



# Spatial monopoly of multi-establishment firms: An empirical study for supermarkets in the Netherlands

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**Abstract.** Multi-establishment firms can create local spatial monopolies in the form of clusters of own establishments without competition. This paper examines the existence of spatial monopolies for Dutch supermarkets in 2009. It is found that 23 percent of consumers can be qualified as being locked-in in a spatial monopoly of a specific supermarket brand.

**JEL classification:** R12, L12, L4

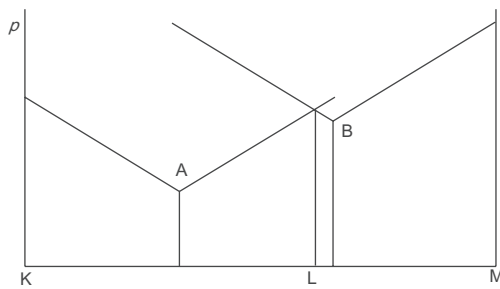
**Key words:** Spatial competition, monopoly

## 1 Introduction

In standard spatial economics, spatial monopoly analysis assumes atomic individual firms. Following for example McCann (2001), a supplier A of a product has spatial monopoly power over its consumers when their extra costs needed to reach a competitor B offering the same product are higher than the extra utility they would get from travelling to and buying the product from B. Figure 1a shows the classic example of the consumer price  $p$  on a line market increasing with distance on top of the 'FOB' price at the doorstep of A and B. For consumers living along KL, product A is cheaper than product B; and for those along LM product B is cheaper, although the FOB price of A is lower than B. How the spatial monopolies are divided depends on the price elasticity. In Figure 1b demand  $q$  is declining with distance and is lower for B due to assumed identical quality and consumer preferences. As a result, the spatial monopolies for A and B are KL and MN, while consumers in the intersection of the two demand areas LM can choose between both products. In two-dimensional space these spatial monopolies will be determined by the demand circles around A and B.

How large these circles are depends on the transport costs relative to the product price and the price elasticities. In this paper we restrict ourselves to a simple retail shopping model assuming that consumers bear the costs of travelling to the retailer and take the product home themselves without extra costs. Then, somebody who wants to buy a 100,000 dollar grand piano will most likely be willing to travel 500 miles, while somebody who only needs a pack of milk

## a. Price and distance



## b. Demand and distance

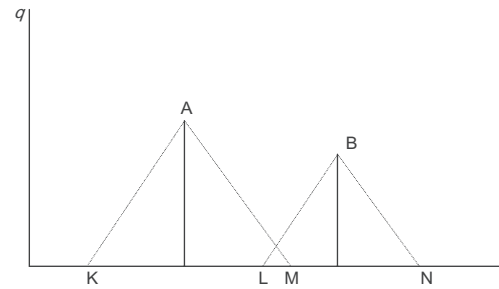


Fig. 1. Spatial monopoly with two suppliers

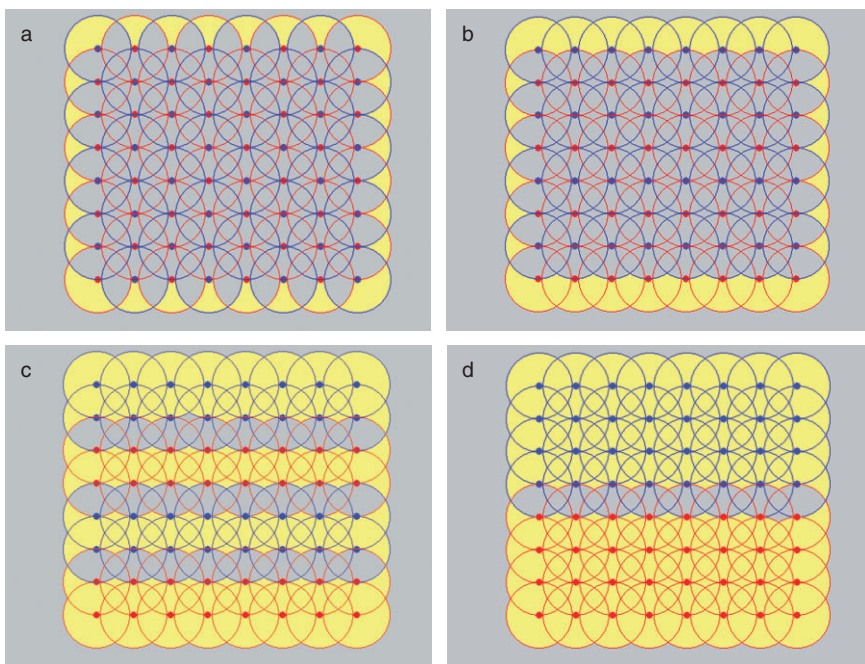


Fig. 2. Spatial monopolies with two multi-establishment firms

will not be willing to spend more than 5 minutes to get it. The elasticities further differentiate these decisions: if that milk is an essential missing part of a Christmas dinner menu you might be willing to spend half an hour drive on getting it.

Very low elasticities would prevent spatial monopolies to exist but they are of course exceptions. In most cases the spatial distribution of the suppliers will be decisive for the freedom of choice of the consumers and its importance increases when goods are purchased over shorter distances.

When A and B are multi-establishment firms, such as for example, two supermarket chains, there are many As and Bs and the question then is: what would be the most likely spatial outcome when both chains maximize their profits? Figure 2a shows an example of maximal spatial competition and minimal spatial monopoly due to the fact that – apart from the edges of the economic space – each consumer is located within the demand circles of both A and B.

Figures 2b–2d show how the spatial monopolies for both chains increase in size when they co-locate their establishments in their own spatial clusters. Market shares remain 50 percent in all four cases but both chains may be able to raise their prices in the lighter marked zones – depending on the price elasticities – without the fear of losing market share to the other.

The question of whether multi-establishment competitors choose to compete ‘head to head’ at the same location or choose to disperse is a first issue. The question of whether chains may be inclined to form their own spatial clusters is yet another one. The theoretical and empirical literature on multi-establishment spatial competition and monopolies is scarce and mainly tries to address the first issue. We agree with Pal and Sarkar (2002) who state that despite its long history from Hotelling onwards “it is surprising how little attention has been paid to study competition among firms who can set up multiple stores” (p. 163). One of the first contributions which incorporates multi-establishment firms comes from Teitz (1968) who showed that a Nash equilibrium does not exist when firms have multiple stores. Some papers following up on this discussion worth mentioning here are Thill (1992, 1997); Chisholm and Norman (2002); Janssen et al. (2005); Aguirregabiria and Vicentini (2006); and Peng and Tabuchi (2005). None of these models, however, allow for the existence of a situation like Figure 2b as a possible equilibrium or even discuss it. The same holds for the more specific literature on supermarket competition (Smith 2004).

The issue is however relevant, in particular for supermarket chains because this market is increasingly being dominated by just a few large brands (Poole et al. 2002b; Burt 2010). Wrigley (2001) illustrates how market expansions of major supermarket chains have boosted policy concern and research on local spatial monopolies in food retailing in the US and the UK. In the UK, a debate started 10 years ago about the dominant position of Tesco in certain regions of the UK and its anti-trust policy is increasingly aware of the possibility of spatial monopolies (EU 1999; Farrel and Morgan 2000). Hughes et al. (2009) discuss in detail the existence of ‘Tesco-Towns’ in the UK and the policy options as proposed in the UK Competition Commission (2000). More recent reports of this commission are critically evaluated in Wrigley et al. (2009). In the Netherlands large take-overs between supermarket chains have recently been subject to antitrust monitoring because spatial monopolies were created in certain regions.<sup>1</sup> In addition in 2009, market leader Albert Heijn was accused of creating spatial monopoly clusters of its own establishments where all establishments of other brands have closed or been taken over.<sup>2</sup>

In this paper we examine empirically whether spatial monopolies as illustrated in Figure 2 exist for supermarket chains in the Netherlands. One way to do this is to approximate local market shares of supermarkets using consumer survey data (Clarke et al. 2010), or using floor space data (Poole et al. 2002a). For the Netherlands these types of datasets are at the moment only available and very expensive on the commercial market and could not be obtained for this paper. What we do have is population for low level postal codes and a database of all Dutch supermarkets with their XY co-ordinates. This enables a second option of measuring spatial monopolies as depicted in Figure 1 directly, so we can make some reasonable assumptions about the willingness to travel. Note from Figure 1b that these two options are conceptually very

<sup>1</sup> The NMA (*Nederlandse Mededingings Autoriteit*) is the Dutch government anti-trust agency that controls and monitors monopoly formation in the Netherlands. It critically reported on large take-overs between supermarket chains in 2006 and 2009. See its English website URL: <http://www.nmanet.nl/engels/home/>.

<sup>2</sup> URL: <http://www.adformatie.nl/nieuws/bericht/klachten-bij-nma-over-monopolie-albert-heijn>; URL: [http://www.spitsnieuws.nl/archives/video/2009/01/breda\\_wordt\\_moe\\_van\\_ah.html](http://www.spitsnieuws.nl/archives/video/2009/01/breda_wordt_moe_van_ah.html).

A customer reaction on one of these links: “In Theresiastraat in The Hague today we find three Albert Heijn stores within less than a kilometer in the same street, really ridiculous. If you also count the Albert Heijn on the Central Station and the one close to that you have five of them in a row. That is nothing else than a monopoly”. Even Albert Heijn itself sometime hesitates for further expansion in certain areas because it fears public accusations of becoming too dominant (Food Magazine, december 2010, URL: <http://www.foodmagazine.nl>).

different. A market share analysis may reveal that both brands A and B may have a 50 percent market share while in fact only the consumers in the small segment LM have a choice between the two.

In our analysis we will not use the highly unrealistic fixed demand circles, because the willingness to travel is different for every consumer depending – among other things – on local geographical settings and the transport modes. Instead we will use a marginal approach. For most people the closest supermarket is the first and most used option. If that one has unsatisfactory supply or too high prices the next establishment of another brand is the second option. The question then becomes how many extra miles or how much time one is willing to spend on going to the next one. These margins can be chosen based on the average distance to the closest supermarket and empirical data on shopping behaviour by travel mode. A spatial monopoly is then defined by the percentage of the population that can not reach a competitor for its closest supermarket within these marginal distances. The results are derived by comparing the spatial spreading of population with all supermarket establishments using a Dutch GIS database for 2009. Section 2 shortly describes the methodology and the datasets used. Section 3 presents the results and Section 4 concludes.

## 2 Method and datasets

According to a recent issue of the *Supermarktgids*<sup>3</sup> the Netherlands had 4,412 supermarket establishments in June 2009. Obviously, not all of them are comparable alternatives. A small local store around the corner may be the perfect place for a missing pack of milk while a larger supermarket further away, may be the best option when getting groceries by car for weekly shopping. We have therefore used four different datasets:

1. all supermarket establishments except those situated in holiday parks (4412);<sup>4</sup>
2. as 1., with more than two cash registers (3,666);
3. as 1., with more than five cash registers including Aldi and Lidl (2,707);
4. as 3., with Aldi and Lidl excluded (1,932).

The threshold of two cash registers basically excludes everything that can be considered as a local store around the corner. Note that this also holds for the more recent phenomenon of large chains opening special small stores like the Albert Heijn ToGo shops. Establishments with more than five cash registers (group 3) are the bigger markets with a full product range. In this group all establishments of the low budget brands Aldi and Lidl are also included, although these two brands do not provide the *Supermarktgids* information about their number of cash registers. According to their own information most Aldi establishments have four and most Lidl establishments have five cash registers, but they usually are close to a larger establishment of a full product range supermarket and could therefore be considered as spatial competitors.

It is, however, questionable whether both low budget brands provide a comparable shopping alternative for the full range product brands like Albert Heijn, C1000, Super de Boer or Jumbo. In many cases they are rather complementary than competitive. Some consumers then buy quality products like fresh vegetables, fish and meat at Albert Heijn and toilet paper at Aldi. Most middle and high income consumers will choose the full range market while lower income groups choose the budget brand. For our purpose this means that the availability of a low budget

<sup>3</sup> *Supermarktgids*. Ondernemers Pers Nederland; URL: <http://www.levensmiddelenkrant.nl/disclaimer>

<sup>4</sup> Establishments on holiday parks are excluded because there guests normally spend most of their time and money inside the park and the local supermarket store is part of the whole consumption package that is offered by the park.

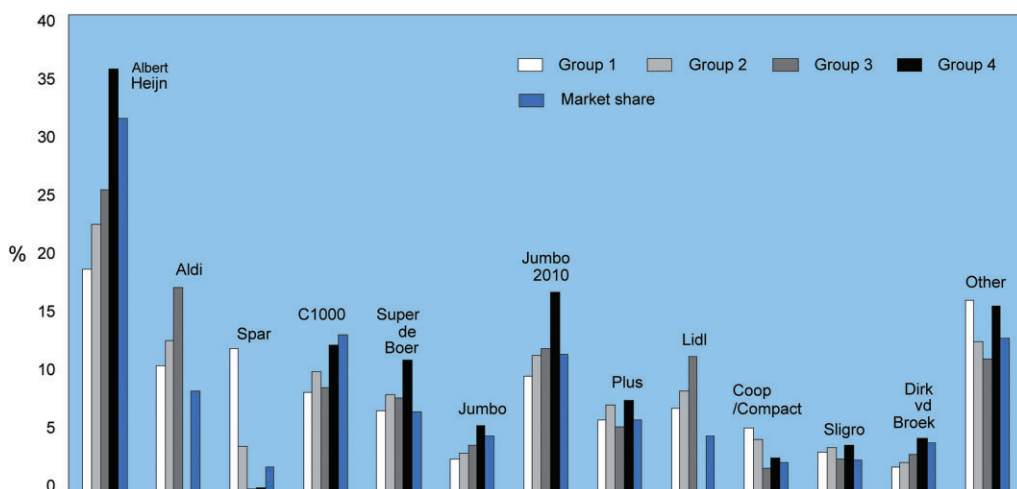


Fig. 3. Share in number of establishments and market share 2009

brand nearby a full range product brand is only a relevant alternative for lower income groups. This is why we have also constructed the more homogenous group 4, which is simply defined as group 3 without all Aldi and Lidl establishments.

The dataset provides brand name, address and number of cash registers for every establishment but not sales. National sales and market share are only known for all establishments together.<sup>5</sup> Figure 3 shows the establishments distribution of the 12 largest brands in each of the four groups and the national market share for 2009. Because of the planned take-over of Super de Boer by Jumbo in 2010 both brands are given separately as well as taken together as 'Jumbo 2010'.

An important brand in group 1 that becomes negligible in groups 2–4 is Spar. Of all 534 Spar Holding establishments, almost 400 do not have more than two cash registers. Market leader Albert Heijn has 19 percent of all establishments, increasing to 22 percent, 25 percent and 36 percent in groups 2, 3 and 4 respectively. In group 4 Jumbo 2010 is the second largest brand with 17 percent share in establishments, followed by C1000 with 12 percent and Plus with 8 percent.

The rightmost bar in Figure 3 represents sales market share. Because Spar has many small establishments its market share is way below its share in the number of establishments in group 1. The same effect shows up for CoopCompact and the group Other. Also both Aldi and Lidl have relatively more establishments than sales but that is partly due to the effect of their low prices. Albert Heijn and C1000 show the mirrored image. Albert Heijn reaches 31 percent market share with only 19 percent of the total number of establishments.

If the establishments were comparable in size, getting a high market share with relatively few establishments in itself can be an indicator of competitive price/quality of supply. However, it can also be an indicator of the opposite: successful spatial monopolies with lack of local competition. In order to investigate this, the establishments of all four groups are mapped with the spatial distribution of population in a GIS dataset. Every supermarket has been given an X-Y co-ordinate based on their address and postal-code. A population raster layer has been created using the map dataset *Wijken en Buurten* 2009 of the Central Bureau of Statistics. A full map of the lowest *Buurten* level for the whole country is too detailed to be readable here so instead, Figure 4 shows a map zoomed in on the Randstad region covering the four largest cities

<sup>5</sup> Source: URL: <http://www.distrifood.nl>





**Fig. 4.** Supermarket establishments and population regions 2009.

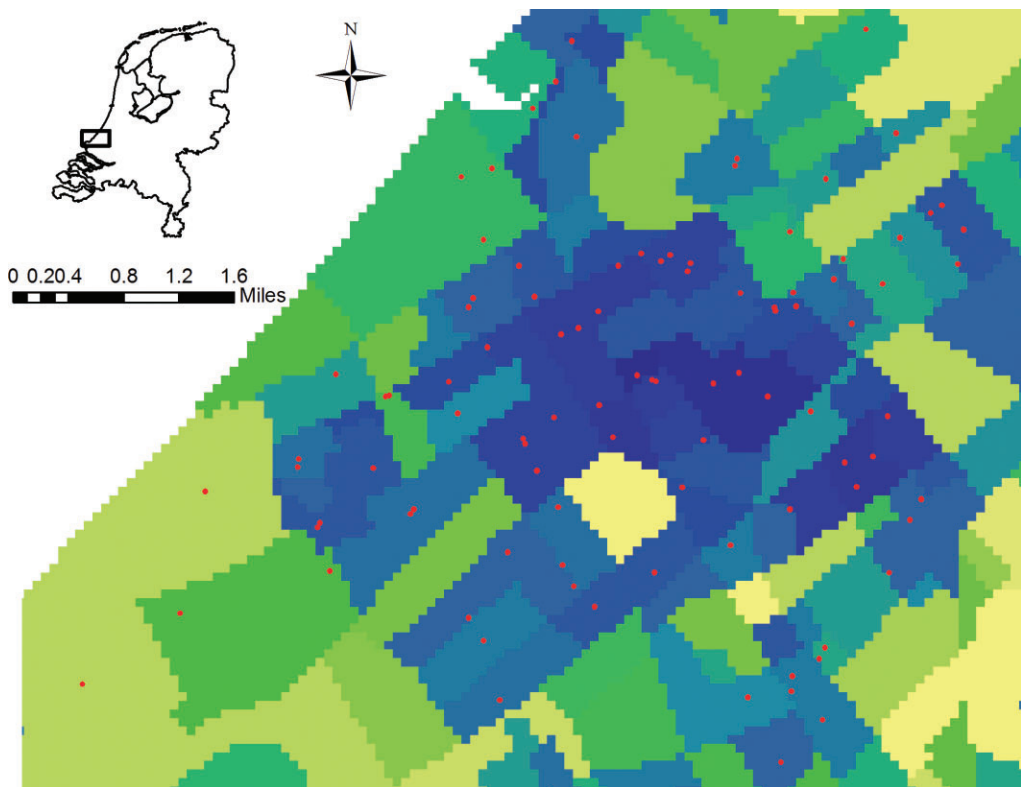
Zoomed in on the Randstad covering the four largest cities Amsterdam, Rotterdam, The Hague and Utrecht

Amsterdam, Rotterdam, The Hague and Utrecht. The data are detailed to a minimum of 50 inhabitants. For regions with a population below this minimum the average population density of the higher *Wijken* level is used as a proxy. Figure 5 further zooms in on the city of The Hague showing how the region map is transformed into a population raster with cells of  $100 \times 100$  metres. We have used the simple assumption that the population is evenly distributed inside each *buurt*.<sup>6</sup>

### 3 Results

When the establishments map and the population raster are combined, the crow-fly distance between every raster cell and every supermarket can be determined. Actual travel time or distance along the infrastructure network is of course preferable but a full network at the required low spatial level was not available for this study and the number of distances required is too high to be obtained from online services like Google Maps. The population-weighted average distance to the closest supermarket turns out to be 725 meters for group 1 and increases to 845, 1135 and 1225 meters for group 2, 3 and 4 respectively.

<sup>6</sup> In the GIS interpolation literature sometimes the so called pycnophylactic interpolation is used, in which population density increases for cells closer to a bordering regions with a higher density. In this case this would lead to an exaggerated suggested accuracy of the population data. See Tobler (1979) or URL: <http://www.ncgia.ucsb.edu/~uwe/pop/pycno.html>



**Fig. 5.** Supermarket establishments and population raster 2009.  
Zoomed in on The Hague and surroundings

Using this information the following indicators are calculated:

1. The percentage of the population for which supermarket  $x$  is the closest establishment.
2. As 1., without another brand within 300 metres further away.
3. As 1., without another brand within 500 metres further away.
4. As 1., without another brand within 1km further away.

The increasing marginal distance needed to find a competitor measures the increasing scale of spatial monopoly. The three distances are chosen assuming that they roughly approximate the maximum marginal time cost consumers are willing to bear for walking, using a bicycle and a car. Given the average distance to the closest supermarket, this means that we assume a maximum search range by car of 1,725 metres for group 1, 1,845 metres for group 2, 2,135 meters for group 3 and 2,225 metres for group 4.

These distances are consistent with de Jong (2001), who found that 90 percent of the customers of the middle-range and large supermarkets in the Netherlands live less than 2.5 km away. More specifically, according to the Dutch annual mobility survey 2007, the average travel distance for all shopping trips by transport mode is 7 km by car, 2 km by bicycle and 900 metres by foot. Given the relative shares by transport modes of 40 percent for car and 30 percent for both bicycle and walking this would amount to a weighed average distance of 3.2 km. Given the

**Table 1.** Share of population situated in a spatial monopoly (percent of total population)

	>300 m	>500 m	>1000 m
group 1	46.4	30.9	14.8
group 2	46.9	31.5	14.8
group 3	48.6	33.1	14.9
group 4	59.7	44.6	23.0

results of de Jong, however, the share of car trips and the average car distance for grocery shopping only will most likely be lower. In addition, the relative transport mode shares for shopping by car are much lower in cities.<sup>7</sup>

Table 1 shows the results for the three spatial monopoly types in each of the four groups. By definition, the share of the population in a spatial monopoly falls when the marginal distance to reach a competitor rises. If all establishments are taken into account without considering their size (group 1) 14.8 percent needs to travel more than 1km extra to reach a competitor of its closest supermarket. Going from group 1 to group 4 the shares go up because the number of establishments to choose from goes down. However, the numbers are almost the same for groups 1 and 2 because most small establishments are in less densely populated areas. The 300m and 500m monopolies rise slightly for group 3 but the 1km monopoly stays about the same, because most Aldi and Lidl establishments in this group are within this distance from the other larger brands. For group 4, which should be considered as the most homogenous one and in which the larger part of household spending is done, the shares go up substantially. If we exclude the low budget brands as a substitute for the larger supermarkets, 23 percent of the population is locked in a 1km spatial monopoly. At the marginal threshold of 500 meters, which still assumes an average shopping distance of 1,725 m (1,225 + 500) this percentage is even as high as 44.6.

Which brands take their highest share in these monopolies? Figures 6a–6d show the population shares for each brand individually. According to Figure 6a, in group 1 Albert Heijn is the closest supermarket for 20 percent of the population, increasing to 36 percent in group 4. The shares of all other brands are much lower. According to Figures 6b–6d, the distribution of the three monopoly types over brands remains roughly the same. Only in the 1km monopoly, the share of Albert Heijn declines somewhat relative to the share of the other brands. This is because the other brands have a stronger position in less urbanized areas where the 1km threshold is more restrictive. The share of Albert Heijn, Jumbo2010, Aldi and Lidl goes up from group 1 to group 4. The share of the other brands goes down from group 2 to group 3, either because they have less larger establishments, or because their establishments are less strategically located relative to their competitors.

Concentrating on the most relevant group 4, Figure 6d shows that 8 percent of the population is locked in a 1km Albert Heijn monopoly, followed by 3.6 percent for C1000, 4 percent for Jumbo2010, 2.1 percent for Plus and 1.6 percent for Sligro. Note that these numbers for all brands add up to the 23 percent mentioned in the last row of Table 1.

These numbers are national aggregates and show a different picture when the analysis is carried out for the ten largest cities. Figure 7 presents the five supermarkets with the highest share in the monopolies for group 4. The four columns correspond with Figures 5a–5d: share as closest supermarket (white), same with a 300m monopoly (light grey), a 500m monopoly (dark grey) and a 1km monopoly (black). In Amsterdam 63.4 percent of the population has Albert Heijn as their closest supermarket of which 40 percent need more than 300m extra to reach a

<sup>7</sup> In the city of Amsterdam 17 percent of all shopping trips are by car, 19 percent by public transport, 23 percent by bicycles and 31 percent by foot. This amounts to an average shopping distance of 1.8 km.



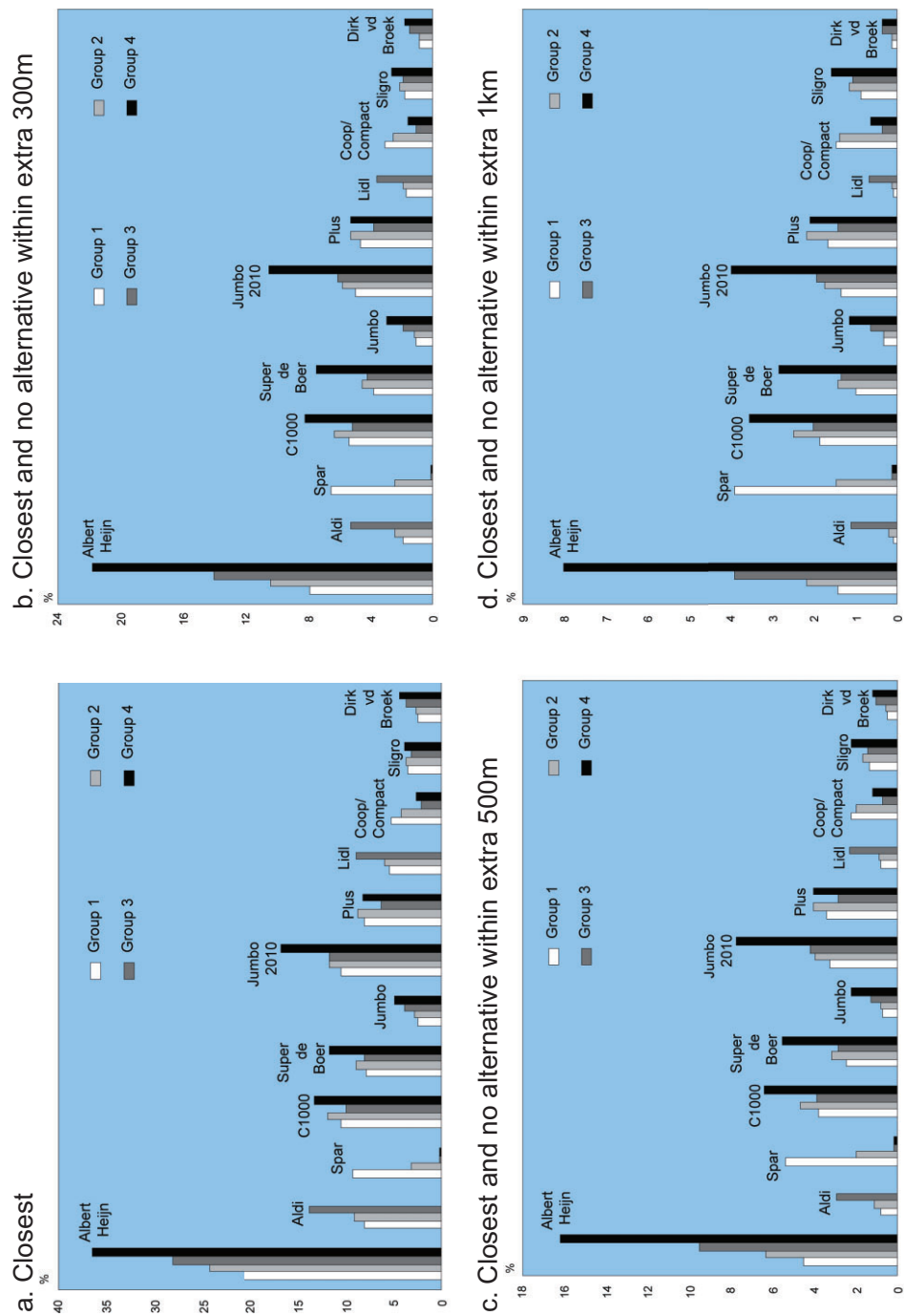


Fig. 6. Population shares of closest supermarkets

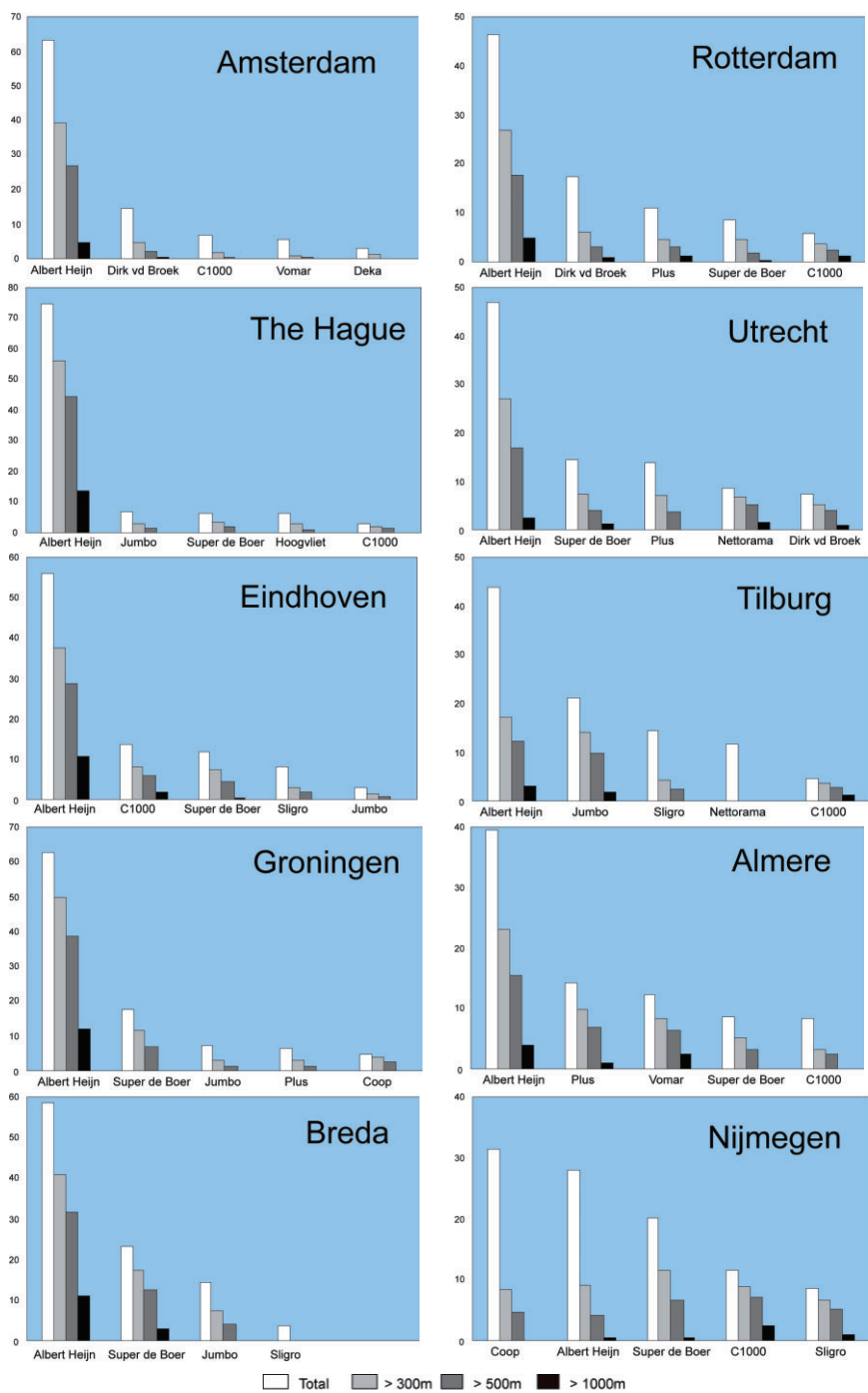


Fig. 7. Population share closest supermarkets for ten cities (group 4)

competitor, 27 percent need 500m and 5 percent need 1km. For most cities there is no clear runner-up in second place. Super de Boer is second in three out of the 10 cities, Jumbo2010 and Dirk van der Broek are each second in two cities.

Of all cities, The Hague has the highest monopoly score: more than 75 percent of the population has Albert Heijn as their closest supermarket, of which more than 40 percent is in a 500m monopoly, and still 14 percent in a 1km monopoly; which is very high in a dense urban area. Nijmegen has the most varying supply: both Albert Heijn and Coop are the closest supermarkets for about 30 percent of the population and the spatial monopolies are negligible.

#### 4 Conclusion and policy options

The most consistent way to measure a spatial monopoly is to compare competitors who offer more or less substitutable products. The larger supermarkets with a broad range of products, defined as group 4 above, can be considered as a group of multi-establishment retail firms who offer the consumer substitutes of more or less equal quality. In addition, a large part of the household budget is spent in these larger supermarkets. A spatial monopoly analysis for this group is therefore not only theoretically defensible but also relevant for a large part of the family budget. From the data for this group it is clear that given an average distance to the closest supermarket of 1.2 km, a marginal distance of 1km to reach a competitor will approach the maximum search range of about 2.5 km for most supermarket consumers. The results show that 23 percent of the population is locked inside this 1km monopoly.

Local or national anti-trust policy discussions on multi-establishment retail are still rare. An exception in the Dutch situation is the rule for national highways; which does not allow two petrol stations of the same brand to be located within 25 km in one direction. If the same type of policy were implemented in the case of supermarkets, a minimum distance of 1km between two establishments of the same brand could be considered. This would have a very strong effect for market leader Albert Heijn because 410 out of its total of 781 establishments now have another one of its own establishments within less than 1km. For Jumbo 2010 this is the case for 44 out of 431 and for C1000 this is just 14 out of 371. Even under a milder policy of a minimum of 500m, Albert Heijn would still have problems with 62 of its establishments because they have another establishment within that range. A very simple rule like this would eliminate most spatial monopolies but a policy discussion on this issue is yet to begin.

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**Resumen.** Las empresas con múltiples establecimientos pueden crear monopolios espaciales locales en forma de conglomerados de sus propios establecimientos sin que haya competencia. Este artículo examina la existencia de monopolios espaciales de supermercados en los Países Bajos en 2009. Se encontró que el 23 por ciento de consumidores pueden clasificarse como cautivos de un monopolio espacial de alguna marca de supermercado específica.

複数の事業所を持つ企業は、競争することなく、自社の拠点クラスターという形で地域における空間的独占を形成することができる。本論文は2009年のオランダのスーパーマーケットによる空間的独占の存在について分析する。分析によれば、消費者の23%が、ある特定のスーパーマーケットの空間的独占に囲い込まれていると見なすことができる。