Un-cashed Switching Benefits – Loyalty or Lock-ins?

The Case of District Heating in Sweden

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Abstract

The paper argues for and defines a locked-in consumer as a consumer that is involuntary locked into a system or to a supplier in spite of an economic incentive to change. A locked-in consumer is therefore not seen as a loyal consumer, which is assumed to be voluntarily loyal to a system or supplier in spite a similar economic gain of switching. District heating is a natural monopoly and has as such been criticized for an eventual abuse of this position. Therefore, this study assuming well functioning ex-ante competition, calculates switching costs for switching *from* district heating *to* pellet burners or heat pumps. The analysis show that there exists relatively substantial switching benefits of switching from district heating to pellet burning or heat pumps in residential areas in Stockholm. With limited available relevant markets, district heating being the only alternative, this negative switching cost cannot be capitalized and represents, in the assumed absence of loyal customers, a lock-in effect. The result indicates that we cannot reject the idea that the district heating plants serving residential areas in Stockholm use their dominant position with a reduction of the social welfare as a result.

Keywords: District heating; Switching cost; Lock-in; Loyalty.

1. Introduction

This paper is about lock-in effects and therefore naturally about switching costs. However, the main statement is that it is not the presence of switching cost that constitutes the problem around lock-ins. Instead it is the eventual presence of switching benefits that are, for some reason, not utilized that needs explaining. The standpoint is that lock-in effects created by un-cashed or un-cashable switching benefits are the results from market failures, i.e. they reduce social welfare. The general question is therefore if observable un-cashed switching benefits originate from a market failure that should be scrutinized by competition authorities and/or regulators or if it simply is a sign of loyal consumers.

The empirical case under investigation is the Swedish heat market in general and the market for district heating in particular. Because of the long expected life time of different installed heat systems, an unfavorable price path of different fuels, the variable cost, of either the installed system or the competing system, can create locked-in consumers either because of the significant investment cost or because of a limited relevant market. This hinders the consumers to be flexible between systems and creates possibilities for companies to make use of the resulting dominant positions.

2. The background and local debate

The reregulation of the Swedish energy markets in 1996 had a profound influence on the market for district heating. From that been run as regulated municipal companies, the district heating plants was now expected (according to the Electricity Act, SFS 1997:857) to operate in a businesslike manner. Being formerly owned by municipal companies the district heating plants was before the reregulation “automatically” regulated through the municipal law stating that no municipal company are allowed to operate with a profit. This meant that the district heating plants had to price according to average cost, i.e. a normal price regulation.

Since 1996 we have seen a substantial shift in ownership of district heating plants. Many district heating plants were sold to private actors or turned into joint-stock companies fully or partly owned by the municipalities.

That district heating constitute a natural monopoly is not a controversial conclusion. The controversy is linked to the possible strength of this monopoly and the eventual use this monopoly power in the unregulated Swedish heat market. There are no unbundling of "boiling" the water from "distributing" the boiled water. District heating companies are thereby not obliged to connect costumers to the network and do not have to let other producers of hot water (for example producers of hot waste water) feed the network and sell this water to the district heating company or directly to consumers.

One eventual signal of local monopolistic behavior put forward by different Swedish authorities is the development of prices as well as the geographical price spread. Even if these prices and price spreads doesn't prove a monopolistic behavior, the ownership and geographical spreads are seen as "problematical". The average price increased 27% between 2000 and 2007. During the same period the price increase for Stockholm alone was 51%. Table 1 shows the average price, standard deviation, max price and min price on ownership.

Table 1. Average price and price spread for district heating in SEK/MWh, 2007

Owner	Average price	Standard deviation	Minimum	Maximum
Fortum (private)	748	34	684	784
Vattenfall (state)	719	52	606	815
E.ON (private)	684	44	598	748
Other private	701	41	626	770
Municipal	648	80	405	796

Source: Swedish Energy Markets Inspectorate

According to the Swedish Competition authority and the Swedish Energy Markets Inspectorate, these signs of price spread might indicate some abuse of dominant positions in the market for district heating. The term locked-in is

frequently used, implying that the consumers are locked-in to the presently used heating system giving the supplier of fuel increased monopoly power. However, any definition or measurement of this lock-in is not presented.

3. Switching costs and lock-ins

Klemperer (1987a,b and 1995) provides excellent overviews of switching costs as do Shapiro & Varian (1999), Shy (2001) and Farrell & Klemperer (2001). Klemperer (1995) defines switching cost as a result from a consumer's desire for compatibility between his current purchase and previous investment, an investment that can be physical, informational, artificially-created or psychological.

Klemperer (1995) lists six categories of switching costs: (1) compatibility need, (2) transaction costs, (3) learning costs, (4) uncertainty about the quality of untested brands, (5) contractual arrangements and loyalty programs and (6) psychological cost of switching. These costs are in most cases difficult to measure since they are connected to individuals and individual values and preferences.

Shapiro & Varian (1999) adds *durable purchases* as a type of lock-in, thereby adding the switching cost "*replacement of equipment*" to the list.

Many of the costs proposed above can be linked to real or imagined product differentiation, which adds to the difficulty of switching cost calculation. Letting the product differentiation factor represent the switching cost, Shy (2000) use the undercut-proof equilibrium and solve the equilibrium for this proposed switching cost. In this way it is possible to calculate a kind of "revealed" switching cost using observed prices and observed market shares.

There are no consensus regarding switching costs and the eventual link with lock-ins. I addition, there is no agreement on the subject weather a lock-in effect is something good or bad. In the management and marketing literature, switching cost is most often regarded as a strategic variable that creates a locked-in consumer which is then defined to be a loyal consumer. In economics, a locked-in consumer

is instead often regarded as a consumer with limited choices available resulting in reduced welfare.

4. Switching costs or switching benefits, setting the stage

Klemperer (1995) and Farell & Klemperer (2007) brings in the time aspect in terms of "ex-ante" and "ex-post" competition and lock-ins. Especially Klemperer (1995) analyze if fierce ex-ante competition for, say a heat system, creates ex-post lock-in into that system. The answer is generally no; the heat system almost always has an expected life time so short run attempts to use ex-post lock-ins by increasing the prices leads to long run losses when the system needs to be replaced. The ability to profit from an ex-post lock-in depends thus on the replaceability. The replaceability together with fixed and variable cost of competing systems is therefore important determinants of the switching or replacement costs. The cost of replacement proposed by Shapiro & Varian (1999), can thus be used to calculate the switching cost using observable data. By doing this it is the switching *benefit* rather than the switching cost that will define a locked-in or loyal consumer. With switching cost being defined as the replacement cost we get that the ex-post switching cost from changing from a system A to a system B (SC_{AB}) is:

$$SC_{AB} = \textit{cost connected to the use of system } \text{B} - \textit{cost of system } \text{A} \textit{ avoided}$$

Assuming for simplicity, and regarding heating systems realistically, that the initial investment cost for the installed system A is sunk, then:

$$SC_{AB} = \textit{per unit fixed and variable cost of } \text{B} - \textit{per unit variable cost of } \text{A}$$

From now on are all costs defined in a per unit form. It can, for example, be per kWh, per month or any other unit. It is now clear that is switching benefits that

need explaining. For any positive value of SC_{AB} the consumer lacks the economic incentive to switch and must be considered to make a rational decision to stay with the original (ex-ante) choice. This since system B cost more that system A subject to that system A is installed.

If, on the other hand, SC_{AB} is negative, then system B is cheaper compared to system A in spite the fact that system A is the one installed. If this switching benefit isn't cashed in (or utilized) by a consumer it can only mean one out of two things; the consumer is either loyal or locked-in. A loyal consumer has then "revealed" that the personal switching cost, as defined by Klemperer's six points, is at least equal to the calculated switching cost while a locked-in consumer simply cannot switch due to some market failure.

Explaining the presence of switching benefits

Type	Source
Loyalty	-Compatibility need -Unobservable transaction cost -Learning cost -Quality uncertainty -Contracts & Loyalty programs -Psychological costs
Lock-ins	-Market failures

With the presence of switching benefits the loyal consumer obviously value features like compatibility, transaction cost, learning cost, quality uncertainty etc higher than the switching benefits and stays loyal. We now turn to the empirical case under investigation; district heating in the unregulated Swedish heat market.

5. Switching costs and heat markets

The study focuses on three systems for heat generation; *district heating*, *heat pumps* and *pellet burners*. The three systems are substitutes but are not compatible which means that there is an ex-ante competitive market for heating system, and an ex-post market situation depending on the chosen system. The fairly long life time

of each system means that there are no contractual arrangements that can reduce the price risk for the fuel. There is an ex-ante investment cost and short run fuel cost transparency, but an ex-post price risk for the fuel in the longer run. This ex-post price risk is presumably lower for the electricity that feed the heat pump or the wood pellet fed into pellet burners compared to the hot water in the district heating system since the two former fuels are bought under competition and the latter under a monopoly situation. A power to fully exploit this monopolistic position implies however a total lack of substitute products. The accessibility to more than one system and substitutability between different systems is thus a precondition for reduced ability to make use of a dominant position. The idea of relevant market is therefore of crucial interest when assessing a possible monopoly strength. With the heat market consisting of the three different systems, the relevant market depends on the availability of each system in each geographical area.

If you can install a heat pump you can also install a pellet burner, but the availability of district heating depends on the accessibility in each specific area. Also, if a consumer use district heating and is living in a residential area, this consumer has very limited possibilities to switch to other systems. We can, to simplify things, identify three relevant markets shown in figure 1.

The three markets are; (1) the market for the two systems heat pumps and pellet burners, (2) the market for district heating alone and (3) the market for all three systems. It is obvious that a consumer limited to the lower right hand market, i.e. the market for district heating alone, runs a higher risk of being involuntary locked-in compared to consumers in the other markets.

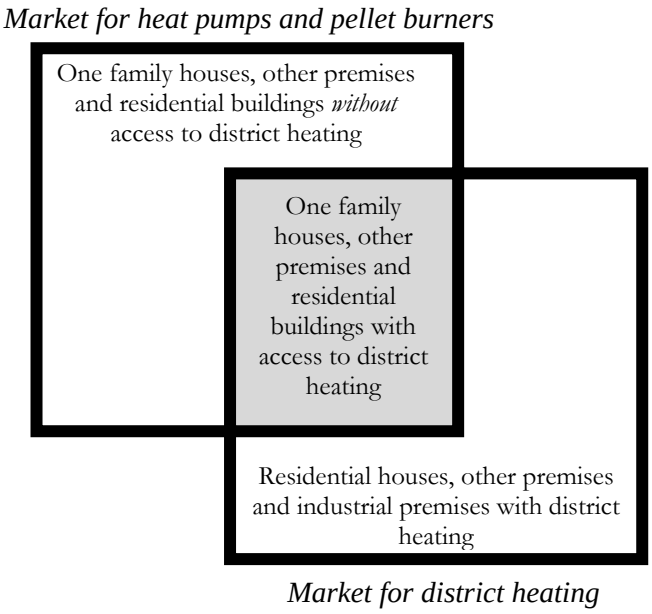

Fig. 1. The three relevant markets

Let the capital cost of the original (ex-ante decision) investment in the *present* system be F_P and let the capital cost connected to the *alternative* system be F_A. These two costs are measured in the same unit. Neither of the systems has any realistic "second hand" value so all induced fixed costs are regarded as sunk costs.

Let V_P and V_A represent the unit variable cost connected to the present and the alternative system respectively. The switching cost changing from the present system to the alternative system, $SC_{P,A}$ is then:

$$SC_{P,A} = F_A + V_A - V_P$$

From which follows that the consumer is indifferent between the systems if:

$$F_A + V_A = V_P$$

stays with present system if:

$$F_A + V_A > V_P$$

and change system if:

$$F_A + V_A < V_P$$

The last expression indicates a switching benefit, i.e. a change to the alternative system is profitable. The question then becomes; in the presence of switching benefits, do we have loyal or locked in consumer?

Using the Swedish Energy Market Inspectorate's assumptions regarding a standard consumer or building[1], the following switching cost in Luleå and in Stockholm are calculated. The municipality owned plants in Luleå has the lowest price on district heating and the privately owned plants in Stockholm the highest. In addition, Stockholm is dominated by residential buildings.

Table 2 shows the yearly fixed plus variable cost ($F_i + V_i$) per kWh for single households (detached house) and residential buildings regarding heat pumps and pellets burners.

Table 2. Yearly fixed plus variable cost in SEK/kWh, 2007

System	Single-household	Residential building
Heat pump	0.93	0.66
Pellet burner	0.87	0.59

Source: Swedish Energy Markets Inspectorate

The variable cost for district heating was in 0.41 SEK/kWh in Luleå and 0.78 SEK/kWh in Stockholm in 2007. Using $SC_{P,A} = F_A + V_A - V_P$ for calculating the switching costs gives the results shown in table 3 and table 4:

[1]The "standard" single household's heat consumption is assumed be equivalent to 25 000 kWh/year and the "standard" residential building is assumed to contain 15 apartments with a total need of 193 000 kWh/year for heating, i.e. almost 13 000 kWh/year per apartment. The assumed depreciation time for a pellet burner is 15 years, for the exchanger used in district heating 20 years and for a heat pump system 10 years for the tourniquet, 25 years for the drilling hole and 15 years for the remaining part of the investment. The interest rate is set to 4.8%, which was the average 10 years interest rate in March 2007 (Swedish Energy Markets Inspectorate, 2007).

Table 3. Switching costs in Luleå 2007

From district heating	To	Heat pump	Pellet burner
Single house		0.52	0.46
Residential building		0.25	0.18

Table 4. Switching costs in Stockholm 2007

From district heating	To	Heat pump	Pellet burner
Single house		0.15	0.09
Residential building		-0.12	-0.19

A positive value implies that it is not profitable for the consumers to replace the district heating with any comparing system and a value around zero means that a consumer is indifferent between the systems.

The presence of negative values, i.e. switching benefits, in Table 4 means that it for residential buildings in Stockholm, would profitable to use pellet burners or heat pumps instead of district heating. An average consumer in a residential building in Stockholm using district heating pays approximately SEK 2 500 more per year compared to the use of pellet burner.

6. Conclusion

With competitive markets we would perhaps expect switching costs close to zero. The relatively high switching costs in Luleå, going from district heating to an alternative system, are however expected. The municipality owned district heating plant in Luleå use primarily hot waste water from the local steel mill and the low cost is transferred to the consumer. The negative switching costs in Stockholm are a disturbing indicator of an involuntary lock-in effect and might indicate that the privately owned district heating plants in Stockholm's residential areas are taking advantages of a dominant position created by limited relevant market. A single household detached house is presumably more flexible when it comes to change between systems, making any dominant position weaker. In addition, most single household buildings have always heat pumps or pellets burners as an option which means that these almost always have access to more than one market. Converting

relatively old residential buildings in Stockholm is however not often an option, in some cases due to limited space and also due to environmental regulations.

The result suggests that the heat market works fairly well as long as the heat market is not limited to one single monopolistic market, as in the case of residential urban areas. Sustainable presence of switching benefits in these areas suggest that the competition authorities and regulators might take a more active role in price monitoring and maybe discuss price regulation in order to protect consumers or evaluate different models promoting third party access.

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