacts

of the changes in electricity prices on both the producer and consumer prices. In addition, the impact on aggregate households account, i.e., the impact on cost of living, is also investigated. SAM price models, after they were introduced by [Roland-Holst and Sancho \(1995\)](#), have been recently used in policy evaluation (e.g., [Parra and Wodon, 2008](#)). The novelty of this paper is that it is the first attempt to quantify how the changes in the electricity prices in Turkey impact on prices in other sectors. I believe that this study is particularly important at a time when there is a heated debate on the electricity demand–supply mismatch and a possible energy crisis due to this problem.

The remainder of the paper is organized as follows. Section 2 overviews the recent reforms in the Turkish electricity sector. The methodology of modeling prices in a SAM framework is explained in Section 3. Section 4 outlines the basic structure and the construction of the SAM. Policy experiments are done in Section 5. Finally, Section 6 concludes with policy recommendations.

2. Recent reforms in the Turkish electricity sector

The figures in [Table 1](#) demonstrate the importance of the electricity sector for Turkey. Rapid economic growth led to rapid growth in electricity demand. Between 1995 and 2007, average annual growth rates of electricity demand and generation were both 8.0% while generation capacity grew by about 6.7%. During the same period, per capita generation capacity and net electricity consumption grew annually by 5.1% and 6.4%, respectively. The need for reform arises from the rapid growth of demand and the need to ensure continuity in electricity supply. As can be seen in [Table 1](#), electricity supply and demand have been in balance over the years. Official projections point to increase in need for investments in generation facilities to meet the demand that is projected to grow by 7.0% on average during the ten-year period 2009–2018 (TEIAS (Turkish Electricity Transmission Company), 2009: 13).

Restructuring and reforms in the Turkish electricity market started in 1984 but with slow progress until recently. Until 1993, the sector was dominated by a vertically integrated public monopoly. In 1993, this monopoly was split into Turkish Electricity Generation and Transmission Company (TEAS) and Turkish Electricity Distribution Company (TEDAS), both of which were state-owned enterprises. However, until 2001, the progress in the electricity market reforms was slow due to the legal obstacles that forbid private ownership in the electricity market. The government attempted to solve this problem by introducing alternative ownership types (i.e., build-operate-transfer, transfer of operation rights, and later on build-operate-own models) to attract private investors by way of long-term contracts. However, these moves did

Table 1

Electricity production and demand in Turkey.

Source: Turkish Electricity Transmission Co., *Electricity Generation—Transmission Statistics of Turkey 2007*

Year	Installed capacity (MW)	Electricity generation (GWh)	Gross demand (GWh)
1995	20,954	86,247	85,551
2000	27,264	124,922	128,276
2001	28,332	122,725	126,871
2002	31,846	129,400	132,553
2003	35,587	140,581	141,151
2004	36,824	150,698	150,018
2005	38,844	161,956	160,794
2006	40,565	176,300	174,637
2007	40,836	191,558	190,000

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