# Competition and Service Quality in Online Grocery*

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**Abstract**

Online grocery has been rapidly growing in recent years and amid intense competition and operational constraints retailers are trying to gain market shares. This paper investigates the impact of competition in the online grocery market on service quality, measured as the elapsed time between order and home delivery. Between July 2016 and June 2019, we have been collecting bi-weekly data on delivery times offered by online grocery retailers in 183 localities across Israel. Exploiting regional and temporal variation in entry decisions by online retailers, we find that: First, service quality is higher in more competitive markets and on low-demand week days. Second, incumbents improve service quality shortly before an entrant begins offering online service in a local market. The improvement in service quality is greater in monopolistic markets and on low-demand weekdays, where incumbents likely experience low utilization of their capacity. Our findings highlight the intricate relationship between operational and competition considerations when evaluating firms choices to improve service quality.

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# 1 Introduction

In many markets firms compete on both price and delivery time. Firms like Fedex and Domino's Pizza dominated their markets as they were able to provide consumers with fast delivery time. In recent years, with the advent of e-commerce and technology, delivery times probably become even more important as consumers expect to be served as quickly as possible. Undoubtedly, Amazon's same-day delivery service greatly contributed to its dominance in e-commerce and is considered an important competitive advantage vis-a-vis potential rivals. Also, in the ride-haling and restaurant delivery services, firms like Uber, Lyft, Grub-hub and Doordash are fiercely competing on customers' waiting times. Somewhat surprisingly, we are not aware of empirical studies that examine the interaction between delivery times and competition. In this paper, we address this gap in the literature focusing on the online grocery market.

The online grocery market is growing rapidly in many countries. In the US, the online grocery market more than doubled from 2016 market to 2018 online for groceries.[1] In the UK, the online grocery channel is the fastest growing purchase channel and more firms enter this market.[2] Growth in online grocery is likely to further continue, partially because the share of the online channel our of total food purchase is fairly low. In 2019 about 10% of US consumers regularly purchase food online, and the value share of online grocery expenditures in the UK is estimated to be only 9% in 2021. Traditional brick-and-mortar food retailers, such as Walmart, Target and Kroger, online giants like Amazon and specialized online food delivery apps like Instacart are looking for ways expand and dominate the online grocery market. Online grocers face both operational and strategic-competitive considerations. Unlike e-commerce retailers that use FedEx or UPS to deliver products, online grocer need to rely on specialized infrastructure to keep food at appropriate temperatures. Sufficient customer density is also important to ensure high utilization of trucks while taking into account frequent demand spikes, occurring before weekends and major holidays.[3] Finally, according to surveys, nearly half of grocery shoppers consider speed as an important factor when purchasing online. Two-thirds of respondents would consider switching to a rival if their normal retailer would not deliver their order within a two-day window.[4]

Our paper focuses on the Israeli online grocery market. This market offers an excellent opportunity to study the importance of delivery times and competition. First, like other countries,

[1] https://www.businessinsider.com/online-grocery-report.

[2] https://www.statista.com/topics/3144/online-grocery-shopping-in-the-united-kingdom/. In Asia, online grocery is expected to triple by 2023. See, www.nhh.no/en/research-centres/food/food-news/2019/august/online-grocery-in-asia-to-grow-198-by-2023/.

[3] See McDonald and Hollingsworth (2014) for a nice description of the history of the U.S. online grocery market, and also www.wsj.com/articles/amazon-to-whole-foods-online-delivery-customers-were-out-of-celery-hows-kale-11553425200.

[4] See, https://www.statista.com/statistics/630351/factors-when-buying-food-online-in-the-united-kingdom-uk/, and https://getfabric.com/2019-grocery-report/.

the online grocery market in Israel has been growing fast in recent years. For instance, the share of online sales by the largest food retailer in Israel has grown from 4.2% in 2014 to 13.6% in 2018. Expectations are that online grocery sales will continue to grow in upcoming years. The fast growth manifests itself not only by increased demand by consumers that shop online but also by retailers entering and expanding into new local markets. We exploit this regional expansion to identify the effect of changes in local competition on delivery times offered by incumbents. Second, delivery time is a natural means through which retailers can compete at the local level. Specifically, retailers' delivery times are both important to consumers and can be observed at the time of purchase. Furthermore, as is common in many retail markets (e.g. DellaVigna and Gentzkow (2019)) prices in the online grocery market are identical across local markets, regardless of the level of competition. Since retailers are not using prices to compete, they are likely to choose service quality to compete and differentiate themselves. Thus, we can expect that online grocers facing more competition will have an incentive to improve delivery time. Third, decisions to improve delivery time, such as pickers' scheduling and the utilization of trucks are typically determined at the local, rather than at the national level. Accordingly, observed variation in delivery times can be attributed to decisions made at the local market, and arguably to changes in the nature of local competition.

Between July 2016 and June 2019 we used a web crawler to collect delivery time data offered by the five online grocery retailers that were active in Israel throughout that period. The crawler recorded data for 183 different addresses across Israel twice a week at midnight on Saturday (low demand weekday) and on Wednesday (high demand weekday). Using the crawler data we measure both the number of active retailers (i.e. those offering service) in each market, and the delivery time offered by each active retailer. The final data-set contains a panel data of 183 local markets over 36 months. For each market and month we have information on the number of active retailers, and for each retailer its delivery time which is based on the minimal difference between the crawler time (on Wednesday and Saturday nights) and the first available delivery time. Using panel data analysis is essential because observed differences in quality across markets might be driven by differences other than the level of competition. In particular, online retailers prefer to offer service in urban areas where they can exploit economic of density and reduce average time between deliveries.[5] Accordingly, it would be likely erroneous to attribute shorter delivery times in urban markets solely to competition.

Our analysis shows that the incumbent retailer improves delivery times in the face of increased competition. This improvement takes place 2-3 months before a rival begins to offer online grocery

[5]In an interview, explaining the failure of Webvan the first online grocery service, its VP said that "The biggest failure of Webvan was delivery density. Mean travel time between delivery stops is the key to success in the home delivery business." See https://www.reuters.com/article/net-us-amazon-webvan/from-the-ashes-of-webvan-amazon-builds-a-grocery-business-idUSBRE95H1CC20130618.

service in the local market. This finding is important for two main reasons. First, it suggests that incumbents improve delivery times to enhance customer loyalty and potentially increase future switching costs. Second, the fact that incumbents improve delivery time before entry actually occurred is useful to ruling alternative explanations for shorter delivery times. In particular, one explanation emphasizes the incentives to provide better quality to discourage consumers from shifting to the competitor. An alternative explanation for shorter delivery times is that following entry, some consumers switch to the rival retailer and the incumbent - overall serving fewer customers - offers its remaining customers shorter delivery times with the same resources. Thus, according to the latter explanation the change in quality is driven by the freed resources which became available after a rival enters. The fact that we find that quality improves before actual entry indicates that the former explanation. i.e., that the incumbent allocated new resources to improve its service quality, is relevant in our setting.

To further examine the impact of competition on service quality, we conduct two additional analyses. First, we separately analyze the impact of competition in markets characterized by different level of competition. We expect that incumbents in concentrated markets will consider entrants as a larger threat and will therefore improve quality more than incumbents in more competitive environments. Second, we examine how incumbents respond to enhanced competition during high and low utilization periods. To do so, we distinguish between Wednesdays as a high pre-weekend demand day and demand on Saturdays as a low-demand weekday. We expect that during high-demand days, incumbents have a higher utilization of their resources and will find it difficult to improve service quality. In contrast, during low-demand period, some resources are idle and improvement is feasible. Our analysis confirms our expectations, incumbents improve quality more in markets in which they operate as a local monopoly before entry. Also, we find that quality improves on low-demand days of the week, while find negligible impact of competition on service quality on high-demand days. Figure 1 nicely summarizes our main results. The figure shows the incumbent's delivery time in low and high demand weekdays before and after the first entry in our sample and in varying market structures. According to the figure, delivery time is shorter in low demand days than in high demand days. Also, for a given weekday, we see that delivery time is shorter in markets with more online grocers. More importantly, we see that the decline in delivery time occurs before entry and it mostly observed on low-demand periods. Finally, the reduction in delivery time is greater, measured by the slope of the delivery time in monopolistic markets compared to more competitive markets. Our regression analyses confirm these patterns.

The remainder of the paper is as follows. in the next section we describe the related literature. In section 3 we describe the industry, the data and provide descriptive statistics. In section 4 we present the estimation and the results. In section 5 we conclude.

## 2 Literature review

Economists have long recognized the importance of quality in firms' decisions and in consumers' choices. In early theoretical models, better quality is more costly to produce but it does not depend on the volume produced by a firm (e.g. Mussa and Rosen (1978), Gal-Or (1983), Tirole (1988)). Examples of sch quality attributes include processing speed, power engine or durability. Other theoretical models recognized that in many settings quality might nevertheless be affected by the total output produced and the production capacity of a firm (De Vany and Saving (1977). De Vany and Saving (1983), Allon and Federgruen (2007)). Specifically, these models stress the importance of congestion externalities, that as more consumers buy a service from a particular firm, that firm will find it harder to maintain the same level of service quality. The leading example in these models is delivery time. Another basic distinction in the theoretical literature is between search and experience goods Nelson (1970). That is, whether quality is observed at the time of purchase or only after consumption. In settings in which consumers can observe quality before buying firms will have a stronger incentives to compete more aggressively on the observed quality attributes.

Theoretical models in operations and economics have also specifically examined how delivery times, capacity concerns and competition interact. These models characterize the equilibrium in markets where firms compete on both price and service time (e.g. De Vany and Saving (1977), De Vany and Saving (1983), Allon and Federgruen (2007), Johari et al. (2010)) or on service time only (e.g., Luski (1976), Kalai et al. (1992)). In particular, Kalai et al. (1992) consider a model in which firms compete on service time, prices are fixed and marginal costs are increasing in the number of customers being served. Comparing a monopoly to a duopoly situation, the authors show that service time will drop only if the marginal cost of providing the service is below a certain threshold. Likewise, we show that the impact of competition on delivery time is larger on low-demand week days, where arguably marginal costs are lower.

Probably due to data limitations, only few empirical papers examine the relationship between competition and quality measures.[6] Early studies relied on cross-sectional variation in the number of firms to investigate how it correlates with quality measures. For instance, Olivares and Cachon (2009) examine the relationship between the number of car dealers in the local market and inventory, between restaurant quality and market size (Berry and Waldfogel (2010)), and between bank quality and competition (Dick (2007)). Such studies offer valuable insights but potentially suffer from omitted variable bias, and therefore some caution is required with the causal interpretation of their findings. As we show below, our estimates when using variation in the number of retailers across markets are considerably larger than the the estimates we derive when we also exploit

[6] The operation literature has studied waiting times in non-competitive settings, such as calling centers and health services.

intertemporal variation in the number of firms in a given market.

More recent studies examine whether incumbents adjust quality in response to entry threats. Prince and Simon (2014) show that incumbent airlines, facing entry or a threat of entry by Southwest Airlines, degrade their quality service measured by on-time performance.Mazzeo (2003) shows that on-time performance is better in more competitive routes. Focusing more on the operational side, Ater (2012) shows that airlines set flight schedules to reduce delays when they operate a larger share of flights in an airport. Fewer papers examine industries outside the airline industry. Orhun et al. (2015) studies how incumbents respond to entry in the US movie-exhibition industry. Focusing on 45 geographical-isolated monopoly markets they find that in response to a rival entry, incumbents do not improve quality measured by popular and recent movies. Probably closest to our study, Matsa (2011) shows that incumbent supermarkets reduce their stock-out rate after Walmart enters the local market. Matsa does not consider incumbents' response across different demand conditions and cannot directly rule out that the improved stock out rate is driven by lower demand at incumbent stores after Walmart enters the local market. Also related is Busso and Galiani (2019) who examines the impact of competition on price and customer satisfaction. They show that prices dropped after entry and that satisfaction increased. They cannot assess whether improved satisfaction is driven by lower prices or by other reasons. A common feature of previous studies is that they rely on quality measures that are observed ex-post purchase (i.e., a flight's on-time-performance) or only upon arriving at the store (i.e., product availability). Accordingly, these studies indirectly assume that firms invest in quality to maintain their reputation and to increase future demand rather than to increase current demand.

Few empirical papers examine how waiting times affect demand. For instance, Allon et al. (2011) studies how waiting times in the fast food industry affect demand, and Allon and Federgruen (2007) examine how the length of a queue affect purchasing behavior in retail stores. These studies do not investigate the relationship between competition and firms' quality decisions. Other studies use data from a single firm and examine how consumer behavior changes when shopping food online, and how the online channel affects sales of traditional stores (Pozzi (2012, 2013), Chintagunta et al. (2012)). Our paper is also related to recent papers on uniform pricing, showing that retailers often set similar prices across locations regardless of the nature of competition they face. Such patterns have been documented in various industries, such as supermarkets, movies, fast food and mass-merchandising and in different countries (e.g., DellaVigna and Gentzkow (2019), Adams and Williams (2019), Ater and Rigbi (2020)). Uniform pricing poses a difficult challenge to researchers in economics, marketing and strategy - how do retailers compete when prices are fixed at the national level. Our findings indicate that firms respond to a change in competition by higher quality, measured by the delivery time that they offer.

# 3 Institutional background, data and descriptive statistics

## 3.1 Institutional background

Sales in the online grocery market in Israel are growing rapidly. Our analysis uses data on the five supermarket chains that offered online grocery service between 2016 and 2019. These supermarket chains rely on their own distribution apparatus to deliver food, though often use external contractors to run the deliveries. Food items are collected from brick-and-mortar stores which typically also serve traditional shoppers. Shufersal, the largest retail Israeli food chain (283 stores at the end of 2015) and is also the dominant player in the online segment. Industry insiders estimate that its market share is about 70% of the online grocery market.[7] Shufersal sells 13.6% of its annual sales through the online channel, up from 4.2% in 2014 and 11.5% in 2017. According to Shufersal's 2018 annual financial report, the online channel is a primary growth engine and this channel is expected to capture 20%-25% of its sales in the upcoming years. The majority of Shufersal's home deliveries are being distributed from its physical stores across Israel, except 4 dedicated delivery stores located in the center of Israel. The geographical coverage of Shufersal's online service is considerably higher than any of its rivals, reaching all localities in our sample. Our empirical analysis focuses on Shufersal's response to entry by other expanding supermarket chains.

Four other retailers (Rami Levy, Victory, Yeinot Bitan and Mega) offered online grocery service with a much more limited coverage. In recent years, Rami Levy and Victory which are considered low-cost chains, opened several traditional stores, growing from 27 and 29 at the end of 2014 to 49 and 47 stores by the end of 2018, respectively. Since these supermarket chains use traditional stores to collect and dispatch online food orders, the opening of the new stores contributed to their ability to expand their online service. In 2019, 7.2% and 4% of Rami Levy and Victory sales are from the online channel. Each of the online retailers operate a dedicated website that customers can use to order food (e.g., Shufersal.co.il, www.rami-levy.co.il). Customers can also purchase from each of the online retailers by accessing Mysupermarket.co.il, an online platform that enables customers to compare retailers' prices and available delivery time before making the actual purchase. Customers who shop through mysupermarket.co.il can observe the available time slots for each retailer and can choose to switch retailers. Figure 2 and Figure 3 show examples of screens observed by consumers who buy online grocery through www.mysupermarket.co.il.

Online Grocery prices are set at the chain-national level and are similar across markets. Delivery fees are also set nationally and are about NIS 30 (less than $9). Delivery fees are sometimes lower for orders above certain thresholds. The common view is that online grocery is still a losing business, where the cost of one delivery is about NIS 37. For instance, Eyal Ravid, the CEO of the

[7] See https://www.ynet.co.il/articles/0,7340,L-4907570,00.html.

supermarket chain Victory said in a newspaper interview: "Everybody loses money in online sales. It is very difficult to make profits, especially in food. Presumably, the online adds sales to existing stores but the costs on wages, cardboard and delivery, are doubled. I think that efficient online food retailers lose 2% of their turnover while less efficient chains lose about 5% of their turnover in the online channel."[8] Chains nevertheless invest large resources in the online segment because consumers, especially young consumers, move to the online channel and therefore presence in this market is essential.[9]

## 3.2 Data and descriptive statistics

We used a web crawler to collect information on delivery times by the five supermarket chains that offered online service to 183 different home addresses throughout Israel. The data collection was performed for three years twice a week on midnight of Wednesday and Saturday between July 2016 and July 2019. We chose Wednesday and Saturday as they represent high (before weekend) and low (beginning of the week) demand conditions, respectively. Retailers experience higher utilization rate on high demand weekdays and likely face higher marginal costs.[10] The crawler records the six earliest available home-delivery time slots for each chain that offers service to each address. In the empirical analysis, we focus on the time difference between the crawling time (which corresponds to the order time) and the first available delivery time to each address and each retailer active in that market.

The number of retailers that offer online grocery service to a particular address is our measure of local competition. To avoid over-identifying instances of entry and exit which are driven by the malfunctioning of the crawler on specific dates, we aggregate the data recorded by the crawler to the monthly level. These data enable us to examine the number of retailers that are active in each local market in each week and to observe the expansion decisions of online retailers. Since Shufersal offered online service in all the localities in our data we consider it as the incumbent firm. Figure 5 shows the evolution of market competition in local markets in our sample. In the beginning of the period, Shufersal was the only provider of online service in 40% of the markets in our data and in nearly 70% of the local markets Shufersal faced one or two rivals in the online segment. Over time competition intensified and in July 2019 only 23% of the markets in our data were characterized as monopoly markets. Our empirical analyses take advantage of this expansion to identify the impact of a rival entry on delivery time offered by the incumbent.

[8] See https://www.themarker.com/technation/.premium-1.8564789, and https://www.themarker.com/markets/reports/1.4622698.

[9] https://www.ynet.co.il/articles/0,7340,L-4907570,00.html.

[10] We illustrate this point in Figure 4 using data from mysupermarket.co.il on the number of consumers who bought online groceries in 2019. Using the weekday of the order we show a normalized number of orders on each weekday. The figure illustrates that the cumulative number of orders on Wednesday is significantly larger than on Saturday night.

Figure 6 shows for each retailer and separately for high and low demand weekdays, the mean delivery times across markets served by different number of firms. The figure demonstrates that service quality in competitive markets is much better (i.e., short delivery time) than in markets in which retailers face weaker competition. For instance, Shufersal's mean delivery times in markets in which it is the only online retailer are 37 hours on low-demand days and 51 hours on high-demand days. In contrast, in markets where there are five online retailers, Shufersal's mean delivery times are 20 and 26, respectively.[11] Yet, these large differences in delivery times across markets might be driven by factors other than competition. In particular, online retailers prefer to operate in large, highly populated cities, where they can exploit economies of density compared to rural areas. To show these patterns, Table 1 presents descriptive statistics of markets with different number of active online retailers at the beginning of our sample period. According to the table, localities that are served by multiple online retailers are more populated, dense and closer to the center of the country. Also, residents at these markets on average earn higher wages and have a higher socio-economic index. The table also separately presents descriptive statistics of markets in which an online retailer entered during the sample period and markets in which no new entry took place during the sample period. In our empirical analysis, we use the markets in which no entry was observed as a control group. Notably, in the empirical analysis we include localities' fixed effects, and are therefore able to control for any time-invariant differences across markets.

# 4 Empirical strategy, estimation and results

Examining how changes in competition affect quality measures, such as delivery time, entails several empirical challenges. First, to identify such relationship researchers need to exploit variation in the level of competition. However, competitive environments do not change frequently and when such changes occur, they are often at the national level, making it difficult to compare markets that experienced a change in competition with markets that did not. To overcome these challenges, researchers often rely on variation across markets, comparing quality measures in markets with more firms to markets with fewer firms. Such approach however is subject to omitted variable biases as the number of firms active in different markets might be correlated with factors that likely affect service quality. Second, to identify the impact of competition on quality, the quality measure should also vary across markets and over time. Yet, often product quality is fixed over time or across markets. Measures of service quality may vary across markets and over time but are rarely observed to researchers, especially not for several firms. Third, quality measures are often observed by consumers only ex-post. Accordingly, it is unclear to what extent consumers make

[11] In Israel grocery deliveries are unavailable on Friday afternoon and on Saturday. To take this into account, we subtract 30 hours from deliveries scheduled after Saturday. Ignoring this aspect, would only make the differences in delivery times between low and high demand weekdays (Saturday vs Wednesday) larger.)

their purchasing choices based on these unobserved quality measures, and to what extent firms have the incentives to invest in improving these quality measures. Our research design helps us address these concerns.

First, we rely on the panel structure of our data and the geographical and temporal variation in entry decisions to examine how the incumbent firm responds by changing its service quality. Thus, we are able to control for time invariant demand conditions across markets and time variant effects which are fixed across markets. Second, our measure of quality varies both across markets and over time, it is observed by consumers at the time of purchase, and is largely determined at the local market. Finally, the fact that prices in the online channel are determined at the national level, underscores the potential importance of service quality as an important competitive tool.

Another main challenge in evaluating the impact of competition on service quality is to distinguish between two potential explanations for improved quality offered by incumbents. First, improvement in delivery times by the incumbent might be driven by idle capacity after some of its customers move to the entrant ('demand effect'). Alternatively, the improvement can be driven by additional resources (e.g., management, longer working hours) that are allocated to preventing losing existing customers to the entrant ('incentive effect'). To address this challenge, we examine the change in delivery time offered by the incumbent before, during and after the entry. We claim that a change in delivery time before entry occurs is driven only by a competitive effect. More specifically, in the main empirical analysis we use an Event Study strategy to identify the impact of a rival entry on the delivery time offered by the incumbent firm. We preform the analysis for all markets and separately for markets with low level of competition, i.e. monopolies and duopolies markets who face entry during the sample period. Some of the markets in our sample did not face any change in their competition level (neither entry nor an exit) during the sample period. We use these markets as our control group of markets.

## 4.1 Estimation and results

We seek to identify the change in delivery time offered by the incumbent in response to entry. Our estimation strategy is in the spirit of Goolsbee and Syverson (2008) who examine the impact of Southwest's entry on prices set by incumbent airlines before and after entry takes place. Specifically, we estimate the following:

$$Log(Delivery\_Time)_{it} = \gamma_i + \alpha_t + \sum_{j=-6}^{6} \beta_j Entry_{it+j} + \lambda Trend_{it} + u_i \quad (1)$$

where the dependent variable $Log(Delivery\_Time)_{it}$ is log of the delivery time of Shufersal in locality $i$ on month $t$. $Entry_{it+j}$ are time dummies for the months before and after the month of the

first entry into the local market during the sample period. $\gamma_i$ and $\alpha_t$ are locality fixed effects and month-year fixed effects, respectively. Locality fixed effects account for market characteristics that may have affected entry decisions. Month-year fixed effects account for seasonal and other trends at the national level. $Trend_{it}$ is a specific locality quarter time trend that captures unobserved time trends at the locality level. In some specifications, we also include as control variables the number of online retailers that offer service in the local market. Standard errors are clustered at the locality level to account for within-market correlation in the error term.

The coefficients of interest for determining the impact of entry on incumbents' delivery time are the $\beta_j$. These measure the change in delivery time in the respective month before, during and after entry. In our main analysis, we include dummies for the six month before entry, dummy for the month of entry and dummies for the six month after the entry. The dummy for the sixth month equals one also for the following months. The reported coefficients reflect the relative change in the dependent variable in the dummy period relative to its average value in the excluded period, which is months earlier than the six months before entry. In order to allow for heterogeneous response with regards to the level of demand and the level of competition, we estimate several specifications of equation (1). First, we distinguish between low and high demand weekdays. Second, we consider three samples representing different pre-entry competition levels: (1) monopoly markets; (2) monopolies and duopolies; (3) all other markets. In all these markets Shufersal, the incumbent in our analysis is active both before and after entry.

Figure 7 presents our main event-study analysis for the impact of entry on delivery time. The figure graphs the point estimates and the 95 percent confidence intervals of $\beta_j$ in equation (1) when $j$ runs from -6 (six months before entry) to 6 (six months after entry, $j$=6 equal one also for more than six months after entry). Estimation results are shown separately for low demand weekdays (blue) and for high demand weekdays (red). Sub-figure A reports the results for monopolies markets, sub-figure B reports the results for monopolies and duopolies markets, and sub-figure C reports the results for all markets.

Figure 7 show significant decline of 10% to 20% in Shufersal's delivery time on low damned weekday in the 3 months before a rival enters a monopoly market. The decline in delivery time continues during and after entry, although post-entry we cannot separate the incentive effect from the damned effect. The effect of competition on service quality is still negative in on markets with more online retailers, although the magnitude is smaller and not always statistically significant. Looking at the change in the incumbent's delivery time before and after entry on high demand weekday, we find a much moderate response. In Figure 8 we report the results from a specification that expands the event window out to 12 month before the entry. The results are consistent with our main findings. Our findings highlight the importance of the pre-entry demand and competition

conditions, when evaluating the impact of entry on service quality. In particular, our findings are consistent with Kalai et al. (1992) that theoretically show entry is unlikely to affect delivery time when the marginal costs of of service are high.

# 5 Concluding remarks

Understanding the impact of competition on firms' strategies and consumer welfare is a cornerstone of research in economics, marketing and management. Theoretical and empirical studies predominantly focus on price as the primary means that firms use to cope with rivals. Yet, theoretical models in economics and management has long recognized that in many instances, prices are not the primary rationing mechanism in the market. For instance, often price and service time are jointly determined and both affect consumer demand. Also, recent evidence shows that prices do not vary across local markets as standard models predict. In such cases, firms need to take into account how competition affects quality in general and service time in particular.

In this project, we study the online grocery segment and study how the elapsed time between order and home delivery change with competition and demand conditions. Our setting offers a unique opportunity to contribute to the Literature on the relationship between competition and quality. First, the measure of quality that we use is observed by a consumer at the time of purchase, and it likely has a direct impact on a consumer's decision to purchase at one retailer or another. Second, the measure of quality that we use is determined at the local market level, and we can examine how it varies with the local competition conditions. Third, our study focuses on a period during which the online market is growing rapidly, and in which retailers are expanding their services into the online segment. We exploit this expansion as a shock to the level of competition in local markets. Finally, the prices charged by each chain are identical in all geographical markets that the chain serves, regardless of the level of local competition. This uniform pricing policy makes product quality choices in the online channel particularly important, as quality is a main dimension through which a chain can differentiate itself and/or deter entry.

We find that incumbents improve delivery time shortly before actual entry takes place. Because this improvement in delivery time occurs before the rival firm actually enters, we are able to rule out alternative explanations for this improvement, which are driven by the actual presence of a competitor. The effect of entry on delivery time is considerably larger in more concentrated markets and on weak demand days. Our findings illustrate that costs and capacity concerns are important in affecting firms' delivery times decisions. In future analysis, we intend to show how entry decisions are determined by the opening of new physical stores, and to examine how the incumbent's response varies with the identity of the entrant.

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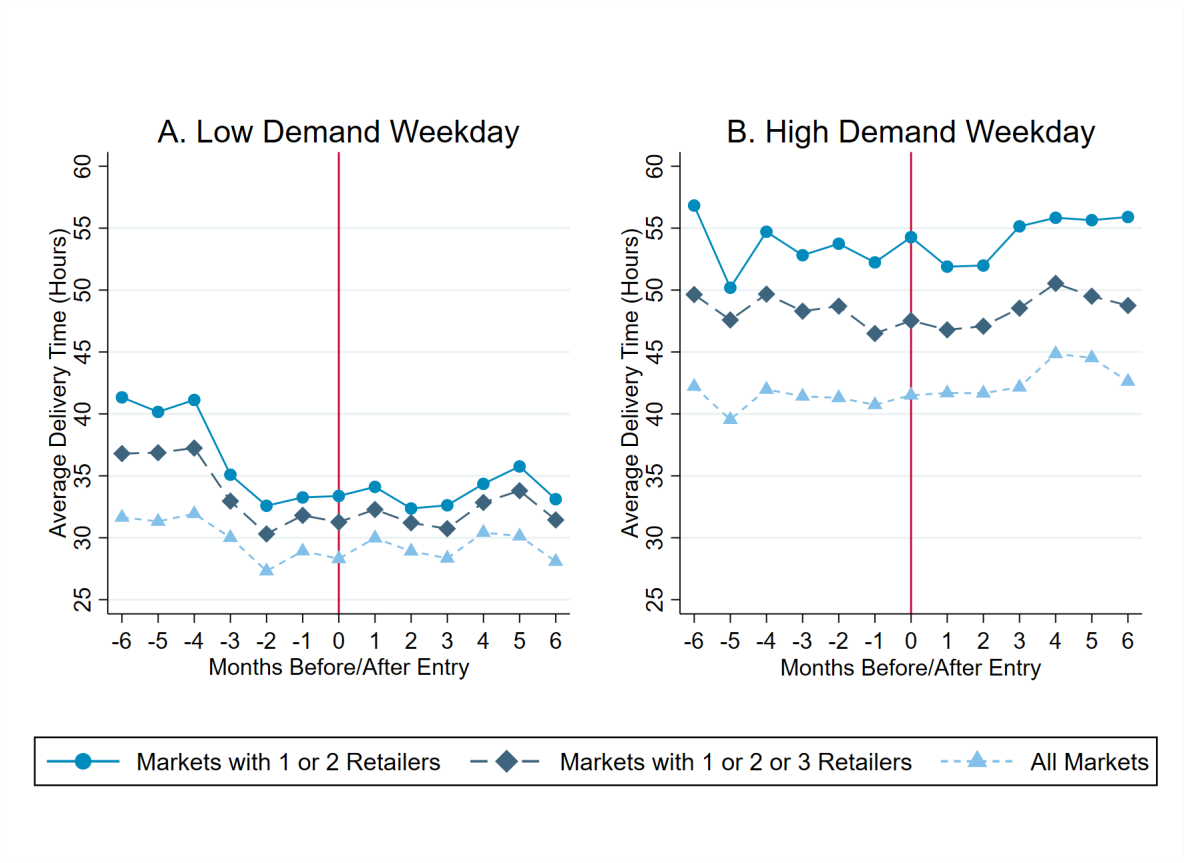
Figure 1: Average Delivery Time by Months Before/After Entry and Market Size

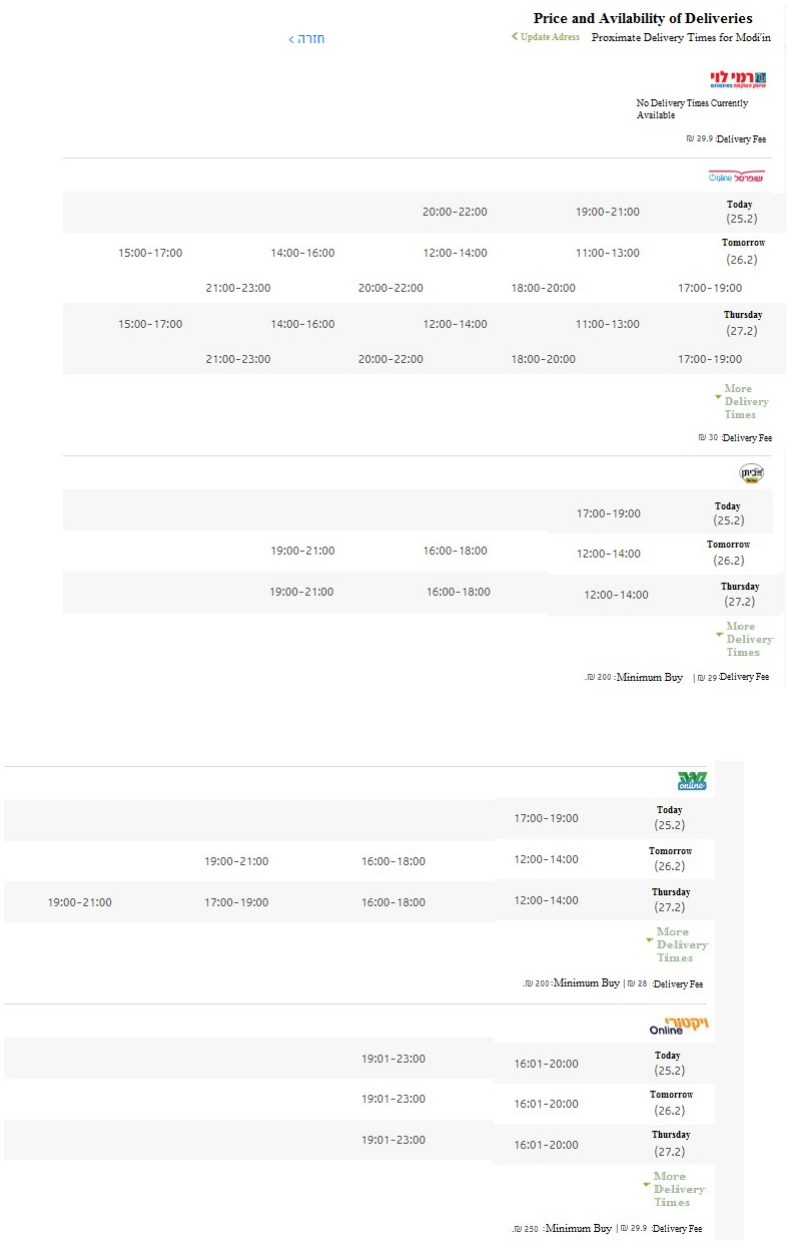



Notes: The figure plots average delivery times by months before and after the first entry of a rival in the sample period (July 2016 - July 2019) separately for low and high demand weekdays and for markets with only one retailer before the entry, markets with one or two retailers before entry and for all markets. As can be observed in the figure, delivery times on low demand weekdays and in markets with more online retailers are considerably shorter. Also, the improvement in delivery times is observed before entry but only on low demand weekdays and on more concentrated markets.

Figure 2: Online Shopping Platform - Basket Price

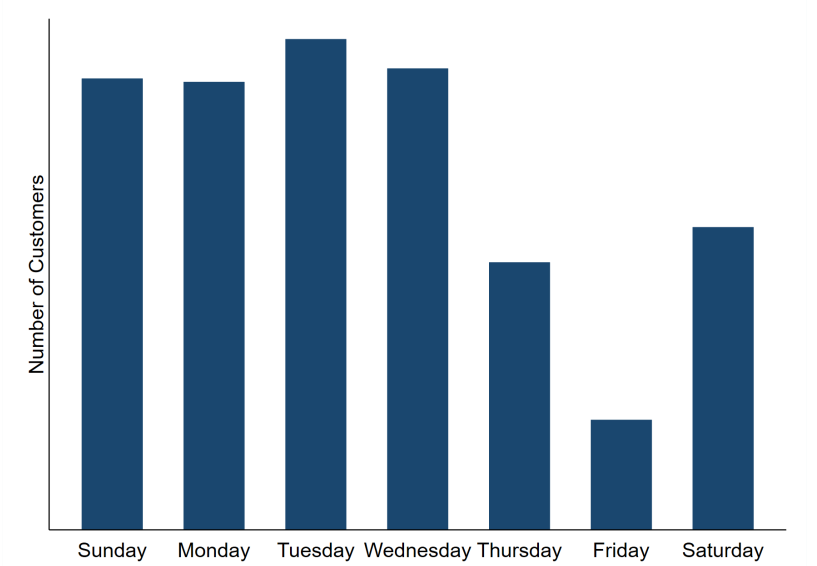

Notes: The figure shows a screenshot from MySupermarket.co.il webpage where consumers observe the respective price by each online retailer and can choose which online retailer they want to order from. Rami Levi, the heavy discount chain offers the cheapest price for this basket (NIS 749.37).

Figure 3: Online Shopping Platform - Delivery Time



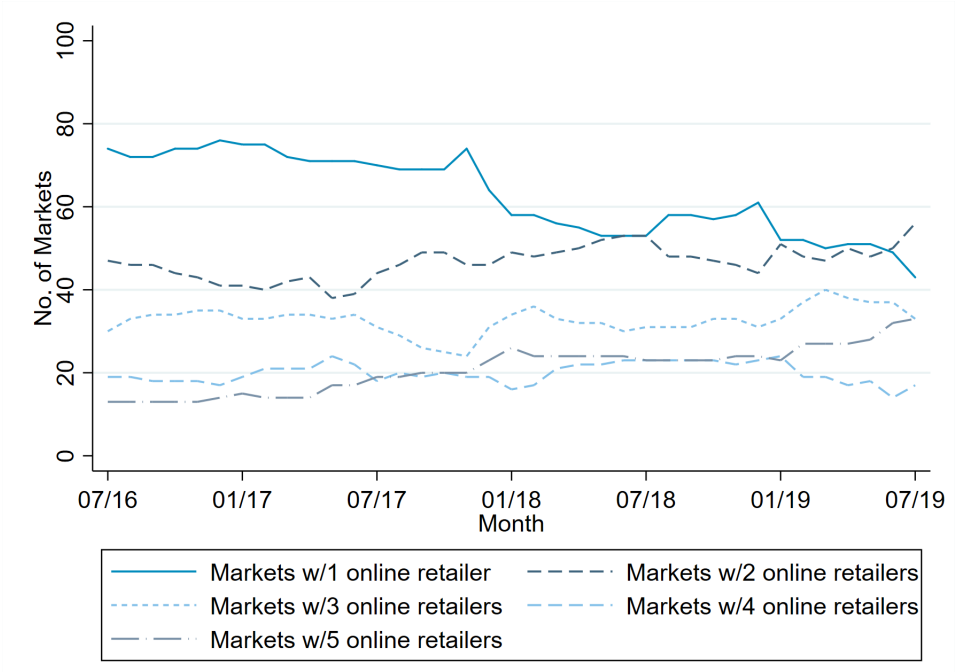

Notes: The figure shows a screenshot from MySupermarket.co.il webpage where consumers observe available delivery times offered by online retailers that offer service to their address.

Figure 4: The Number of Mysupermarket's Consumers in 2019 by Weekday




The figure shows a normalized measure of the number of consumers at an online platform that allows consumers to purchase online at different grocers. The figure illustrates that the number of order during the week (Sunday-Wednesday) is considerably higher than during the weekend. Accordingly, available delivery times when ordering on Wednesday nights are longer than when ordering on Saturday nights.

Figure 5: The Evolution of Market Competition in Local Markets, July 2016 - July 2019

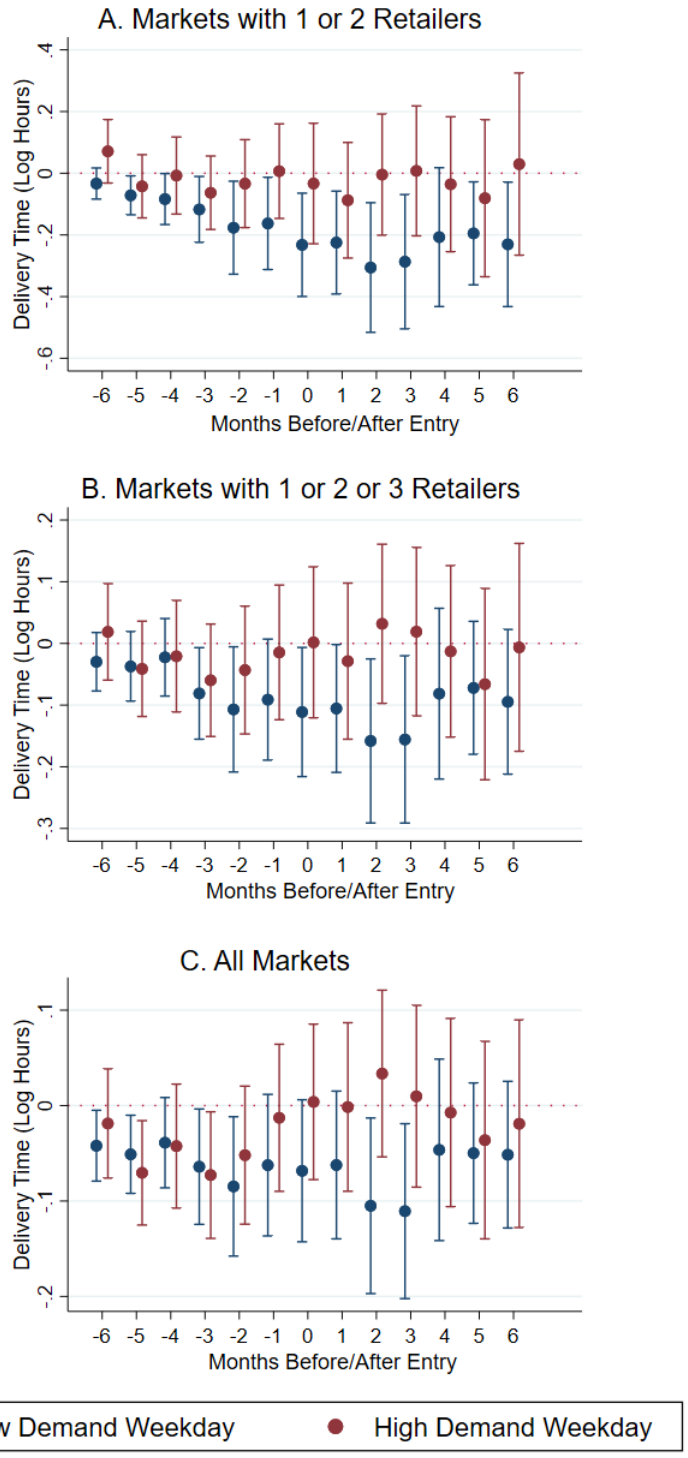



Notes: The figure shows the evolution of the number of markets characterized by the number of active online retailers between July 2016 and June 2019. As can be seen, over the time period, competition intensified, and retailers offer service in many more local markets. For instance, in July 2016, Shufersal was the only online retailer in nearly 80 markets while in June 2019 it was monopoly only in 42 markets.

Figure 6: Average Delivery Time by No. of Active Retailers

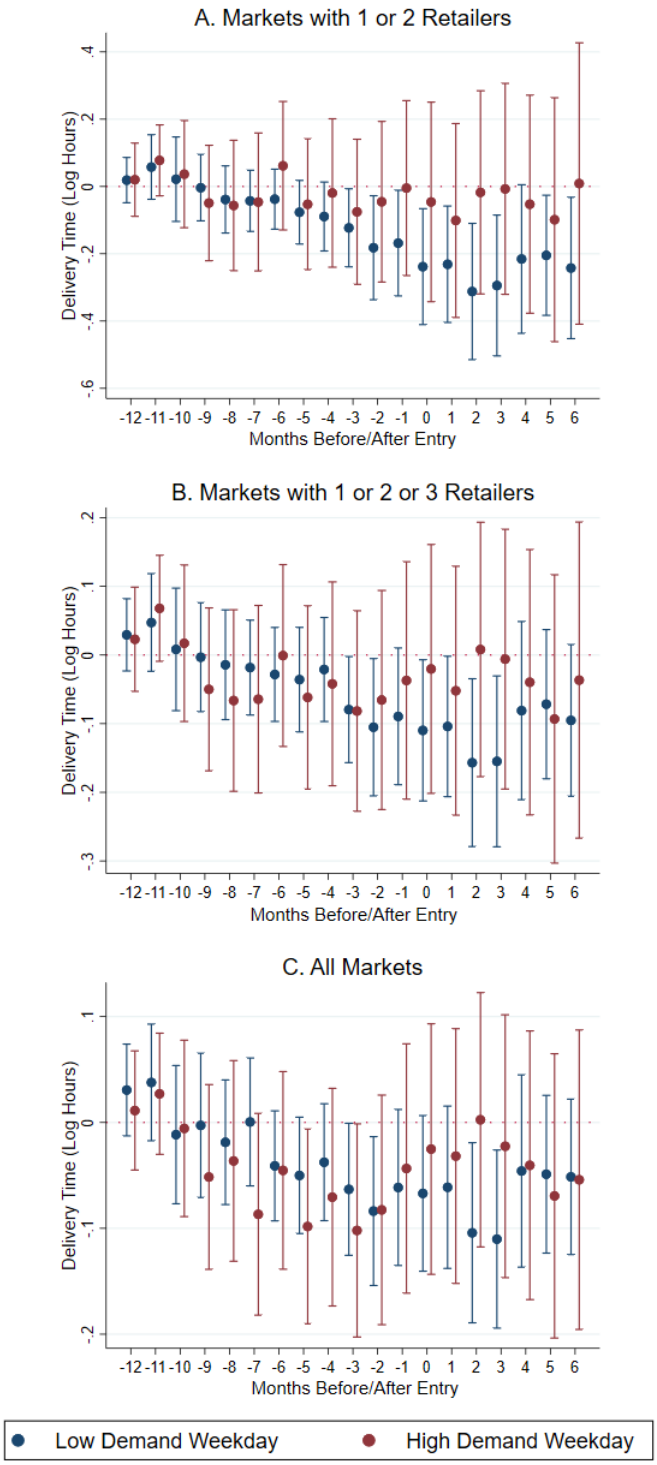

Notes: The figure shows - separately for high and low demand weekdays - the average minimal delivery times for each retailer when it operates in markets served by different number of retailers. The figure suggests that as the number of retailers active in the market increases the delivery times fall significantly. For instance, Shufersal's delivery time falls from 51 (37) hours on monopoly markets to about 27 (21) hours on markets served by 5 online retailers. Delivery times are based on the minimal time between crawling time (on Wednesday and Saturday midnights) and the first available delivery time for each retailer in each market. The mean delivery times for each retailer are calculated based on the entire sample of dates and markets. Note also that in Israel grocery deliveries are unavailable on Friday afternoon and on Saturday. To take this into account, we subtract 30 hours from deliveries scheduled after Saturday.

Figure 7: Entry Effect on Incumbent Delivery Time by Competition and Demand Level




Notes: The figure plots the coefficients $\beta_j$ for $j$ running from -6 to 6 and their 95 percent confidence intervals from a regression of equation (1) for different sub-samples. Estimated results for low damned weekday are in blue and estimated results for high damned weekday are in red. Panel A includes only markets with 1 or 2 retailers, panel B includes only markets with 1 or 2 or 3 retailers and panel C includes all markets. The depended variable is the log delivery time of Shufersal in the local market. The regression also includes locality fixed effects, month fixed effects and specific locality quarter time trend. Standard errors are clustered at the locality level.

Figure 8: Entry Effect on Incumbent Delivery Time by Competition and Demand Level - Extend Pre-Period




Notes: The figure plots the coefficients $\beta_j$ for $j$ running from -12 to 6 and their 95 percent confidence intervals from a regression of equation (1) for different sub-samples. Estimated results for low damned weekday are in blue and estimated results for high damned weekday are in red. Panel A includes only markets with 1 or 2 retailers, panel B includes only markets with 1 or 2 or 3 retailers and panel C includes all markets. The depended variable is the log delivery time of Shufersal in the local market. The regression also includes locality fixed effects, month fixed effects and specific locality quarter time trend. Standard errors are clustered at the locality level.

Table 1: Descriptive Statistics

| | Markets with 1 or 2 Retailers | | Markets with 1 or 2 or 3 Retailers | | All Markets | |
|---|---|---|---|---|---|---|
| | Treatment | Control | Treatment | Control | Treatment | Control |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Population density | 6352 | 4483 | 7331 | 4569 | 8898 | 6833 |
| | (4659) | (3405) | (7082) | (3784) | (7339) | (5871) |
| Population (K) | 29.96 | 26.19 | 41.93 | 25.85 | 52.56 | 53.61 |
| | (21.21) | (16.28) | (99.85) | (15.80) | (95.98) | (89.43) |
| Population age 30-44 (K) | 18.35 | 18.44 | 18.43 | 18.62 | 18.92 | 19.07 |
| | (1.592) | (1.735) | (1.769) | (1.994) | (2.207) | (2.749) |
| Population age 45-59 (K) | 15.60 | 15.24 | 15.88 | 15.53 | 15.98 | 15.74 |
| | (3.325) | (2.821) | (3.253) | (2.730) | (3.159) | (2.569) |
| Average income | 9741 | 10249 | 10093 | 10527 | 10226 | 10852 |
| | (2139) | (1999) | (2297) | (2144) | (2314) | (2205) |
| Apartment per capita | 0.298 | 0.315 | 0.291 | 0.318 | 0.305 | 0.344 |
| | (0.054) | (0.052) | (0.050) | (0.051) | (0.056) | (0.059) |
| Vehicle per capita | 0.407 | 0.332 | 0.383 | 0.342 | 0.375 | 0.365 |
| | (0.606) | (0.060) | (0.480) | (0.071) | (0.394) | (0.089) |
| Socioeconomic index | 6.141 | 6.315 | 6.326 | 6.522 | 6.452 | 6.839 |
| | (1.781) | (1.641) | (1.736) | (1.672) | (1.670) | (1.646) |
| Periphery index | 4.632 | 4.788 | 5.059 | 5.112 | 5.559 | 5.767 |
| | (1.665) | (1.454) | (1.721) | (1.584) | (1.826) | (2.000) |
| Markets | 52 | 38 | 84 | 44 | 127 | 56 |

Notes: The table reports means and standard deviations in parenthesis for local markets' characteristics. Column 1 includes markets where only Shufersal was active at the beginning and a rival entered during the sample period. Column 2 includes markets where only Shufersal was active during the whole sample period or Shufersal and one more rival were active during the whole sample period. Column 3 includes the same markets as in column 1 and markets where Shufersal and one more rival were active at the beginning and a rival entered during the sample period. Column 4 includes the same markets as in column 3 and markets where Shufersal and two more rivals were active during the whole sample period. Column 5 includes all markets faced a rival entry during the sample period. Column 6 includes all markets with a constant number of active firms during the whole sample period. (source: the Israel Central Bureau of Statistics, Localities file, 2017)