Det Nationale
Videnscenter for
Cykelfremme

Cyclists and the retail trade

A literature study

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Contents

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1 Summary

Many cities are working to make urban spaces more attractive to cyclists. Sometimes at the expense of accessibility by car. This can lead to a debate about the impact on the retail trade. On the one hand, limited accessibility for motorists can lead to some shoppers going elsewhere and a drop in turnover for retailers. On the other hand, car-free towns and cities can create more peaceful urban spaces, which can lead to a larger customer base and increased turnover for shops. To support the debate, this report provides an overview of existing Danish and international knowledge on the consequences for retailers of measures that make cycling more attractive. A total of 52 studies and analyses were identified in the report.

Key findings are summarised below.

Retailers tend to underestimate the proportion of their customers who arrive by bicycle. Eight international studies compare the expectations of retailers on the proportion of customers who arrive to their shops by bicycle, on foot, by car or other modes of transportation. They all showed that retailers underestimate the proportion of people who cycle. On average, the actual share of people cycling is 4% higher than retailers expect. One study also suggests that retailers' attitudes towards car-free streets change and become more positive as time passes once the street has become car-free.

Cyclists account for a larger share of retail turnover in larger cities. While cyclists in the largest Danish cities account for up to 35% of turnover, in towns like Lyngby and Slagelse (in Denmark) they account for around 10% of turnover. Based on a meta-analysis of a number of studies covering 20 cities in Denmark and abroad, it can be seen that the larger the city, the higher the proportion of people cycling to shops. Across all the studies, motorists spend more per shopping trip than cyclists. In Danish cities, motorists spend between 60% and 120% more than cyclists per shopping trip. International studies show that the entire difference between how much cyclists and motorists spend per shopping trip is due to background factors such as income and age.

Some studies show that traffic-calming measures contribute positively to retail trade, while others show that the measures have a negative impact on retail trade. A number of studies look at the impact of a total of 33 specific traffic-calming measures. None of them have been implemented in Denmark. They typically improve conditions for cyclists and pedestrians and reduce accessibility for motorists to a greater or lesser extent. 15 of them have a clear positive impact on trade, while eight of the measures have a clear negative impact. For the remaining 10 measures, there is no effect or both positive and negative effects. The measures vary e.g., some create more space for cyclists at the expense of parking spaces for cars, while others convert carriageways into cycle tracks. There is no one type of measure that has a clear positive or negative impact on retail trade. Several studies suggest that local conditions are crucial.

Retailers whose customer base mainly shops locally gain from traffic-calming measures. Several studies show that the effects of traffic calming on turnover vary depending on where customers come from. If there are many local customers more retailers will benefit, while the opposite is true for retailers where customers come from further away.

2 Introduction

Improving urban spaces to make cycling more attractive has several spin-off positive effects, such as improved public health, fewer traffic accidents and urban spaces that encourage a range of activities. However, changes to urban spaces can also affect the local retail trade. Poorer accessibility for motorists may result in less retail turnover locally, while better conditions for pedestrians and cyclists can encourage more people to shop locally and increase retail turnover.

There is dispersed knowledge about how traffic-calming measures affect the retail trade. To get a comprehensive overview of knowledge and facts, this report collects and disseminates experiences from Danish and international studies on the subject. The definition of retail trade varies from study to study, and some studies includes not only retail, but also the catering industry such as cafes.

The report focuses especially on the retail trade in cities, including how consumer patterns among local residents change when urban spaces are made more attractive for cyclists. Therefore, studies that focus on cycling tourism are not included. Since better conditions for cyclists often also improve conditions for pedestrians, studies that look at measures to improve conditions for pedestrians are also included.

2.1 Details of the literature study approach and methodology

In the literature review, a systematic search for studies in the field was conducted. This included a search of databases from which relevant published articles were retrieved and a search for unpublished studies such as consultant reports, government documents, municipal evaluations, etc.

In addition to the literature search, Danish and foreign professionals have provided input on relevant studies in the field. In connection with writing the report, a dialogue was held with more than 30 organisations and individuals in Denmark and abroad, including the Danish Cycling Council, the Institute of Transport Economics in Norway (Transportøkonomisk institutt, TØI), Swedish Cycling Cities in Sweden (Svenska Cykelstäder) and the Dutch knowledge centre for cycling policy (CROW-Fietsberaad).

Structure of the report

The results of knowledge gathering divided into the following topics:

- → **Retailers' expectations and actual numbers of people arriving at shops by bicycle.** Some of the scepticism about traffic calming in urban spaces comes from the business community, including retailers. This is partly due to an expectation from retailers that a large part of the customer base arrives by car, which is why car access and parking spaces are highly valued by retailers. This section examines whether retailers' expectations of what modes of transportation their customers use are in line with the facts.
- → **Cycling and consumer patterns**. What percentage of retail turnover are cyclists responsible for? And how do their shopping habits differ from motorists, e.g. in terms of number of trips and purchases per trip? This section provides an overview of the knowledge from existing literature on the shopping habits of cyclists and compares it to the shopping habits of motorists.
- → **Impact studies of traffic calming.** How does it affect retailers when traffic-calming measures are implemented that makes urban spaces easier and safer for cyclists and pedestrians to move around?

This section examines the impact on the retail trade of different types of traffic-calming measures that improve urban spaces for cyclists and pedestrians. It includes both measures that aim to increase accessibility for cyclists without reducing accessibility for motorists (e.g. reprioritising free road space to cycle tracks) and measures that reduce accessibility for motorists without improving conditions for cyclists or pedestrians (e.g. higher parking fees).

Results of the literature search

The literature search identified a total of 52 studies that are relevant for inclusion in this report. In addition, a further 26 studies were identified where the quality was not sufficiently good, or the study did not provide clear enough results to refer to it among the main results of the report. This literature study identified slightly more studies than previous literature reviews, e.g. Visnes, Tønnesen og Tennøy (2015) and Bouwen, Dons og Schoeters (2022).

The studies included in the literature review primarily analyse the relationship between cycling and consumer patterns (19 studies) and the effect of traffic calming (17 studies) and, to a lesser extent, retailer expectations of the proportion of consumers arriving by bicycle (9 studies).

3 Retailer expectations of the proportion of consumers arriving by bicycle

Part of the scepticism about traffic-calming measures comes from the business community, including retailers. Measures, such as eliminating parking spaces in favour of cycle lanes or introducing car-free zones, limit accessibility by car and some retailers are worried about losing part of their customer base.

Therefore, the literature on the relationship between cyclists and retailers often includes studies on what retailers' expectations of their customers' transportation habits are. This literature also explores what customers' actual transportation habits are and how they align with retailers' expectations.

Retailers underestimate how many of their customers arrive by bicycle
Previous literature studies have noted that retailers tend to overestimate how many of their customers arrive by car, see Olimstad og Gjellebæk (2015), and underestimate how many arrive on foot and by bicycle, see O'Connor and more (2011).

In the foreign studies identified in the literature search, retailers expect less than 5% of their customers to arrive at their shop by bicycle, except for one study in Berlin, cf. Figure 1. The actual proportions of customers arriving at shops by bicycle are higher, and in all the studies shown in the figure, retailers underestimate how many people arrive at their shop by bicycle. On average, the actual proportion of people cycling is 4% higher than retailers expect. There is statistical uncertainty in the individual studies. However, that uncertainty is reduced when we look across all the studies. We therefore believe that overall, there is a tendency for retailers to underestimate the proportion of customers who arrive at the shop by bicycle.

In virtually every study identified, retailers also underestimate the proportion of their customers who arrive on foot. In the studies, the proportion of customers who arrive on foot is on average 16% higher than retailers' expectation. Only in one study from New Zealand (Fleming, Turner og Tarjomi (2013)) do retailers overestimate the amount of pedestrians among their customers.

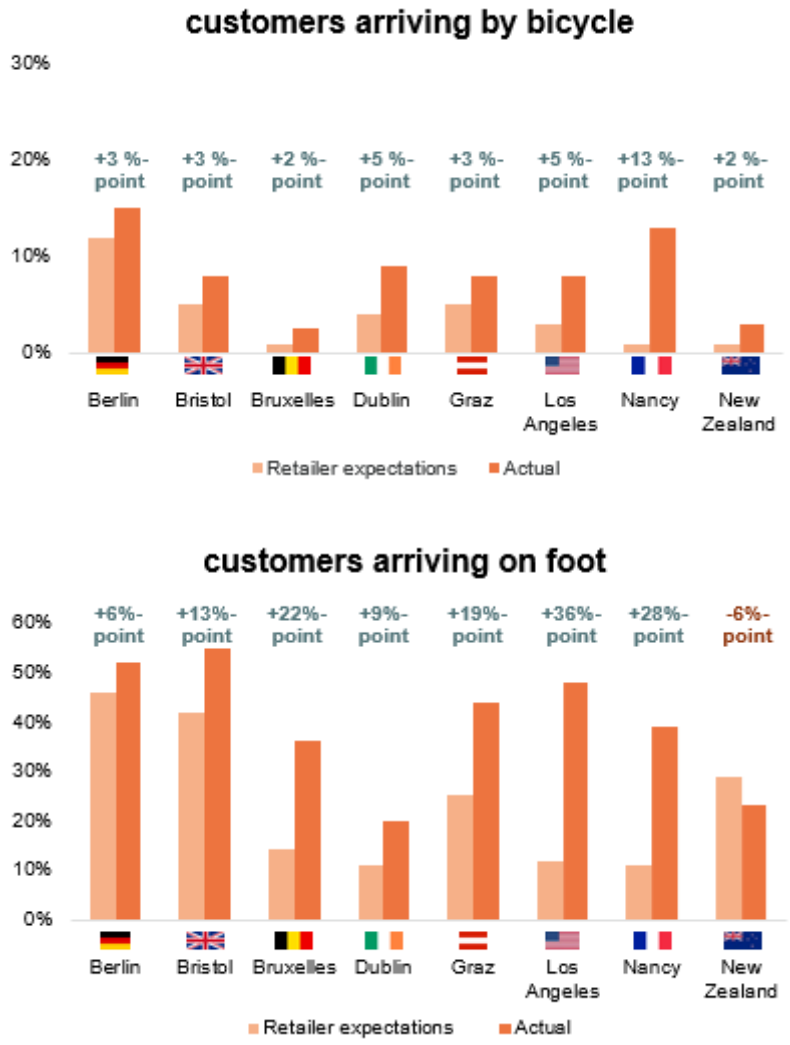
Other studies that do not measure and illustrate the effects in the same way as the studies in Figure 1, have found similar conclusions. For example, De Jong (2012) in a survey conducted on a shopping street in Halifax, Canada, found that one in two retailers expect less than 25% of their customers to arrive by bicycle or on foot. In reality, more than 80% of shoppers arrived on foot (70%) or by bicycle (14%).

Retailers' attitudes adjust positively over time
Trivector (2003) points in an older literature study to the fact that the negative attitude of retailers decreases over time. The results show that their attitudes towards car-free streets change and become more positive as time passes after a street has been made car-free.

Figure 1

Retailers' expectations and actual share of people arriving at shops by bicycle and on foot

The figure shows how much of the total share of trips to shops are made by consumers arriving by bicycle or on foot and what retailers expect.



Source: EY based on von Schneidemesser and Betzien (2021), Sustrans (2006), van Oosteren (2019), O'Connor and more (2011), Sustrans (2003), McCormick (2012), Agence Scalen (2021) and Fleming, Turner and Tarjomi (2013).

4 Cycling and consumer patterns

While some of the literature suggests that retailers may tend to underestimate how many of their customers arrive by bicycle, this does not tell us anything about the role cyclists play in retail turnover and the consumer patterns of cyclists.

This chapter first examines how much of the turnover in retail trade is generated by cyclists. The amount of turnover generated by cyclists depends on two factors:

1. Number of shopping trips by bicycle. That is, how many shopping trips each person uses a bicycle for.
2. Purchases per shopping trip. That is, how much each cyclist spends per trip.

These two conditions are described in the following sections 4.1 and 4.2.[1] Section 4.3 summarises existing knowledge on how cyclist spending is linked to socioeconomic factors. Sections 4.4 and 4.5 explore the characteristics of shopping trips by bicycle and what the main barriers are to people cycling to and from shopping.

4.1 Cyclists and pedestrians account for at least 40% of turnover

The proportion of turnover, cyclists account for in retail turnover, is an indicator of how central a role they play in retail. Overall, the studies identified in the literature search suggest that cyclists and pedestrians play a significant role in retail turnover. This is especially true in larger cities, where cyclists and pedestrians in some cases generate more than half of retail turnover.

Turnover from bicycles and pedestrians
The majority of the studies identified in the literature search show that cyclists and pedestrians account for at least 40% of retail turnover, see Figure 2. For some cities, districts, or streets, more than half of the turnover generated by the retail trade comes from pedestrians or cyclists. For other cities, the proportion is smaller, but still accounts for a good portion of the total turnover.

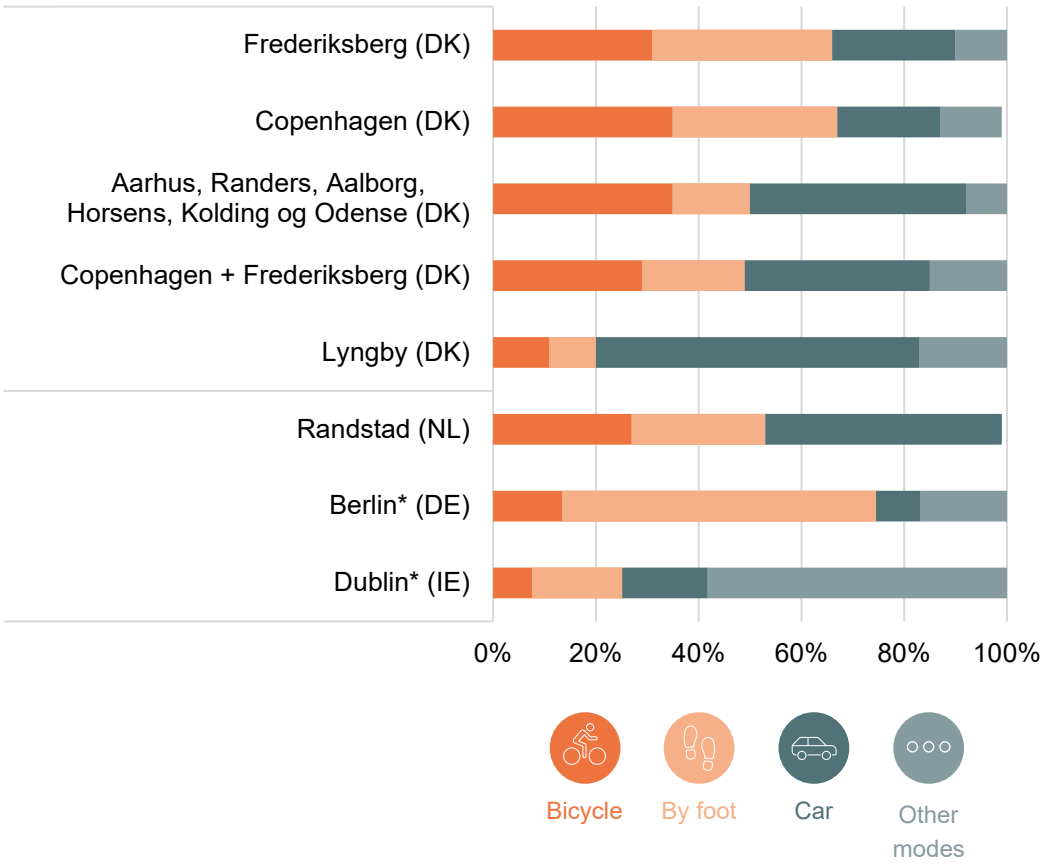
Most of the studies that calculate retail turnover by mode of transport are conducted in Danish cities, but there are also two foreign studies.

In major Danish cities, around 20-35% of turnover comes from shoppers arriving by bicycle. Studies conducted in smaller Danish towns with less than 50,000 inhabitants, such as Lyngby and Slagelse, show that around 10% of turnover comes from cyclists. Studies conducted outside of Denmark show that the proportion of turnover from cyclists is smaller than in Danish cities.

[1] In the studies found, the level of detail in the reporting of the results varies. Some studies only show results for how the number of trips to and from shops are broken down by mode of transport. Others report the average spend per trip broken down by mode of transport. Therefore, it differs which cities and shopping streets are listed in the sections.

Figure 2 **Retail turnover by customers' mode of transport**

The figure shows the estimated share of business turnover from customers arriving by bicycle, on foot, by car or other modes of transport (primarily public transportation).



Source: EY based on Clifton, Muhs, Morrissey, Morrissey, m.fl. (2012), COWI (2015), COWI (2016), COWI (2017), COWI (2018), Incentive (2012), O'Connor m.fl. (2011) and von Schneidemesser og Betzien (2021).
For data points where multiple cities appear, an average has been calculated.
Note: *Only covers a single shopping street.

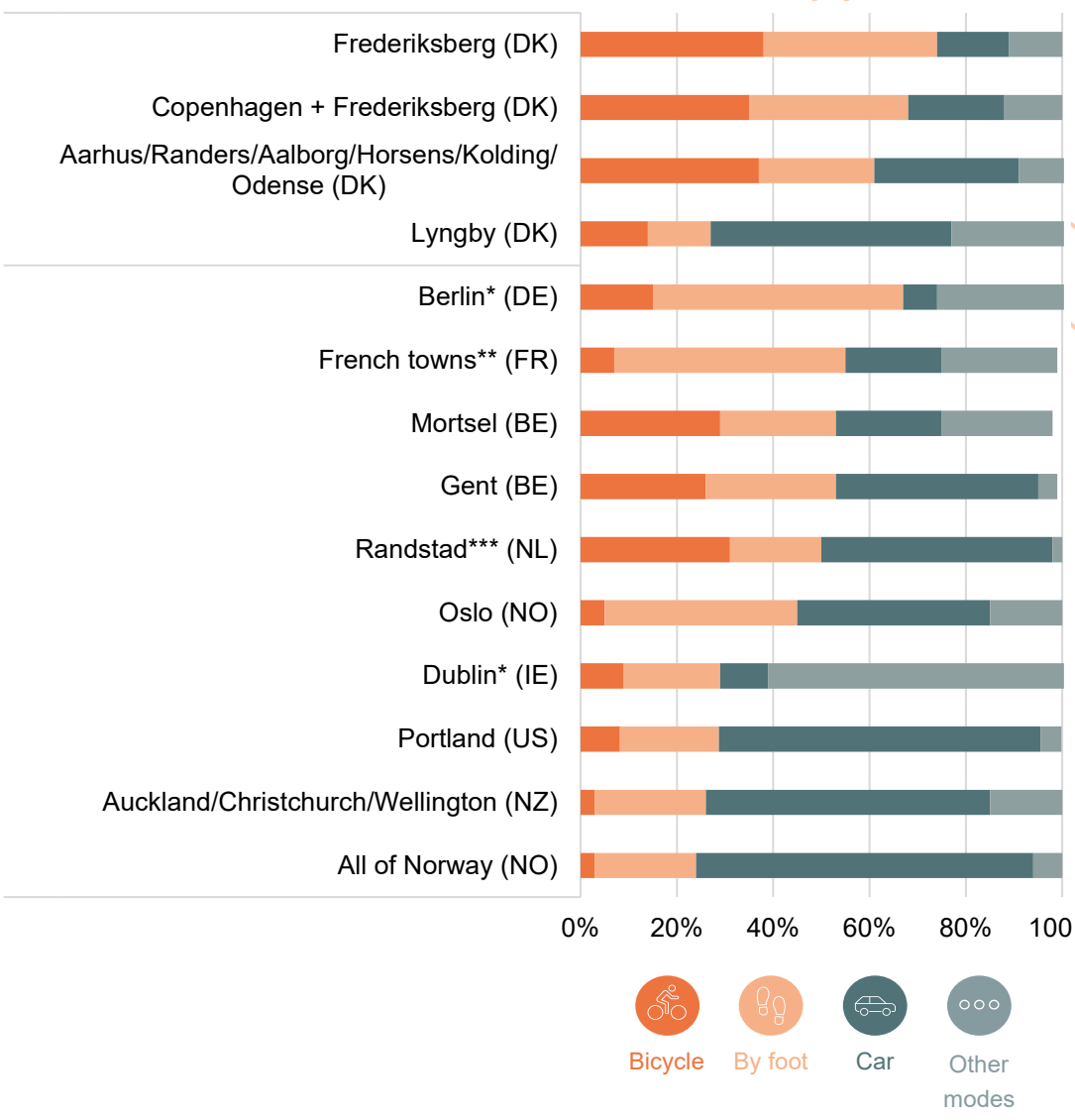
4.2 In about half of the studies, cyclists and pedestrians account for 50% of trips to and from shopping

The majority of the studies found in the literature search show that 40-70% of shopping trips are made by bicycle or on foot, cf. Figure 3. The fact that cyclists and pedestrians account for a significant portion of turnover may be due to the fact that they make many shopping trips. This section summarises how shopping trips are broken down by mode of transport.

Figure 3

Customer shopping trips by mode of transport

The figure shows how many retails customers arrive by bicycle, on foot, by car or by other modes of transport (primarily public transport).



Source: EY based on Clifton, Muhs, Morrissey, Morrissey, m.fl. (2012), COWI (2015), COWI (2016), COWI (2017), COWI (2018), Delaere and Vandommele (2015), Fleming, Turner, og Tarjomi (2013), FUBicy (2004), Incentive (2012), Kennisplatform Verkeer en Vervoer (KpVV) (2013), Mobiliteitsbedrijf (2018), O'Connor m.fl. (2011), Olimstad og Gjellebæk (2015), Sick Nielsen m.fl. (2016) and von Schneidemesser og Betzien (2021). For data points where multiple cities appear, an average has been calculated.
Note: *Only covers a single shopping street.
Note: **Average for Dijon, Grenoble, Lille, Nantes, Salon-de Provence and Strasbourg.
Note: *** Randstad includes Rotterdam, The Hague, Amsterdam, and Utrecht, so the proportions are an average of the four cities.

Studies looking at transportation habits in Denmark, Belgium and the Netherlands generally show that cyclists' share of total trips is higher than in other countries.

When looking at turnover by mode of transport (Figure 2) and shopping trips by mode of transport (Figure 3), it appears that cyclists and pedestrians play a greater role in the retail trade of large cities, such as Copenhagen and Berlin.

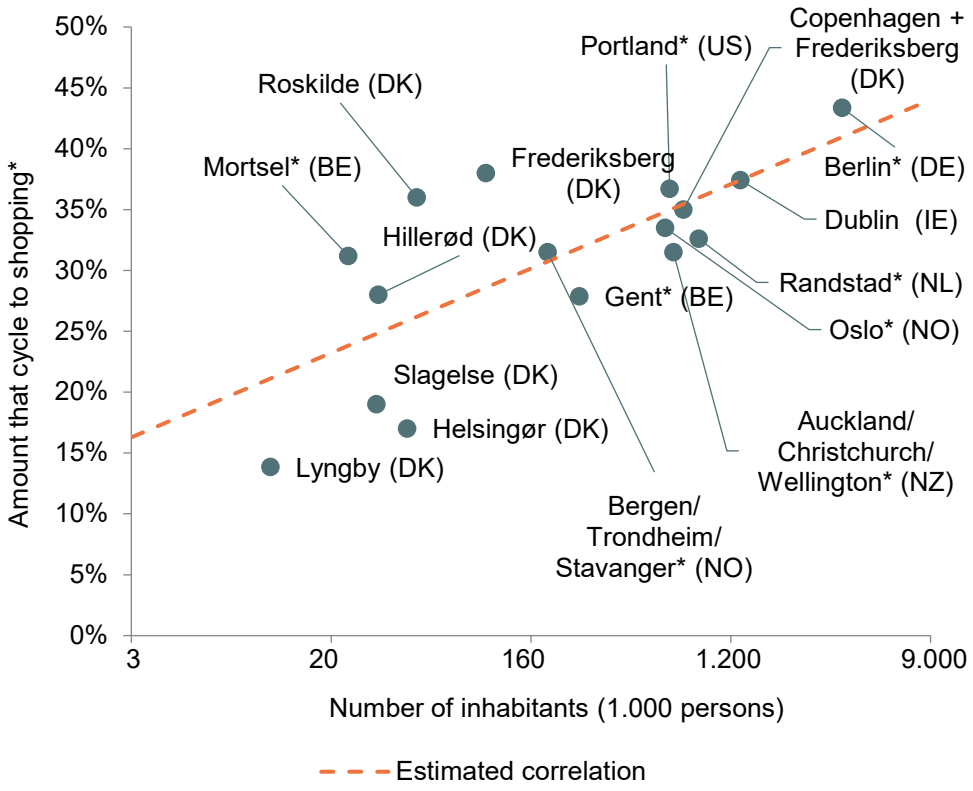
Figure 4 illustrates the correlation between the proportion of shopping trips made by cyclists and the population of cities. The analysis indicates that the larger the city, the greater the proportion of people who cycle when shopping.

Studies that use data at municipality level rather than city level draw similar conclusions. Ibsen and more (2022) finds a positive correlation between the proportion of people who cycle to and from shopping at least one day a week and the population density of Danish municipalities (measured by inhabitants per m^2).

The trend illustrated by Figure 4 also applies to the proportion of pedestrians. There is also a positive correlation between the proportion of people who do their shopping on foot and urban populations.

Figure 4 **The relationship between the size of a city or town and the proportion of people who cycle to shopping**

The figure shows the proportion of shoppers arriving by bicycle* (y-axis, % of total shopping trips) and the size of the city (x-axis, measured in number of inhabitants on a logarithmic scale**). A logarithmic scale is used in the figure to make it easier to compare cities of different sizes in the figure.



Source: EY based on Clifton, Muhs, Morrissey, Morrissey, m.fl. (2012), COWI (2015), COWI (2016), (COWI (2018), Delaere and Vandommele (2015), Fleming, Turner, og Tarjomi (2013), Incentive (2012), Kennisplatform Verkeer en Vervoer (KpVV) (2013), Mobiliteitsbedrijf (2018), O'Connor m.fl. (2011), Olimstad and Gjellebæk (2015), Sick Nielsen m.fl. (2016) and von Schneidemesser og Betzien (2021).
For data points where multiple cities appear, an average has been calculated.
Note: *Cities marked with "*" have been adjusted for country-specific effects. This is done to account for the fact that cities outside Denmark differ from Danish cities on a number of characteristics, such as cycling infrastructure. The correction makes data points for cities outside Denmark comparable to data for Danish cities.
Note: Randstad covers Rotterdam, The Hague, Amsterdam, and Utrecht. The population is an average of all four cities.

Comparing the cities that appear in both Figure 2 and Figure 3, it can also be seen that the proportion of cyclists and pedestrians in the total turnover is smaller than the proportion of cyclists and pedestrians in the total number of shopping trips. For example, over 70% of shopping trips in Frederiksberg are made on foot or by bicycle, while cyclists and pedestrians account for around 65% of turnover. That means cyclists spend less per trip than motorists do.

4.3 Motorists spend more per trip than cyclists

This section summarises the spending of cyclists per shopping trip compared to motorists. This is knowledge that can help shed light on whether cyclists spend less per trip, as the last section indicated.

All the studies identified in the literature search that examine purchases per trip by mode of transport show that cyclists spend less per trip than motorists, cf. Figure 5.

The studies show that on average, motorists spend between 10% and 130% more per trip than cyclists. In Växjö, motorists spend on average 12% more per trip than cyclists, while on selected shopping streets in Copenhagen and Frederiksberg, motorists spend on average more than twice as much per trip as cyclists.

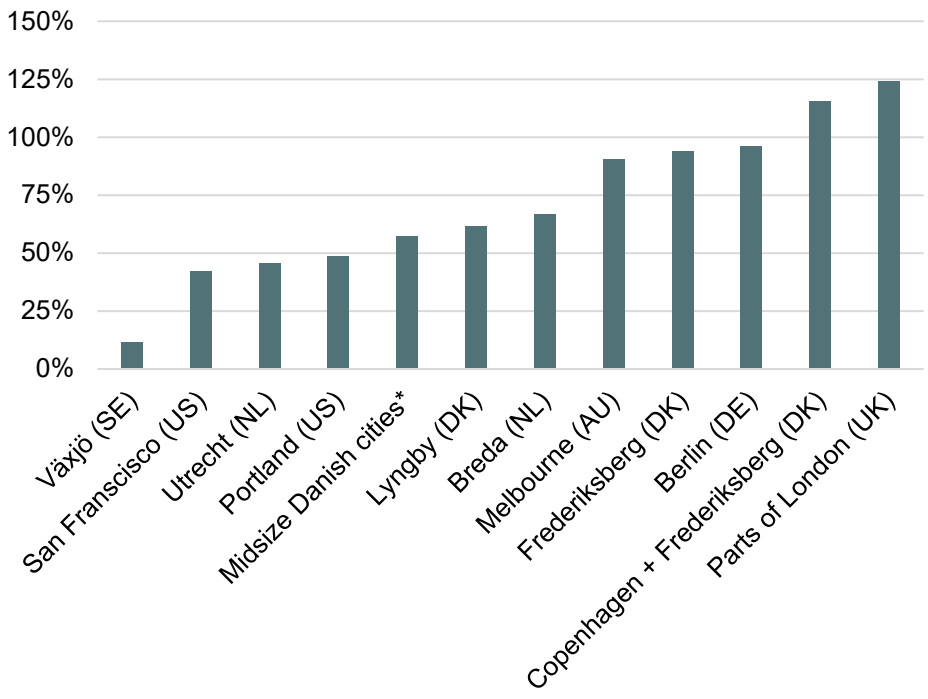
For methodological reasons, Figure 5 does not show the actual spend per shopping trip. The surveys were conducted in different countries and in different years. The price level and currency, in which the data is calculated, are therefore different from study to study, making a comparison misleading. However, below are a few examples to give an idea of spending per shopping trip.

In Frederiksberg, cyclists spend an average of DKK 320 per shopping trip, while a motorist spends an average of DKK 620 per trip (COWI (2018)).

In Melbourne, Australia, a cyclist spends an average of 62 Australian dollars per shopping trip (equivalent to about DKK 300 per shopping trip), while a motorist spends about 118 Australian dollars per shopping trip (equivalent to about DKK 550 per shopping trip), cf. Lee and March (2010).

Figure 5 **The spending of motorists per shopping trip relative to cyclists**

The figure shows how much more motorists spend on average per shopping trip compared to cyclists.



Source: EY based on AB Handelns Utredningsinstitut (2010), Accent (2016), Bent og Singa (2009), Clifton, Muhs, Morrissey, Morrissey, m.fl. (2012), COWI (2015), COWI (2018), Incentive (2012), Krag (2002), Lee og March (2010), Sick Nielsen m.fl. (2016) and von Schneidemesser og Betzien (2021).

The studies also gathered knowledge about how much pedestrians spend on average. Pedestrians generally spend the same per shopping trip as cyclists. In some cities, cyclists spend slightly less per shopping trip than pedestrians, e.g. in Frederiksberg, where cyclists spend DKK 320 per trip, while pedestrians spend DKK 380 per trip, (COWI (2018)). In other cities, cyclists spend more than pedestrians, e.g. in Lyngby, where cyclists spend DKK 551 per shopping trip, while pedestrians spend DKK 487 per shopping trip.

To summarize, cyclists account for a significant portion of retail turnover, make more shopping trips, but on average spend less per trip than motorists.

4.4 The difference in spending per shopping trip is smaller when socioeconomic factors are considered

The fact that cyclists spend less per trip than motorists may be driven by underlying factors. The choice of transport is often dependent on income. For example, the relatively high cost of transportation by car compared to other modes means that car ownership is typically higher among residents and in urban areas with higher incomes. Conversely, Fleming, Turner og Tarjomi (2013) in New Zealand finds that people who live in cities with high-quality public transportation and thus use their cars less, spend less money on transportation and are able to spend a larger portion of their income on shopping.

This section summarises the existing knowledge that examines purchases per trip but checks for differences in socioeconomic factors.

The literature review did not identify any studies in Scandinavia that investigate whether cyclists shop more or less per trip than, e.g., motorists, after factoring in underlying socioeconomic characteristics such as income. Ibsen m.fl. (2022) looks at the extent of trips and finds no statistical correlation between a socioeconomic index (which the authors measure by the proportion of inhabitants on social security, early retirement, etc). and the average proportion who cycle to shopping in Danish municipalities.

International studies controlling for background factors such as income, age, gender, car ownership, etc. show no difference in spending per shopping trip between cyclists and motorists, cf. Popovich og Handy (2014) and Clifton, Muhs, Morrissey, Morrissey, and more (2012).

This therefore indicates that the correlations found in the previous section between spending per trip and mode of transport are partly due to factors such as income and family composition. This also means that if more people switch to shopping by bicycle instead of car, it will not necessarily lead to a decrease in spending per shopping trip, as income is the most important factor behind spending – not the mode of transport.

4.5 On average, people make shorter shopping trips by bicycle than by car

This section summarises the available knowledge from existing studies investigating different characteristics of shopping trips by bicycle. This includes the duration of shopping trips, distance from home, etc.

Time spent shopping and number of shops visited
The duration of shopping trips varies depending on the mode of transport used. Based on Danish data, COWI (2016) prepared surveys of four cities on Zealand in Denmark. The study indicates that cyclists and pedestrians spend less time on shopping trips than motorists. The study also shows that cyclists and pedestrians visit fewer shops than motorists per trip.

Similar patterns are also seen in studies conducted in London, where around 40% of cyclist and pedestrian trips to the shops take less than 30 minutes, while the proportion is just over 20% for motorists, cf. Accent (2016).

Existing literature in Denmark and the UK suggests that cyclists on average take shorter trips than motorists. This indicates that cyclists are more likely to shop locally and make less extensive shopping trips than motorists.

Distance between home and shopping
In general, people shop close to where they live, cf. COWI (2015), COWI (2018) and Sustrans (2006). However, there is some difference depending on which mode of transport shoppers choose for their shopping trip. Danish and international studies indicate that cyclists and pedestrians shop closer to where they live than motorists do, cf. COWI (2015), COWI (2018) and Clifton, Muhs, Morrissey, Morrissey and more (2012).

60-65% of shoppers surveyed (all modes of transport) in a study in Frederiksberg lived within a two-kilometre radius from the point of purchase,[2] cf. COWI (2018). For motorists in cities in Funen/Jutland in Denmark, 79% of respondents lived within a two-kilometre radius from the point of purchase, cf. COWI (2015).

The above suggests that in Denmark, people shop close to where they live – even if they drive.

Types of retail and consumer patterns
Lee og March (2010) finds from Australian data that consumers are more likely to use the car when shopping for groceries, while they are more likely to cycle to cafés and restaurants. Popovich og Handy (2014) suggests that this is due to the fact that trips to restaurants and cafés are not constrained by the need to carry a large amount of goods home. Clifton, Muhs, Morrissey, Morrissey m.fl. (2012) finds a negative correlation between spending per shopping trip in supermarkets, and whether consumers walk or cycle, but does not find a negative correlation for other types of shopping trips (e.g. restaurants, cafés, and supermarkets).

4.6 Distance to shops and poor bicycle parking are barriers to cycling for shopping

There are a number of reasons why people do not use their bicycles to do their shopping and take the car instead.

Existing literature suggests that better bicycle parking options can encourage more people to cycle to the shops. Distance is another reason why people do not cycle to the shops in Denmark.

However, cyclists and motorists also have different attitudes towards bicycle parking. In the Copenhagen questionnaire survey, motorists see bicycle parking as a bigger problem than cyclists do, cf. Incentive (2012).

In some Danish surveys, a certain proportion of motorists indicate that poor bicycle parking conditions may play a role in their choice of transport for shopping. In a survey in Frederiksberg, 30% of motorists and public transport users surveyed believe that it is reasonably, moderately or very likely that better bicycle parking will make them cycle more to the shopping areas in Frederiksberg, cf. COWI (2018). The same trend is seen among motorists in the Incentive (2012) survey conducted in Copenhagen and Frederiksberg. However, this is not a trend seen in smaller Danish towns in Jutland and Funen, cf. COWI (2015).

[2] The point of purchase is the place where the respondent was interviewed.

Cyclists in Copenhagen expressed little satisfaction in the most recent bicycle survey with parking options at shops (35%) compared to other locations, e.g. near their home (76%) and at work (77%), cf. Københavns Kommune (2022).

In surveys across the range of Danish towns and cities, between 25% and 45% of motorists surveyed said that distance was a decisive factor in their decision not to take the bicycle on a given shopping trip, cf. COWI (2015), Incentive (2012) and COWI (2016).

Similarly, the availability of retail shops and the distance to the nearest shop play a role. For example, Skov-Petersen og Sick Nielsen (2014) finds that a higher supply of retail shops within four kilometres is positively associated with more people cycling to shop. In a detailed analysis of Danish municipalities, Ibsen m.fl. (2022) finds that the possibility of grocery shopping close to the home, the safety of being able to move around the area, and the presence of footways and cycle tracks on most busy roads are factors that are positively associated with the proportion of people who cycle to shops.

Foreign studies

Foreign studies have also asked cyclists why they chose cycling as a mode of transport for their trip and asked motorists what it would take for them to cycle to the shops. Outside of Denmark, distance was also the reason why many motorists chose not to cycle, cf. Accent (2016) and Clifton, Muhs, Morrissey, Morrissey and more (2012). Another important explanation is poor cycling infrastructure, cf. Accent (2016).

5 Impact studies of traffic calming

Urban spaces have been modified in several cities to make them more attractive to cyclists – sometimes at the expense of car accessibility. This can have an impact on the retail trade of the streets that have undergone changes. On the one hand, limited accessibility for motorists can lead to the loss of a portion of a shop's customer base and a decrease in turnover. On the other hand, car-free streets can create a calmer urban space, which can lead to more attractive shopping conditions, a larger customer base and higher turnover in shops. This chapter reviews the existing literature that examines the impact of different traffic-calming measures on the retail sector. This covers measures that change conditions for cyclists, pedestrians, and motorists, such as the creation of cycle tracks and reducing the number of parking spaces.

In section 5.1, the chapter begins with an introduction to what determines the effects on the retail trade. Section 5.2 then provides an overview of available knowledge from existing studies in Denmark and abroad. In sections 5.3, 5.4 and 5.5, measures that primarily affect cyclists, pedestrians and motorists respectively, are reviewed.

The effects of traffic calming vary depending on the size of towns and cities and types of businesses affected, among other factors. Finally, section 5.6 reviews studies that examine whether the effects of traffic calming vary by city size, by type of business, and how the effects evolve over time.

This makes it possible to get an overview of what knowledge exists in the field. It can be used when considering the introduction of similar measures. However, the effects can vary greatly, depending on local conditions.

5.1 Improved urban spaces can increase business turnover, while fewer shoppers in cars can reduce turnover

The impact each measure has on the retail trade depends on local conditions. Impact depends particularly on how much the measure affects motorists, cyclists, and pedestrians.

The impact on the retail trade depends on motorist behaviour
When urban spaces are converted for the benefit of cyclists and pedestrians, it usually means that conditions for motorists deteriorate, for example in the form of longer travel times or having to park further away from their destination.

A traffic calming measure can affect the behaviour of shoppers in three scenarios:

Unchanged behaviour.
The motorist will continue to travel in the same way, even though the journey by car has been made more difficult.

Changed modes of transportation.
Motorists shop in the same places as before but switch to other modes of transportation.

Changed location for purchasing.
Motorists drive elsewhere to do their shopping.

As for the first two scenarios, local turnover from (former) motorists remains unchanged. As for the last scenarios, local turnover from motorists is reduced.

The impact on the retail trade depends on how the urban space is improved for cyclists and pedestrians
If the behaviour of non-motorists changes, e.g., if cyclists prioritise shopping on a street that has become more bicycle-friendly, shops in the area can benefit financially. This benefit to shops can help offset the potential loss in turnover they would experience from fewer shoppers using their cars.

If the restructuring of traffic does not improve the urban space for cyclists and pedestrians, but only makes it more inconvenient for shoppers in cars, it is more likely to see a local negative impact on the retail trade. Conversely, it is more likely to see a positive impact on the retail trade if the measure has a limited impact on shoppers in cars and improves the urban space for pedestrians and cyclists.

5.2 Traffic-calming measures can have positive and negative effects on retail shopping

Overall, the studies vary in terms of the effects of traffic-calming measures on shops, with some studies estimating positive effects and others negative. 15 of the 33 measures described in the studies have a clear positive effect on the retail trade, while nine of the measures have a clear negative effect. The remaining nine measures have not had an impact.

Some of the measures are from the same city and are examined in the same study. E.g., seven of the measures deemed to have a positive impact on the retail trade were developed in New York by New York City Department of Transportation (2012) and New York City Department of Transportation (2013). One of the measures implemented in New York is having a negative effect.

Measures that benefit cyclists and pedestrians will often also affect the conditions for shoppers in cars, albeit to varying degrees.

Measures are categorised as "no effect" and "positive effect" if there are multiple results pointing in different directions, or if a result is on the borderline between being, e.g., no effect and positive effect.

The studies measure the effects on retailers differently. Overall, three different ways of measurement are used (also known as impact measurement):

- **Turnover.** Usually total turnover or per shop.
- **Number of customers/visitors**. E.g., the number of people passing through a shopping street over a given period of time.
- **Number of shops**. This can be measured both in terms of the number of shops on a street/area/neighbourhood and as a share of vacant retail space on a street.

5.3 Effect of measures that primarily benefit cyclists

Some measures that improve conditions for cyclists have a positive effect on shops, while others have no effect or have a negative impact on shops.

Some studies estimate relatively large gains for shops, e.g. New York City Department of Transportation (2013), which shows gains of 10-45% in retail turnover after improved conditions for cyclists were introduced in New York. Conversely, there are also some studies, such as Poirier (2018) of Columbus Street in San Francisco, which find that shops experience a decrease in turnover after providing better conditions for cyclists. It is not clear whether conditions for motorists have worsened.

The effect of the measures, e.g. whether cycle tracks are established by removing parking spaces or by reducing the number of carriageways, also varies between studies. In Barcelona, Escobar (2018) finds that the dismantle of parking spaces in favour of cycle tracks has a negative effect on local shops, as the number of shops decreases on one street but increases on another where a carriageway has been converted to a cycle track. Rowe (2013) in Seattle reaches the opposite conclusion, as the conversion from parking spaces to cycle tracks on Greenwood Avenue leads to an increase in turnover per shop, while there is no effect for Latona, where a carriageway was converted to a cycle track.

The results indicate that reprioritising street space for cyclists over motorists has different local effects but does not necessarily lead to a loss in turnover for local shops.

The differences of the effects indicate that local conditions are particularly important for how bicycle-friendly measures affect nearby shops. This shows that there are local conditions that must be taken into account before introducing a bicycle-friendly measure, and that the involvement of local players is particularly important, which has also been pointed out in previous studies conducted in Scandinavia, cf. Tennøy, Tønnesen og Øksenholt (2015) and Kaijser (2020).

Below is more detailed information about the studies, including the differences in impact measurement.

Table 1 **Overview of studies that have investigated the effect of measures to make urban spaces more bicycle-friendly**

City	Name of street/neigh-bourhood	Neighbour-hood or street	Key figures (impact measurement)	Impact	Control group	What the cycle track replaced?	Source
Barcelona	Carrer de Provença	Street	Number of shops	9%	Yes	Parking spaces	1
Barcelona	Carrer de Londres	Street	Number of shops	-16%	Yes	Carriageway	1
Calgary	Calgary	City	Turnover per customer per month	No effect/ negative	No	Parking spaces	2
Los Angeles	York Boulevard	Street	Turnover	No effect	Partial	Carriageway	3
San Francisco	Valencia Street	Street	Turnover per shop	2%	Yes	Carriageway	4
San Francisco	Columbus Avenue	Street	Turnover per shop	-15%	Yes	Partial carriageway**	4
San Francisco	Polk Street	Street	Turnover per shop	-6%	Yes	Partial carriageway**	4
Seattle	Greenwood	Street	Turnover per shop	No effect	Yes	Carriageway	5
Seattle	Latona & 65th	Street	Turnover per shop	400%	Yes	Parking spaces	5
Toronto	Bloor St.	Street	Turnover per customer per month	No effect/ positive	Yes	Parking spaces	6
Vancouver	Hornby St.	Street	Turnover	-4%	Yes	Parking spaces	7
Vancouver	Dunsmuir St.	Street	Turnover	-10%	Yes	Parking spaces	7
New York*	8th and 9th Avenue	Street	Turnover	46%	Yes	Carriageway	8
New York*	Vanderbilt Avenue	Street	Turnover	10%	Yes	Carriageway	9
New York*	Columbus Avenue	Street	Turnover	9%	Yes	Partial carriageway**	9
New York*	9th Avenue	Street	Turnover	23%	Yes	Carriageway	9
Trondheim*	Olav T. Gate	Street	Turnover	No effect/ negative	No	Carriageway	10

Source:

Note: *Includes improved conditions for pedestrians.
Note: **Partial carriageway means that a cycle track has not been built, but that an area has been marked that is prioritised for cyclists and where cars are allowed to drive.

Case 1

Effect of converting parking spaces to cycle tracks on a shopping street in Toronto

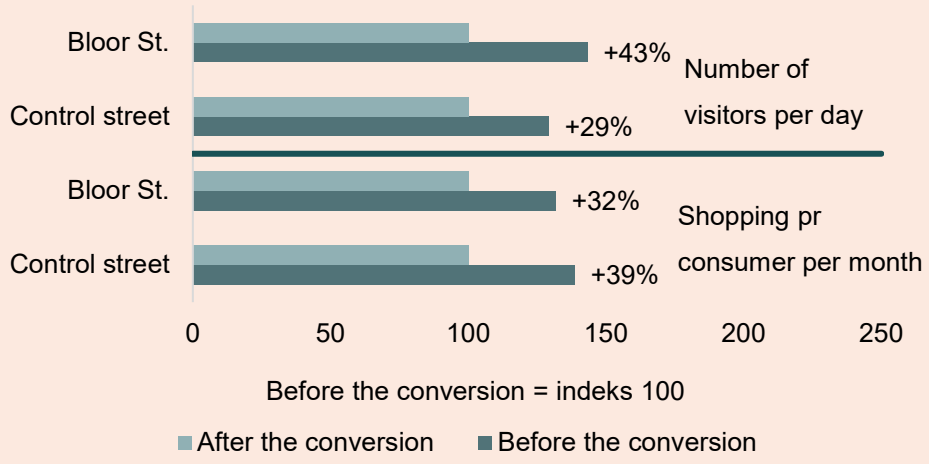
An example of a high-quality study is Arancibia et al. (2019), in part because the study accounts for local economic effects by including a control street.

Arancibia m.fl. (2019) examines the impact on turnover on retail trade of converting 136 parking spaces to cycle tracks on Bloor Street in Toronto in 2016. The development of key performance indicators among shoppers on Bloor Street was compared with similar indicators for a similar street[3] (control street), which did not undergo conversion.

Overall, the study found that the conversion from parking spaces to cycle tracks had no negative impact on local retail trade.

There was an increase in purchases per customer for both streets, although the increase was slightly higher on the control street (39% vs. 32%). Similarly, the number of customers on Bloor Street and the control street increased, but the number of customers per day on Bloor Street increased more than on the control street (43% vs. 29%).

This indicates that the turnover in the shops on Bloor Street increased at least as much as the turnover in the shops on the control street.



[3] Measured by the mix of retailers, among other things.

Studies that have partially investigated the effects of better cycling conditions on retail trade
The literature search also identified studies that only partially investigated the effects of better cycling conditions on local retail trade. Characteristic of these studies is that they have not measured the effect of the measures in a way that allows any conclusion as to what the effects were on retailers.

For example, Kumar og Ross (2006), which, after a traffic calming measure was implemented in Bangkok, asked affected shops whether their turnover had increased, remained the same or decreased as a result. 47% responded that they had experienced an increase in turnover, while 18% said that turnover had decreased because of traffic calming. The rest reported that turnover was unchanged. Overall, it is difficult to deduce whether the overall effect is positive or negative. Of the 18% who have experienced a decrease in turnover because of traffic calming, it is not clear how much of a decrease. If the decrease in turnover for the retailers that are negatively impacted is large, it could mean, e.g., that the overall effect on turnover for all companies is also negative.

These types of studies are not included in the main analysis, but the studies and their main results are reported and included in the list of references as they are interesting despite their results and conclusions being unclear.

Case 2 **The effect of a new mobility plan for Ghent**

The study by Mobiliteitsbedrijf (2018) is described below. This is an example of a European study that covers a larger area than e.g. Arancibia m.fl. (2019), which only looks at a single street. It is also an example of a study where it is not clear from the evaluation what the effects of the cycling promotion measures are for the retail trade.

In 2016, the city council of the Belgian city of Ghent approved a mobility plan. For cyclists, the mobility plan included creation of several cycle tracks in Ghent and making it safer for cyclists to cross central street corners. The changes took place in the first half of 2017.

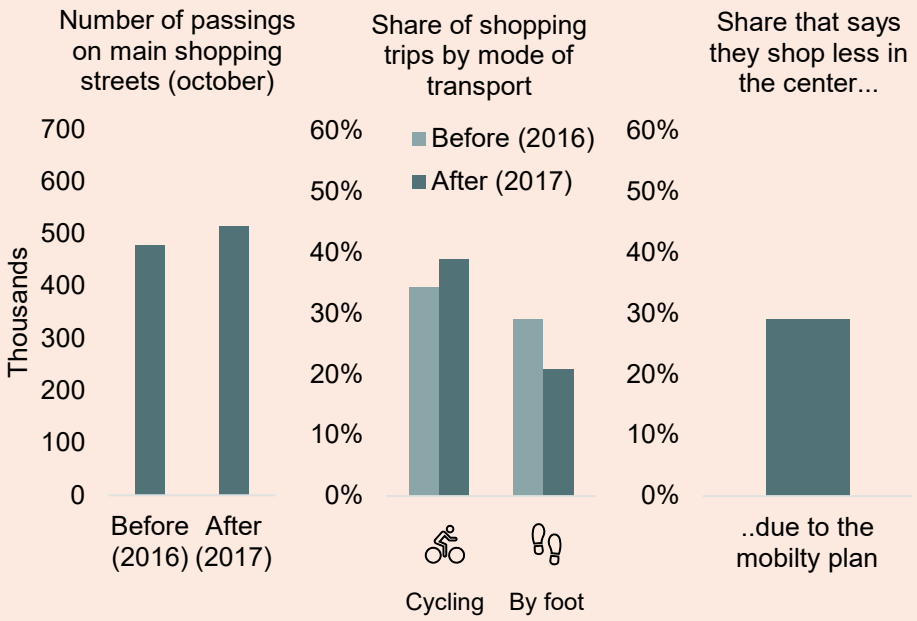
Subsequently, the mobility plan was evaluated.

Overall, it is difficult to conclude from the evaluation whether the mobility plan had a negative or positive impact on the retail trade in the centre of Ghent.

The number of passers-by on the two main shopping streets increased the year after the mobility plan was implemented, cf. the figure below. There is no evidence to suggest that the retail trade on these streets has been negatively affected by making it harder for motorists to get into the city centre.

It was also found that a larger share of shopping in the centre of Ghent is done by shoppers arriving by bicycle and less by car.

However, almost one in three of the surveyed citizens in Ghent say that they shop less in the city centre as a result of the mobility plan. It should also be noted that the evaluation was conducted immediately after the mobility plan was implemented. The effects may therefore be different in the longer term.



5.4 Effect of measures that primarily benefit pedestrians

Many of the measures that improve conditions for cyclists also improve conditions for pedestrians. Several of the measures in New York that ensure better conditions for cyclists also improve conditions for pedestrians, e.g. by transforming parts of the streets into squares and installing benches (New York City Department of Transportation (2013)). However, there are also some studies that focus primarily on the effects of improved pedestrian conditions.

As with measures that improve conditions for cyclists, measures that primarily benefit pedestrians can have both positive and negative effects on shops.

Some studies find indications that retail trade improves, such as Carmona m.fl. (2018), which estimates that the proportion of retail space vacant in Bromley and Clapham decreased after traffic-calming measures were implemented. Conversely, there are also some studies, such as Goudappel, Decisio og Meet4research (2022) of Wagenstraat in The Hague, which show that the number of shops decreased after better pedestrian conditions were implemented.

Below is more detailed information about the studies, including the differences in impact measurement.

Table 2 Overview of studies that have investigated the impact of measures to make urban spaces more pedestrian-friendly

City	Name of street/neigh-bourhood	Neigh-bourhood or street	Key figures (impact measurement)	Impact	Control group	What replaces pedestrian facilities?	Source
Bromley	Bromley	Neigh-bourhood	Vacant premises	Positive	Yes	Unclear	1
Clapham	Clapham	Neigh-bourhood	Vacant premises	Positive	Yes	Narrower carriageways	1
The Hague	Stationsweg	Street	Number of shops***	2%	No	Parking spaces	2
The Hague	Wagenstraat	Street	Number of shops	-26%	No	Reprioritising existing walkway	2
Hornchurch	Hornchurch	Neigh-bourhood	Vacant premises	Positive	Yes	Lower speed limit	1
Madrid	Madrid city centre	Neigh-bourhood	Turnover	6%	Partial	Car-free zone	3
New York	Pearl Street	Street	Turnover	150%	Partial	Narrower carriageway	4
New York	Nicholas Avenue/ Amsterdam Avenue	Street	Turnover	41%	Partial	Car-free zone	5
New York	Bronx Hub	Street	Turnover	Negative	Partial	Parking spaces	5
New York	Willoughby Plaza		Turnover	39%	Partial	More friendly urban space**	5
Walworth	Walworth	Neigh-bourhood	Vacant premises	No effect	Yes	Parking spaces	1
Woolwich	Woolwich	Neigh-bourhood	Vacant premises	No effect	Yes	Partial carriageway***	1
Mortsel*	Mortsel	Neigh-bourhood	Vacant premises	No effect	No	Lower speed limit	6

Source: [1]Carmona m.fl. (2018), [2]Goudappel, Decisio, og Meet4research (2022), [3] (Madrid City Council 2019), [4]New York City Department of Transportation (2012), [5]New York City Department of Transportation (2013) and [6]Sem og Floriaan (2015).
Note: *Includes improved conditions for cyclists and impaired conditions for shoppers in cars.
Note: **Improved pedestrian crossings, greener and friendlier spaces.
Note: ***Partial carriageway means that a cycle track has not been built, but that an area has been marked that is prioritised for cyclists and where cars are allowed to drive.

Older studies show positive effects of measures that improve pedestrian conditions
The literature review includes only recent studies, i.e. primarily studies published post 2000.

However, there have also been previous studies on traffic-calming measures that benefit pedestrians. For example, in a literature study, Whitehead, Simmonds, og Preston (2006) collected an overview of studies that were primarily conducted before 2000.

The literature study looks at the improved conditions of general traffic calming of urban spaces (limited through traffic for motorists) and improvements to urban spaces in the form of pedestrian streets, benches, and squares, etc. The literature study collects information from 22 studies that have examined the effect of various forms of traffic calming on retail turnover and shows that turnover in these areas increase by 10-25% (on average 17%). It is unclear to what extent these types of older studies use control streets/areas.

However, the results indicate that there are no visible negative consequences for retail in the city centre (measured by turnover) from the introduction of traffic-calming measures for pedestrians.

5.5 Effect of measures that primarily worsen conditions for motorists

This section looks at what the effects are when conditions for shoppers in cars are made more difficult. Measures that exclusively worsen conditions for shoppers in cars do not have any clear effect.

Steijaert (2017) looks at selected shopping centres in the Netherlands and examines whether changes in parking prices and parking duration lead to changes in visitor numbers. The author uses control groups, i.e. similar shopping centres that have not changed parking rates and finds that lower parking rates result in more visitors. In the centre in Leiden, a time limit on parking was introduced. This resulted in a drop in the number of visitors.

Mingardo og Van Meerkerk (2012) examines the relationship between parking availability (both in terms of the price of parking and the number of parking spaces) and turnover in 80 shopping areas in the Netherlands. The authors found no positive correlation between the amount of parking spaces and turnover in shopping areas. The study shows a positive correlation between the price of parking and turnover. The study suggests that a higher parking price leads to higher turnover.

However, the study does not measure the effect of any given measure, but rather a correlation between parking availability and turnover across a large number of shopping centres in the Netherlands and is thus unable to identify the cause of the effect of raising parking prices on turnover. The positive correlation between parking prices and turnover may, e.g., be due to the fact that shopping centres with high turnover are more attractive, making it more profitable to increase the price of parking as the volume of visitors remains high.

Below is more detailed information about the studies, including the differences in impact measurement.

Table 3 **Overview of studies investigating the effect of measures that worsen conditions for motorists**

City/country	Name of street/ district	Neigh-bourhood or street	Key figures (impact measurement)	Impact	Control group	Type of measure	Source
Leiden	Luifelbaan	Neigh-bourhood	Number of visitors	Negative	Yes	Change in the number of hours parking is permitted	1
Netherlands	80 areas	Area	Turnover	No/positive effect	No	No measures	2
Spijkenisse	Kolkplein	Neigh-bourhood	Number of visitors	Negative/no effect	Yes	Change in parking prices	1

Source: [1]Steijaert (2017) and [2]Mingardo and Van Meerkerk (2012).

There are a limited number of studies that have investigated the effect of e.g. higher parking fees on shops, especially compared to measures that improve conditions for cyclists and pedestrians. However, the results of the two Dutch districts studied in Steijaert (2017) indicate that the effects on retail trade are negatively affected by measures that target motorists and do not simultaneously improve conditions for cyclists and pedestrians.

5.6 The size of cities and shop composition play a role in determining the effect of the measures

This section takes a closer look at whether the effects of traffic-calming measures on local retail trade vary depending on the size of the cities, how different types of shops are affected, and how the effects develop over time.

There are indications that the effects depend positively on city size
The studies included in this report are primarily conducted in larger cities.

There are no studies comparing the effects of measures on the retail trade in cities and towns of different sizes. However, it can be assumed that the retail trade will be more positively impacted if a large proportion of customers already cycle to shop.

The Danish National Travel Survey, which is the most comprehensive study of Danish transportation habits, shows, e.g., that a larger share of traffic in large Danish cities is on foot or by bicycle than by car compared to the distribution in smaller towns (Christiansen and Malmgren 2022).

Retailers with a local customer base are more likely to make financial gains
Several studies show that the effects of traffic calming on turnover vary by type of shop. However, there is a tendency for shops that sell locally to benefit more financially from improved conditions for cyclists.

Among shops in Mortsel, Belgium, Sem og Floriaan (2015) finds that specialised retailers with a geographically broader customer base experience a decrease in turnover when traffic-calming measures are implemented. The authors argue that this type of retailer has a relatively large number of customers who come from far away. Traffic-calming measures, on the other hand, put retail shops that focus on local customers in a relatively better position.

Poirier (2018) provides an analysis for all types of shops and an analysis for shops in sectors more likely to sell locally (e.g. cafés, supermarkets, clothing shops, etc.) In the analysis of retailers more likely to sell locally, improved cycling conditions on average result in gains for the shops (measured by turnover per shop) for all three streets in the study. When the authors analyse across *all* types of shops, they only find a gain (in terms of turnover per shop) for the shops on one out of three streets.

Escobar (2018) finds that the negative effects of the closure of parking spaces are equally distributed between catering and retail (measured as the number of open shops) when a control group is taken into account. In contrast, Escobar (2018) finds that the closure of a carriageway to make way for a cycle track has positive effects on retail shops, while there is no effect on catering venues.

The literature shows that it is primarily shops where a large part of the existing customer base shops locally that benefit. Whether it is catering venues such as cafés, retail shops or shops in a third sector depends largely on what shops are in the affected area and what the needs of the inhabitants in that area are.

There is a time aspect to the effects of traffic-calming measures
Previous studies (Trivector (2003)) have found that retailers' negative attitude towards traffic-calming measure decreases over time. There can also be differences in the effects of traffic-calming measures over time. E.g., the negative effects of measures can diminish over time.

In an analysis of traffic calming on Skibhusvej in Odense Municipality, Denmark, COWI (2022) estimates that there will be greater benefits for business in the long term than in the short term.

Overall, the long-term impact is uncertain, as it depends on the transportation habits of shoppers. There may also be a change in shop composition. This will often happen over a longer period. This is the case in Mortsel, where Sem og Floriaan (2015) finds no change in the number of shops over a 6-year period after the town introduced several traffic-calming measures. Here, shops that opened after Mortsel underwent traffic-calming measures are more positive about the measure than shops that were there before the traffic-calming.

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7 Appendix

The literature review included both Danish and international literature. Common to all literature screened is that it examines the correlation between traffic-calming measures and the retail trade, or otherwise sheds light on the role cyclists play in the retail trade.

7.1 Types of literature and sources

In the literature search, relevant studies were identified either through database searches or by reaching out to local networks and stakeholders.

Searching databases is useful to ensure that the literature search is systematic and to identify articles published in a scientific journal. However, databases do not contain studies that are not published (e.g. consultant reports, government documents, municipal evaluations, etc.) or that are not immediately publicly available. Such studies are found by contacting organisations, networks, and individuals with knowledge of the field.

Studies found through own database searches
The literature search was conducted in Google Scholar and Scopus as well as through regular Google searches. Search strings such as " turnover in retail trade", "shopping", "retail trade", "retail" and "spending" are used, along with search strings such as "cycling", "traffic calming" and "parking closure".

Local databases have also been searched. The Dutch Knowledge Centre for Cycling Policy (CROW-Fietsberaad), e.g., has a database that was used in the literature search.

Studies received through networks and stakeholders
In addition to our own searches, we reached out to relevant stakeholders to obtain relevant studies that are not published or publicly available. Stakeholder organisations such as the Danish Cyclists' Federation and the Cycling Embassy of Denmark, the Swedish National Cycling Advocacy Organisation and Syklistforeningen (the Norwegian cyclists' association) and the Institute of Transport Economics in Norway were contacted. In addition to stakeholder organisations, we reached out to companies that have worked extensively with cycling, such as COWI, Urban Creators and the World Bank.

Finally, a LinkedIn post was created to reach as large a network as possible.

7.2 Screening of studies

Based on the summary/abstract and conclusion of the studies, an initial screening of the studies and an assessment of their relevance was performed. If the studies were not considered relevant, they were discarded. The box below outlines the three criteria that determine whether a study is considered relevant or not. Ultimately, elimination was based on assessment of all three criteria.

Criteria for whether a study is relevant

1. What does the study investigate?

As a starting point, studies that address the following topics are included in screening:

- Retailers' expectations for the proportion of consumers arriving by bicycle.
- The consumer patterns of cyclists.
- The effects of traffic-calming measures on retail trade.
- Another link between cycling and the retail trade.

2. What type of study?

As a starting point, screening focused on studies conducted within the above topics, i.e. a questionnaire survey, measured or estimated effect, as well as literature studies.[4]

3. When is the study from?

Screening focused on recent studies (post-2000) to ensure that the literature review contains the most relevant and current studies. However, older studies are also referenced.

The literature review includes self-designed studies and literature studies.

In the main analysis of the report, there are a few studies that are not included, even though they are relevant to the topic. This may be because the quality of the studies is not sufficiently high, e.g. Drennen (2003), or because the study lacks key descriptions of the methodology, e.g. Willi (2021) and Rambøll Norge (2008). For some studies, the quality is sufficiently high, but they measure the effect of the measures in a way that makes it difficult to deduce what the overall effect is for the retailers, e.g. Kumar og Ross (2006) and van Hintum (2018).

Finally, there are some articles that are not included in the main analysis because they use results that have already been highlighted in another article, such as the article by Larsen og Herby (2012), which uses the same data as Incentive (2012).

Quality assessment of impact studies

In the literature review, a quality assessment was made of the studies that have quantified the effects of traffic-calming measures on the retail trade. The quality assessment is based on how the studies examine the effect of traffic-calming measures on retail trade. Emphasis has been placed on a quality assessment of effect studies. The quality assessment is generally based on what is considered best practice in socioeconomic analysis, and overall, the quality assessment says something about the extent to which the studies are able to isolate and measure the effect of traffic-calming measures on the retail trade.

[4] Literature studies have been included, partly because they can often help shed light on a topic, and partly because they often refer to unpublished reports that do not appear in databases such as Google Scholar.