Agglomeration economies in urban retailing: Are there productivity spillovers when big-box retailers enter urban markets?

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ARTICLE HISTORY
Compiled June 13, 2018

ABSTRACT
Previous studies have found that big-box retail entry does not affect the productivity of incumbent retailers when entry occurs in urban areas. In this paper, we show that there are positive spillover effects of big-box retail entry to incumbent retailers in urban areas as well, but that these are limited to relatively small retailers, making the effects difficult to detect using traditional econometric methods, such as difference-in-difference estimation on the full sample of firms. In a two-step procedure, we first use panel smooth transition regression to determine size thresholds that delimit incumbent retail firms by their possible reactions to the new big-box entry. We then use difference-in-difference estimations on these subgroups of firms to determine, within each group, the direction and magnitude of the effects of big-box entry on their productivity. For the group of small incumbent retailers, we find positive spillover effects on productivity of approximately 9%.

KEYWORDS
Productivity growth; Cobb-Douglas production function; IKEA; panel smooth transition regression; regression tree analysis.

1. Introduction

Several studies (Artz and Stone 2006; Maican and Orth 2012; Håkansson et al. 2016; Han et al. 2018; Rudholm et al. 2018) report that positive spillover effects of big-box retail entry to incumbent retailers are limited to entries that have taken place in smaller local markets. Only small positive effects, or no effects at all, have been found when investigating big-box retail entry in urban areas. The two studies most closely related to this study, Håkansson et al. (2016) and Han et al. (2018), found no statistically significant spillover effects when the big-box retailer IKEA entered the urban area of Gothenburg in 2004, while finding positive effects when IKEA entered smaller rural markets\textsuperscript{1}.

Finding no effects whatsoever in Gothenburg was surprising. After all, an average IKEA entry in Sweden attracts customers who spend approximately 800 million SEK (73.5 million Euro, exchange rate 2018-05-23) in the local market. This is expected to have an impact on retailers located near the new IKEA, even in a large retail market

\textsuperscript{1}It should be noted that in an international perspective, Gothenburg has a medium-sized metropolitan area, with a population of 573 000 in 2016

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as Gothenburg. The purpose of this study is thus to empirically investigate the impact of big-box retail entry on incumbent retailers in urban areas using the IKEA entry in Gothenburg in 2004 as our case study.

2. Methods and material

Previous studies indicate that when IKEA enters the market, incumbent retailers increase their use of labour (Daunfeldt et al. 2015, 2017) and capital (Rudholm et al. 2015). Also, in Swedish retailing, small firms tend to grow faster than larger firms (Daunfeldt et al. 2012). A possible explanation for this is that there are diminishing returns to investments in capital and/or labour, making the production function of small firms more responsive to the investments in capital or labour that incumbent retailers make when IKEA enters.

The panel threshold regression model (PSTR) can distinguish subgroup observations with different regression slopes based on a threshold variable with borders (González et al. 2005). To identify if there is a threshold effect of either capital or labour on output in retailing, we use PSTR to find subgroups where the coefficient of either capital or labour on output differs depending on some threshold value. The analysis is done on pre-IKEA entry data, as entry could affect the production function. Our transition regression is specified in Eq.(1):

\[ y_{it} = \mu_i + \beta_1 L_{i,t-1} + \beta_2 K_{i,t-1} + (\beta_3 L_{i,t-1} + \beta_4 K_{i,t-1})g(q_{i,t}, \gamma, c) + \epsilon_{it}, \]

where

\[ g(q_{i,t}, \gamma, c) = \left(1 + \exp(-\gamma(q_{i,t} - c))\right)^{-1} \]

and \( y_{it} \) is the log-transformed consumer price index adjusted sales of firm \( i \) at time \( t \), and where \( L_{i,t-1} \) and \( K_{i,t-1} \) are measures of the cost of labour and capital lagged one period to alleviate a potential endogeneity problem\(^2\). \( \mu_i \) are firm level fixed effects, and \( \epsilon_{it} \) is an error term assumed to have zero mean and constant variance. \( g(q_{i,t}, \gamma, c) \) represents a continuous transition function bounded by 0 and 1, where \( q_{i,t} \) is the transition variable (either capital or labour) and \( c \) is the threshold value. The slope parameter \( \gamma \) determines the smoothness of the transition function: \( \gamma = 0 \), the model collapses into a linear regression model, and when \( \gamma = 1 \), there is at least one threshold in capital or labour affecting the production function.

In a second step, we estimate a difference-in-difference (DiD) Cobb-Douglas production function, both on the whole dataset and for subgroups of firms below and above the threshold values identified by the estimation of Eq.(1). The DiD regression equation is written:

\[ y_{it} = \beta_0 + \beta_1 L_{i,t-1} + \beta_2 K_{i,t-1} + \alpha_1 TR_i + \alpha_2 TP_t + \alpha_3 (TR_i \cdot TP_t) + \epsilon_{it}. \]

where \( y_{it}, L_{i,t-1} \) and \( K_{i,t-1} \) are defined above, \( TR_i \) is an indicator variable equal to one for firms located in the IKEA-entry region, Gothenburg. As in Håkansson et al. (2016) and Han et al. (2018), retail firms located in the Stockholm metropolitan area.

\(^2\)For details regarding the measurement of sales, cost of capital and cost of labour, as well as descriptive statistics, see e.g. Han et al. (2018) who use the same dataset.
are used as controls for retail firms located in the Gothenburg metropolitan area. \(TP\) is an indicator variable equal to one for the treatment period, while \(TR_i \cdot TP\) is an interaction variable equal to one for firms located in the IKEA-entry region after IKEA entry. The parameter corresponding to this variable, \(\alpha_3\), measures how the output of incumbent retailers in the entry region compares after IKEA entry with their own output before entry, and with the output of retailers in the control group throughout the study period, holding the levels of inputs (labour and capital) constant.

3. Results

To test for firm size heterogeneity when estimating Eq.(1), Wald test statistics and p-values are calculated under the null hypothesis of homogeneity (\(\gamma = 0\)), and the results are presented in Table 1. The results show that heterogeneity exists, and that capital is a more suitable transition variable than labour. Consequently, firms should be separated into two subgroups according to size (p-value < 0.10). The threshold value of logarithmic converted cost of capital (\(c\) in Eq.(1)) is estimated to be 4.3, which translates to firms having a capital stock of approximately 1 500 000 SEK (138 000 EURO). This results in a small firm subgroup composed of 1 569 firms and a large firm subgroup consisting of 1 281 firms.

<table>
<thead>
<tr>
<th>Table 1. Homogeneity test.</th>
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<tr>
<td></td>
<td>(\chi^2) statistic</td>
<td>(F) statistic</td>
</tr>
<tr>
<td>capital</td>
<td>6.473 (0.039)</td>
<td>2.422 (0.089)</td>
</tr>
<tr>
<td>labour</td>
<td>5.662 (0.059)</td>
<td>2.118 (0.121)</td>
</tr>
</tbody>
</table>

Note: \(H_0\): Linear model (\(\gamma = 0\)) versus \(H_1\): PSTR model with at least one threshold (\(\gamma = 1\)). Two statistics are separately calculated assuming \(\chi^2\) and \(F\) distributions (p-values are in parenthesis).

The results from the estimations of Eq.(2) are presented in Table 2.

<table>
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<th>Table 2. DID regression results.</th>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>labour</td>
</tr>
<tr>
<td>capital</td>
</tr>
<tr>
<td>(TP \cdot TR)</td>
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Note:***Significant on the 1%-level, *significant on the 10%-level.

For all firms, the results are in line with those presented in Håkansson et al. (2016) and Han et al. (2018), who found no effects of the IKEA entry in Gothenburg on the productivity of incumbent retailers in the entry region. However, the results presented

\(3\)For a discussion regarding why the Stockholm metropolitan area is suitable as the control region, see e.g. Håkansson et al. (2016) and Han et al. (2018).

\(4\)\(c^4.3 = 73.7\), and cost of capital is measured in 1 000 SEK. With a threshold value for the cost of capital of 73 700 SEK, and with an assumed average interest rate on capital of approximately 5%, this equals approximately 1 500 000 SEK in total capital (73 700/0.05 = 1 474 000).

\(5\)We have also tested if there should be more than one threshold level, and these tests show that the one-level model is preferred to models having two or more levels.
4. Discussion

Previous studies of IKEA entry into Swedish municipalities have concluded that positive agglomeration economies only exist when IKEA enters small- to medium-sized retail markets located in rural areas. This is surprising since a new IKEA store attracts consumers spending approximately 800 million SEK in the markets where they enter, and this should be enough to have an effect on incumbent retailers also in urban entry areas, such as Gothenburg.

In this paper, we use a two-step econometric procedure to first identify the cost of capital threshold level where IKEA entry is most likely to have an effect, and to then estimate the impact of IKEA entry on the productivity of the affected incumbent retailers. We find that IKEA entry does have an effect on incumbent retailers in the urban area of Gothenburg. The reason why previous studies failed to find any effects is that the effects in urban areas are limited to relatively small incumbent retail firms with a capital stock of less than 1 500 000 SEK (approximately 138 000 EURO) before IKEA entry, making the effect difficult to identify when analysing the full dataset of affected retailers.

Acknowledgements

Research funding from the Swedish Retail and Wholesale Development Council, grant number 2015:4, is gratefully acknowledged.

References


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6To investigate how stable our results are with respect to the choice of method for determining subgroups, we have also used DID-based regression tree analysis (Breiman et al., 1984) for partitioning the data into subgroups and estimating the IKEA-entry effects on incumbent retailers. The regression tree algorithm indicates that there are three subgroups, small firms (capital $\leq 4.4$), middle firms ($4.4 < \text{capital} \leq 5.6$) and large firms (capital $> 5.6$). The results show that IKEA entry only has an impact in the group of small firms, with an average increase in incumbent firm productivity of 13.2%, statistically significant at the 5% level.


