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The deregulation effects of Finnish electricity markets on district heating prices

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ABSTRACT

This paper investigates an empirical econometric panel data model in order to test deregulation and regional market structure effects on district heating prices in Finland for period 1996–2002. The data was collected from 76 district heating firms throughout Finland. Special emphasis is placed on the modeling of policy-induced competition, which began in year 1999, regional based fuel selection, local market structures, and distribution network sharing effects. The results imply that the local structures of energy production and sales have an important role to play in the formation of market prices and that the price lowering effects of energy market deregulation are permanent.

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1. Introduction

After decades of public ownership and government regulation, heat and power sectors are being deregulated worldwide. Finland is no exception to this global phenomenon. However, since Finland is a sparsely inhabited country, effective competition among district heating markets may be impossible. This meager result is a consequence of the general and specific features of the Finnish electricity and district heating markets.

Generally, market power is a prominent issue in the current debate surrounding the restructuring of the electricity and heat industry. Increasing the number of suppliers by opening networks to competition does not necessarily reduce market power as the standard theory suggests. Location advantages, contracts, and vertical integration allow some firms to maintain profits and prices near to monopoly levels, even though seller concentration is at a level generally considered to be competitive. If there is an independent national transmission system with adequate capacity, there may even be scope for competition across local electricity markets. In contrast, the presence of transmission bottlenecks and peak load periods may induce temporal local market power, even for a firm with a small market share. In district heating markets, however, the heat transmission network is highly localized and no interconnections are technically or economically feasible for larger areas. Producers may share the same network, or some parts of it, only in some big cities or highly urbanized regions. In some cases, energy input substitution is also possible for small house owners. However, a change in the form of energy input for space warming does not necessarily increase competition in markets that are highly integrated, horizontally and vertically, at local level.

In this paper, we use firm-level data to analyze, in details, the Finnish district heating markets in 1996–2002. Our theoretical background is based upon the industrial organization (IO) and antitrust literature, that both stress the importance of a firm's market share for its pricing policy. We build an empirical econometric model that focuses upon three specific pricing effects in connection to the firm's local market share in energy production and retail markets: the effects of policy-induced competition in related electricity markets, the effects of sharing a distribution network, and the effects of region based fuel dependency.

There are very few empirical economics papers written on district heating. Papers that pay attention to final user prices, market shares, and regulation are almost non-existent. Agrell and Bogetoft (2005) and Munksgaard et al. (2005) analyze the efficiency of the Danish district heating firms with data envelope methods (DEA). The monopoly market structure of district heating emphasizes the need for an appropriate type of regulation. The authors find large inefficiencies among the firms but note that regulators should be very careful with the choice of a regulation model and the object of regulation. Gatautis (2004) focuses on the special features of the Lithuanian district heating sector, where transition from a state-owned monopoly to a private vertical monopoly is causing extended regulatory needs. Grohnheit and Mortensen (2003) analyze district heating networks as a part of the EU and the

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Nordic combined heat and power (CHP) industry (see also Olsen and Munksgaard, 1998). Both papers stress the call for careful analysis of competition between natural gas and a range of other fuels on the market for space heating.

Although these papers offer valuable reviews of district heating issues in the EU and Nordic countries, Brännlund et al. (2004) is more interesting, in both methods and results, for our context. Brännlund et al. claim that market imperfections are present with respect to the use of wood as fuel in the Swedish district heating sector. This single special aspect is important because it shows the importance of non competitive market conditions. In this respect, our target is more direct, as we model the price responses of district heating firms to their local market conditions.

The structure of paper is as follows. Section 2 provides a closer look at the Finnish district heating markets. Section 3 introduces our econometric methods, specifications with relevant pricing variables, and hypotheses tests. Section 4 focuses on the obtained results, and Section 5 concludes. Appendices A–C provide a more detailed picture of the data and econometric model specification used in our study.

2. District heat markets in Finland

2.1. Background

District heating is the most important heating product in Finland. It is the primary heating system for 48 % of all Finnish buildings. Electricity and light fuel oil account for a total of 17% of the market share for heating goods. Due to the Northern European weather conditions, there is demand for heating for 7–10 months in a year. In 2005, the total district heating production was 32.2 TWh.[1] CHP production accounted for 74% of all district heating, and separate production accounted for the remaining 26%. However, the number of CHP companies accounted for about 25% of the total district heating companies.

A district heating company can be divided into production, distribution, and sales business units. Still, most district heating companies are vertically integrated. In some small companies, the maintenance services of the distribution network are outsourced. In some cases, the production business also belongs to a separate, independent company. As a result, the district heating water is produced by a different industrial company that produces hot water as a side product, or production units are divided into independent production companies. These independent production companies do not usually own any distribution network. The distribution network business includes network building, maintenance, and distribution of district heating. The sales business includes the purchasing of district heating, sales, and the marketing of district heating services to customers (small private houses and apartment blocks). Note that the sales business only contracts with the end-user customer. However, the sales business is typically not separated from the distribution business.

Although aspects of location, independency of production, and the distribution network are more important in the district heating markets than in the electricity markets, market complexity is not redundant for district heating markets in Finland at the local level. First, the heat producing companies are integrated into other power markets in many ways. Many firms also produce other forms of energy and are connected to the national electricity network. Typically, big plants are more efficient (economies of scale), and they have combined energy production. Second, the ownership structure is strongly integrated, vertically and horizontally. For example, 39.5% of the firms in our sample were selling both district heat and electricity. Similarly, 13% of the firms were owned by national level energy production and distribution companies. Small suburban areas and towns typically only have one heat producer with its own distribution network. In addition, the contractual forms, which deliberately suppress market mechanisms, between the firms in vertical, horizontal, and spatial dimensions can be very varied.

2.2. Special features of the district heating markets in Finland

The household electricity markets in Finland were opened up to competition on the 1st of November, 1998. Regulation was only extended to limit unreasonable pricing and to separate the different business units (production, distribution and sales). However, the district heating industry does not have sector specific regulation. Instead, it is regulated by the general Competition Laws. The policy induced competition in the electricity industry in late 1998 was expected to affect the district heating industry, since both industries compete in the same heating goods markets and in many cases the firms' produce both heat and electricity. Industry is also constantly monitored and faces the threat of intensive regulation by the state authorities. The regulatory threat became even more credible after the Finnish Competition Authority (FCA) started to investigate the pricing of two district heating companies (Helsingin Energia and Kuopion Energia) in late 1998. In 2001, the Competition Council found that there was not enough evidence regarding unreasonable pricing and abuse of dominance. The price effects of the induced competition in 1998 are modelled in a regression model framework with different trend breaks and dummy variable specifications.

Although the household heating product markets are geographically limited to the area which is covered by the local district heating (warm water) pipe network, there are still some regions – typically in large towns – where different production or distribution companies share the district heating network. However in Finland, the majority of the district heat companies are isolated from each other. Typically, they have a local monopoly in both heat distribution and production. They are often operated by the same local private or publicly owned company. Thus the analysis of market dominance and competition (e.g. Canoy et al., 2003) is important in the district heating markets. However we stress the fact that district heating is a relevant product market in Finland at the local level where seller concentration across regional or national markets is not important. The specific local market structures are mainly expected to have effects on competition and prices in the wholesale and retail heat markets. We analyze these price effects by adding the firm's market share, both in local heat production and sale markets, to the estimated model. The share variables directly measure the extension of the vertical and horizontal integration of the local district heating markets. An alternative interaction model is also estimated, where the network sharing dummy variable interacts with other model variables. These network effects are also connected to the regional analysis (see below).

The geographical location of a heat producing unit also affects what raw material inputs it uses. The price of fuels is important in the regional context. In Southern Finland, firms typically use natural gas (imported from Russia), but coal and oil is still used in the coastal regions, and peat and wood (woodchips) are the main inputs in the northern parts of the country. The regional pricing structure is affected by the fuel type used by the local district heating company. Many firms have a cost-advantage with wood based inputs at the local level, since they use production waste from wood and paper industry as their fuel input. Peat production in Finland is subsidized by the state. However, we notice that many heat companies can easily use different raw material inputs at same time. We build a (3×2) — cross-classifying dummy variable that reflects the regional input specialization and network sharing. This solution enables us to concurrently test the network and regional specific price effects.

Differential pricing is applied to different end-users, i.e. the prices of heat (and electricity) are not the same for small private houses, apartment blocks and industrial buildings. The price differences are mostly based on different tax rules, but quantity discounts are also

[1] TWh = terawatt hour i.e. 1 TWh = t1000 GWh = t1,000,000 MWh.

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