Market power and investment – *The case of technology adoption in the Norwegian grocery industry*

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1 Introduction

Market power is rising across industries and across the world (De Loecker & Eeckhout 2017). This raises the question of how the competitiveness of markets affects economic outcomes. Despite a large research effort, the effect of market power on investments remains and unanswered question (Schmutzler et al. 2010).

In this paper, we investigate the relationship between market power and investments in labor-replacing technology in the Norwegian grocery industry. The industry employs approximately 37 % of workers in the retail sector, and is therefore and important source of employment for unskilled workers. Understanding how market power affects investments in the retail sector, and implications for future labor demand, thus constitutes an important research topic.

We investigate how market power affects the probability that a grocery store installs self-checkout machines. We use a unique cross-sectional data set that contains all customer receipts for approximately one year, covering 99.9% of the Norwegian grocery market.[1] Our preliminary results show that market power increases grocery stores' investments in labor-replacing technology.

2 The Norwegian grocery industry

At first glance, concentration in the Norwegian grocery market may seem low. There are 14 national national brands of grocery stores. In addition, there are small and independent supermarkets, but they only have a market share of approximately 0.1% of revenues. Ownership concentration is high, as only four grocery store chains own the nationwide brands. They chains are NorgesGruppen (43.1%), Coop (29.7%), Rema1000 (23.4%), and Bunnpris (3.8%).

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[1]Our data set resembles other scanner data, however it is much more detailed. Instead of aggregated prices, our data consists of individual receipts, with information on items' prices and quantities, and which items are purchased together.

Due to import tolls and different tax systems, a number of groceries are significantly cheaper in Sweden. Examples of such groceries are meat, dairy products, candy and soft drinks, alcohol, and tobacco and cigarettes. Statistics Norway estimated that Norwegian households on average made 3.49 shopping trips to Sweden in 2018. According to Norway's main organization for the trade and services industry, the revenue leakage in the grocery sector exceeded the revenue of Bunnpris in 2016 and has continued to increase. Norwegian grocery stores close to the Swedish border therefore face substantial competitive pressure.

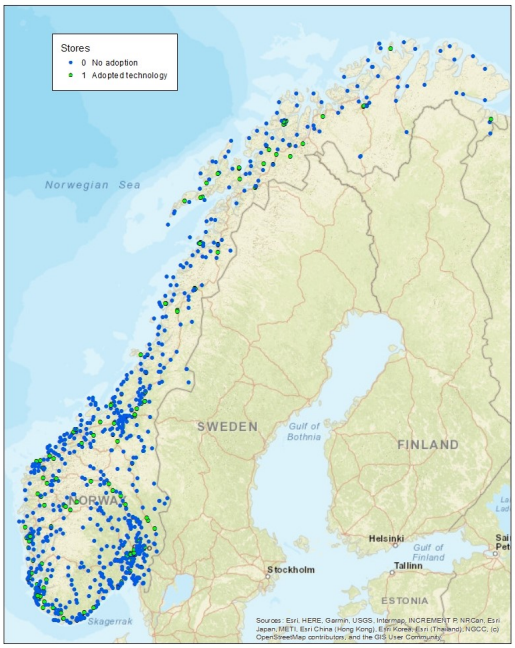

Figure 1: Location of Coop stores by technology adoption status

The first grocery store to substitute *all* manual cashiers was a store on the campus of the University in Oslo in 2011. However, most stores with the new technology have chosen a hybrid solution, installing self-checkout machines while also keeping some manual cashiers.

The main organization for the trade and services industry estimates that the share of employment in the industry will drop 10% by 2030, mainly due to self-checkout machines. As the Norwegian grocery industry employs approximately 37 % of workers in the retail sector, this constitutes a substantial reduction in retail employment.

3 Empirical strategy

In our cross-sectional analysis, we need to disentangle the effect of competition on technology adoption status (a binary variable). In our analysis, we therefore use the distance between each store and the closest border crossing point as an instrument for competition. We thus use the following instrumental variable model:

$$I_{Technology,i} = \beta_0 + \beta_1 Marketpower_i + \gamma \mathbf{X}_i + u_i \tag{1}$$

$$Marketpower_i = \pi_0 + \pi_1 Distance\_Sweden_i + \gamma \mathbf{X}_i + v_i \quad , \tag{2}$$

where $I_{Technology,i}$ is an indicator variable for technology adoption by store i, $Marketpower_i$ is a measure of the store's market power, $\mathbf{X}$ is the vector of control variables, $Distance\_Sweden_i$ is the distance from the store to the closest border crossing point between Norway and Sweden, and u_i and v_i are error terms.

As Swedish stores exert competitive pressure on Norwegian stores, proximity to the Swedish border is likely correlated with competitive pressure. However, it seems unlikely that proximity to a national border should affect stores' technology adoption decisions directly.

We therefore argue that the exclusion restriction is likely satisfied for our instrument.

To construct a measure of firms' market power, we use a method from employer-employee matching literature.[2] We use the following fixed effects model to estimate store fixed effects:

$$ln(p_{ij}) = \psi_i + \theta_j + \omega_{ij}, \tag{3}$$

where p_{ij} is the price of good j in store i. The store fixed effects, ψ_i, capture the overall price-level of the store. This reflects store characteristics, such as the store brand,[3] and the competitive pressure the store faces. The product fixed effects, θ_j, capture product characteristics such as production costs and product quality. The error term ω_{ij} is a match-specific error term. Intuitively, we can think of the error term as a product-store specific value of the match. We subsequently use the store fixed effects as a proxy for the store's market power in our instrumental variable model.

4 Data

Our scanner data contains the receipts from all four chains, thus covering 99.9% of the market. Our analysis is cross-sectional, as the time period spans approximately 8-17 months, depending on the chain. For the two largest chains, NorgesGruppen and Coop, the scanner data includes information on whether the store has installed self-checkout machines. This data covers 72.8% of the market.

On the transaction level, the data contains information on e.g. transaction/receipt ID, transaction time and date, whether the transaction was executed by a cashier or on a self-checkout machine, total number of items purchased, the total transaction amount, and the total transaction time in seconds. On the item level, the data contains information on e.g. item ID, item description (text), unit price (price paid, regular price and discounted amount), and quantity and unit of measurement.

The scanner data constitutes our main source of data. In addition, we use data on demographic variables from Statistics Norway (e.g. population size and age composition).[4] We use data on border crossings by road between Norway and Sweden from the Norwegian Mapping Authority (Kartverket). Using web scrapers, we have collected store names, addresses, and geographic coordinates. We use the unique store ID numbers from the scanner data to extract stores' names and addresses form an online database, subsequently extracting stores' coordinates from OpenStreetMap.

[2] See for example Abowd et al. (1999) or Card et al. (2013).

[3] Note that store a chain's choice of store brand is endogenous to the competitive pressure in the local market

[4] The demographic data is available for all basic statistical units. Norway is divided into approximately 40,000 statistical units, called "Grunnkrets".

5 Preliminary results

Our preliminary results show that stores with more market power are more likely to invest in the laborsaving technology. As a robustness check, we change our measure of market power, and use the extent of local sales/discounts as a proxy for competitive pressure. The result of less technology adoption close to the Swedish border, as well as the positive relationship between market power and investments remains.

Due to the geography and climate of both Norway and Sweden, northern regions are more scarcely populated and there are less stores and shopping centers on the Swedish side of the border. As Norway becomes more narrow further north (see figure 1), these regional effects are likely correlated with the distance to Sweden. We therefore control for regional differences, by including the longitudes of the stores' locations as a control variable. Furthermore, we control for several sociodemographic characteristics of the local markets that may be correlated with the distance to the Swedish border.

References

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