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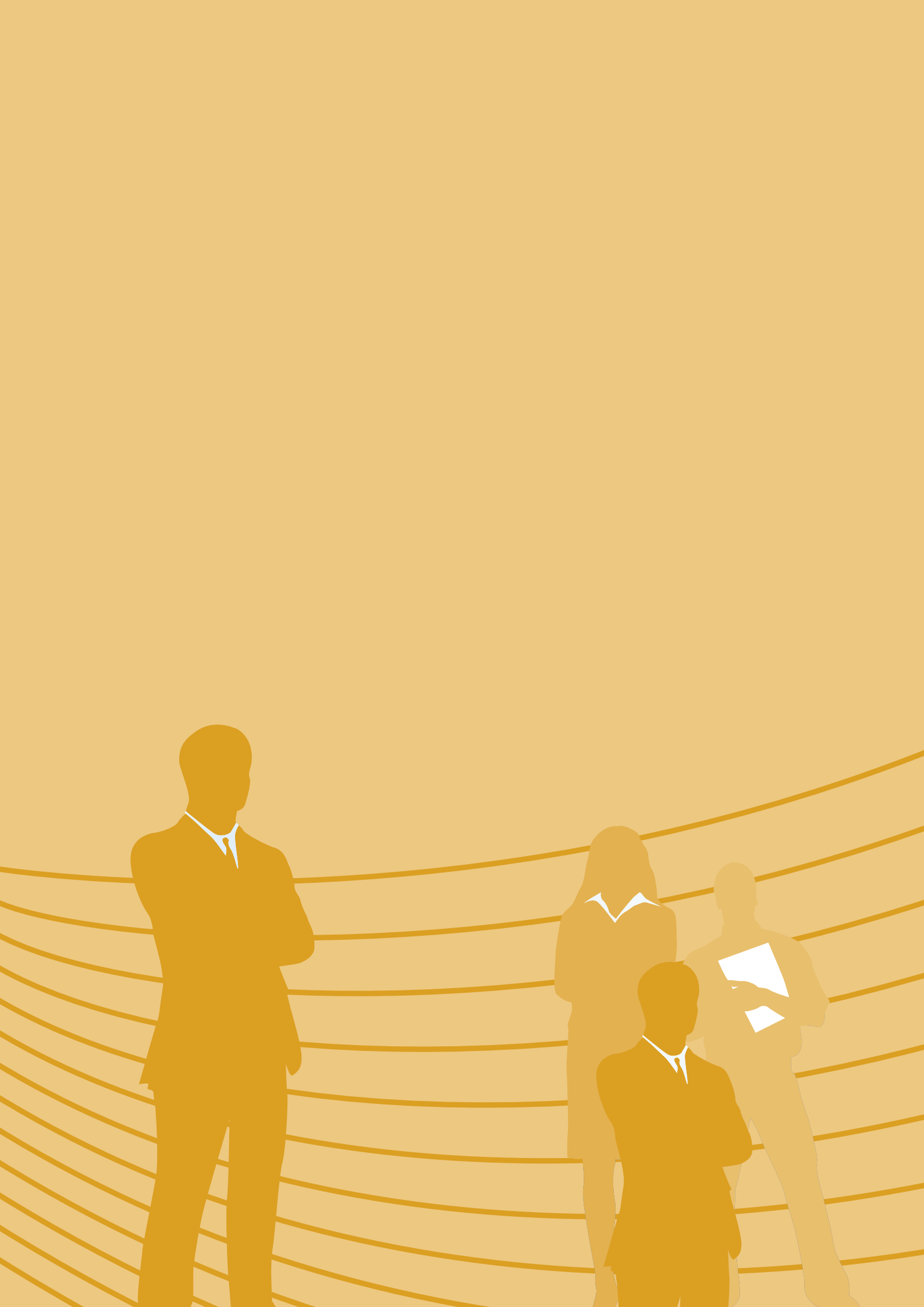
Economic rationale for parking tariffs

A price for parking which also does justice to quality and accessibility

November 2012



Economic rationale for parking tariffs

A price for parking which also does justice to quality and accessibility

November 2012

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Foreword

Parking policy evokes strong emotions. Especially when parking tariffs are constantly on the increase. That paid parking is of great importance to the accessibility and vitality of urban areas is often quickly forgotten. Many car drivers consider parking too expensive.

One of the reasons for this is that many municipalities do not properly substantiate their parking tariff choices and neither do they communicate these adequately. Parking tariffs are determined from the need to cover costs, as a result of political negotiations, or in relation to what the neighbouring municipality charges. Some tariffs have simply grown historically. Transparently chosen parking tariffs are very scarce.

This publication offers a methodology to calculate market-based parking tariffs. Not so much as an alternative to the ultimate tariff choice, but more as a reference on which to base a choice. This methodology has been tested in five Dutch municipalities and has proven its worth, both for checking the current parking tariff policy as well as for determining the future tariff policy. The methodology also provides insight into whether the parking acreage available meets demand.

In other words, this report opens the route to a more rational method for determining parking tariffs which is easy to communicate. In my view, this will benefit municipalities, the parking industry and last but not least, the citizens.

Wim van Tilburg
Director KpVV


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Management summary

The level of tariffs for parking on the street and in parking facilities still evokes strong emotions. The general impression is that parking tariffs are too high and that there is even price fixing and unfair competition. As a customer you feel at the mercy of a market that is by no means transparent. At the same time we see that the introduction of paid parking has made a tremendous contribution, not only to the quality of life in the cities, but also to their accessibility. There are few municipalities that would want to abolish paid parking.

Economic approach pilot projects

With this background, it is remarkable that so little is known about the rationale behind the parking tariff; answers are lacking or differ greatly from each other. Why does one municipality opt for € 2.20 and another for € 1.10 per hour? What works better? Each municipality has its own considerations for determining the tariff: the need to cover costs, the results of negotiations, contribution to good utilisation result and operating result, and so on. To a greater or lesser extent these considerations often play a role when determining the parking tariff. But sometimes a municipality will simply look at what the neighbours or centres of a similar size charge, or parking tariffs have simply grown historically. Often a municipality no longer knows what the ground rules were for deciding the original tariff. The lack of transparency is therefore not unwillingness.

At the request of and in collaboration with the KpVV, Ecorys Transport en Mobiliteit has worked out a detailed rationale for the parking tariffs based on economic considerations: 'the economic approach'.

Core of the approach: maximum benefit to society

Central in the economic approach is the parking tariff that takes account of the maximum benefit to society. The maximum benefit to society arises if people choose the right parking space based on the parking tariff. A cheap tariff is not ideal because too many cars will be attracted and there will be no space for people who want to park close to their destination. A tariff that is too high will mean that people stay away. The ideal tariff is largely determined by the attractiveness of the area. The more attractive the area, the higher the tariff. This way parking tariffs reflect the success of the area rather than the parking tariffs being the problem.

The advantage of a parking tariff set in accordance with the principle 'maximum benefit to society' is that this can easily be explained. By comparing the ideal parking tariff with the current tariff and utilisation rates, we gain insights which go beyond just setting the parking tariff:

- Is the current parking tariff in proportion to the economic performance of the centre? Could an adjustment to the tariff help the area improve its performance?
- Are there enough parking spaces, and if not, can demand be muted with higher tariffs and/or would it make sense to invest in more public transport or more parking capacity?
- To what extent can greater differentiation in tariffs help to distribute the pressure on parking more evenly?

The formula and decision tree which were central to the pilots turned out to be remarkably simple to apply.

Results from the pilots

After the approach lead to useful insights in Almere, the same approach was applied in four other Dutch municipalities with contrasting characteristics and different parking issues: Emmen, Apeldoorn, Utrecht and Dordrecht.

Despite the fact that some questions remain open, the approach transpires to be quite usable. It offers municipalities an additional yard stick which they can use to make statements about the parking acreage and the correct level of the parking tariff. It is an instrument that provides additional rationale for the level of the parking tariff and it adds the necessary transparency.

Furthermore, the pilots confirmed that doing the 'essential shopping' is quite different from 'fun shopping'. Currently both functions were allocated the same value in the economic theory as far as the value of time is concerned. In practice, it would be desirable to make a distinction.

It also transpires that the location of the car park is more important for those doing the 'essential shopping' than it is for those out 'fun shopping'.

Finally, the pilots also give insight into the relationship between the parking tariff and the distance to the actual destination. When is it interesting to park the car some distance away or to opt for another means of transport? The economic approach indicates what differentiation in parking tariff is needed to make parking at a distance an attractive alternative.


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1 Introduction

The 'Economic approach to parking' pilots were commissioned by the KpVV and conducted by Ecorys Transport en Mobiliteit in five Dutch municipalities (Emmen, Apeldoorn, Dordrecht, Utrecht and Almere). The aim was to determine whether this approach to parking offers the municipality insights that benefit its parking policy. At the same time, the pilots were intended to test the economic approach and to refine it where necessary.

Each municipality has received its own report. Central to this overall report are the experiences from the pilots which may also be relevant for other municipalities. Besides additional experiences regarding parking policy, in the pilots new understanding regarding applications came to light, such as the relationship between parking fee and distance and paid parking at neighbourhood shopping centres.

1.1 Why take an economic approach to parking?

The parking tariff has many stakeholders
The tariff for parking on the street or in a car park is a determining factor in the success of the municipal parking policy and whether visitors feel welcome. If the price is too high, visitors will stay away and if it is too low, there will be too much traffic and problems with accessibility and the local quality of life. Neither the one nor the other can be the purpose of the parking policy. The level of the parking tariff is also relevant for the commercial operation of the parking facilities. The revenue must cover, at least in part, the costs of on-street parking and the built parking facilities. Furthermore, the level of the parking tariff is still a subject with a considerable emotional load, for residents, retailers and companies.

Considering the many interests involved with the 'correct parking tariff', it is rather strange that so little is known about what an ideal rate should be in a specific situation. When setting the tariffs, municipalities often look at neighbouring municipalities or the need to cover the costs of the policy, and hardly any consideration is given to price differentiation between areas and time of day.

An economic approach of the parking tariff
It is with this background that the KpVV adopted an Ecorys initiative to derive a more economic approach to setting parking tariffs. Not to make other approaches superfluous, but as a well-founded and additional approach which, in certain situations will provide municipalities with meaningful information. The approach offers the municipality objective information concerning its own ideal parking tariff.

The economic approach has been worked out in more detail with some of the larger municipalities and was presented at national and international parking sector congresses. The five pilots serve to further test the practical applicability of the approach.
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There are many ways to determine a parking tariff. The economic approach does not provide the ideal parking tariff, but it does provide information that does justice to social economic principles. As a well-founded second opinion, the approach can be used in addition to existing approaches

1.2 Justification of the pilots

Pilots using the economic approach were conducted in 2010 and 2011 in Emmen, Apeldoorn, Dordrecht, Utrecht and previously in Almere. These municipalities were recruited by the KpVV.

Each pilot was tailored to the questions raised within the municipality itself, but always with an eye for the aspects that might be of interest to other parties. The pilots relied entirely on the willingness of the municipality to provide material. At the start of each pilot an individual project plan was drawn up to define the activities and expected envisaged results.

The progress of the four pilots that were carried out simultaneously was monitored and experiences were exchanged under the guidance of the KpVV. The reports with the conclusions per municipality have been given a high degree of confidentiality. For this reason, this final report only describes the key features per pilot.

1.3 Guidelines for reading

The report begins with a summary of the economic approach to parking: how this approach came about and what the key points are. It explains how the approach can be applied to the parking situation in areas with many visitors.

The following chapter deals with the pilots themselves. The emphasis lies on the practical aspects that a municipality faces when applying the approach. Is it too labour-intensive, are the results applicable?

Chapter 3 discusses the practical applications of the approach used in the pilots and which are potentially interesting to other municipalities.


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2 Background: the economic approach to parking

This chapter discusses the backgrounds of the economic approach used in the pilots.

2.1 Background to the approach

2.1.1 Benefit to society

NEI / Ecorys has developed a methodology to calculate the ideal variation in parking tariffs for visitors on a more economic basis. From an economic and societal perspective, how should the fee for parking in the street or in a parking facility be calculated? Attention was focused on the aim of achieving a parking tariff with the highest possible benefit to society: "Every car in the right place".

In the pilots, this approach was further calibrated and then supplemented with the latest insights from the theory of parking. For this we are indebted to Dr Henri de Groot (spatial economist at the VU University Amsterdam) who has helped in this update[1)].

The economic approach is not the only approach to parking tariffs. There are various other known methodologies, such as:
- the tariff that is derived from the cost price of the parking facilities and/or from the cost of enforcement (with or without a surcharge);
- the tariff that balances out supply and demand (for example in the centre of Rotterdam);
- the tariffs required to optimise throughput, so that the accessibility to the city remains intact;
- the tariffs required to restrict traffic in the city, in the context of sustainability;
- the tariffs in a neighbouring municipality (benchmarking).

2.1.2 Additional conditions

The economic approach certainly does not pretend to calculate the one and only correct parking tariff. Instead the methodology is intended to initiate a more transparent discussion on parking tariffs. The tariffs currently set by municipalities or operators are often only partially substantiated and give an arbitrary impression; nobody benefits from that.

The economic approach defines the key aspects of parking at a specific spot. These aspects are translated into a simple formula to calculate a parking tariff. The economic approach functions alongside other methods of determining the parking tariff.

1) This also involved discussions about further detailing the methodology in collaboration with the VU University Amsterdam.

When we talk about 'the parking tariff' in the following, this does not mean that the economic approach prescribes the parking tariff, but that with this approach the way in which the existing tariff is set can be checked. In the discussion around the pilots a traffic light model was suggested for this:
- 'Blue parking tariffs': the tariffs are well under what should be feasible according to the economic approach; an adjustment upwards would not necessarily create problems.
- 'Grey parking tariffs': the tariffs are in the vicinity of the economic tariffs; a change does not seem useful (plus or minus 10% – the municipality can determine this itself).
- 'Red parking tariffs': the tariffs are well above the economic tariffs; downwards adjustment is feasible (danger zone).

2.2 Theoretical framework

2.2.1 The beginning: the need for a parking tariff

Much research has been conducted into the need for a parking tariff. Does a parking tariff really help or is it just there to determine the enforcement costs and to create some financial reserve for the municipality concerned? The usefulness of a parking tariff can be demonstrated hypothetically with the following example:
Suppose that parking is free in the whole urban area. However, the urban area is not uniform: there are places where many people want to be, and other places remain empty; there are places with relatively many parking spaces and other areas with only a few parking spaces. Relatively, there will be the fewest parking spaces available in the most sought after spots:
Firstly, demand there will be greater (everyone wants to go there) while there is no mechanism at all to prevent people from parking their third or fourth car there. The available spaces will not necessarily be used by the desired target group.
Secondly, the price of land will be higher there. The pressure to convert parking spaces to something with a higher economic return will be great. More money can be earned with extra shopping or office space than with parking spaces that are made available for nothing.
Establishing some form of paid parking at the most popular places can prevent that all parking spaces are transformed into property and that no parking spaces remain available for the desired visitors.

2.2.2 A parking tariff to balance supply and demand

A parking tariff contributes to the balance between supply and demand. As parking pressure on the street increases, the parking tariff will also have to rise to ensure that the parking pressure does not rise too high. This approach, aimed at achieving the balancing tariff, has been successfully applied in Rotterdam for many years. The result is a parking tariff in the inner city that varies from street to street and time of day, and parking pressure that is more or less uniform everywhere. In certain situations, however, it is not easy to enforce this principle.

For example, when there is considerable demand for just a few parking spaces, the tariff can increase dramatically, as a consequence visitors stay away, endangering the performance of the area (this has not yet occurred in Rotterdam). Conversely, large numbers of empty spaces could lead to a premiums being offered to entice cars to park in the area. This is not conducive to achieving a balance with the greatest benefit to society.

2.2.3 A parking tariff that takes account of the benefit to society

If parking pressure is too high this will endanger the performance of the area; visitors cruise extensively looking for a place to park, it takes them a long time to get to their ultimate destination from the parking space or they stay away altogether. These are examples of negative external effects that can be reduced with a parking tariff. In the increasing number of scientific articles dedicated to the ideal parking tariff, the authors point to the necessity of setting a tariff that at least takes the negative external effects of 'unlimited parking'[2)] into account. It is not possible to summarise all the external effects in a single formula and the discussion around this topic is far from conclusion. A number of key features are however becoming clearer.

[2)] The economics of pricing parking; Anderson and De Palma (2003)

These are explained in the following point by point reasoning:
- *Everyone wants to park at the most attractive spot* as close to their destination as possible. As that destination becomes more popular, more people will want that and fewer people will succeed in actually parking at the destination itself.
- People are then forced to park further away from the destination *after a long search for a spot*. The result is loss of time and a long walk back and a great deal of extra congestion on the roads in the search area. Much of the traffic in such areas is only still driving because they haven't yet found a place to park. Applying this principle leads to a price for parking that is higher as the location becomes more popular, and decreasing as people have to park further away. Only in this way can balanced parking pressure on all these areas be achieved. This theory is thus the basis for the 'peel system' which is often applied; a high tariff in the centre that gradually becomes cheaper towards the edge of the city.
- For some motorists the additional walking time to the destination weighs heavier than for others. Business travellers *have more money to spend* on being able to drive on and park near the destination. For them time is money; the parking space may be expensive. Day trippers prefer a cheaper spot and are prepared to walk a short distance, and they have much more time. The pricing of the parking spaces must take account of all these differences in 'willingness to pay' per target group. The differences in 'willingness to pay' per motive play a large role in the societal cost and benefit analyses. A direct consequence of applying this principle would be that parking spaces intended for business travellers should be more expensive. For those who do not want to or who cannot pay this, Park & Ride (P+R) offers an alternative: cheaper parking, but longer travelling time.

These factors are much more effective in certain areas in the city than in others. And neither are they constant during the day or in the course of the week. Ideally, the parking tariffs should fluctuate with the day and week rhythm and there should be a greater difference between areas. Some experience has been gained with such nuanced tariffs in the centre of Rotterdam.

2.3 From theory to practice: the economic approach

2.3.1 Focus

The economic approach is based on the theory maximizing the economic benefit and the benefit to society. This benefit not only takes account of the transactions and immediate economic benefits, but it also considers the external effects of economic activity. These external effects have a large role to play in traffic and transport: people drive a car but do not pay the for environmental nuisance caused by their car in the surroundings or for the traffic jams (vehicle hours lost) that they contribute to. The idea behind road pricing is that if the motorist has to pay the congestion charge, he will adjust his behaviour and the traffic jams will decline. Parking is part of the traffic and traffic and transport policy where the road user pays directly for his behaviour and thus can lead to better choices. A great deal of the external costs involved in parking have, in fact, already been internalised.

Maximising the economic benefit is achieved by minimising the cumulative social costs (including all external effects). As those parking their cars pay a parking tariff that reflects the external costs more realistically, the benefit to society will increase. This theory is applied in the economic approach to the parking tariff by internalising the most relevant external effects when determining the parking tariff, for example, the cost of walking and cruising. The right visitors should park in the right spot, so that the area receives just as many cars as it can handle. This is the case in the following situations:
- *Visitors* park at the right spot if the parking tariffs take account of their specific wishes and there is sufficient choice is between parking options (provided that the visitor is familiar with the alternatives).
- *The area* gets as many cars to process as possible and is desirable. The parking tariff is high enough to deter excessive car traffic and low enough to not form a barrier to people who can reach the area only by car. When the ideal tariff is set there will therefore be no more than the desired number of cars, *without this leading to fewer visitors in the area* .

This economic approach focuses on *destination areas for visitors*: city centres, peripheral shopping areas and perhaps even amusement parks, and the like. Visitors sensitive to changes in the parking tariff for parking on the street or in the car parking come to these destinations. This approach is not intended for residential areas where cars are mainly parked outside homes or work areas where everyone parks with a permit, season ticket or on private property. The level of the parking tariff per hour is not particularly relevant for these groups. People with a permit or a season ticket, in fact have been granted the right to unlimited parking.

So this approach only says something about parking spaces that can be used by visitors to the area. Within the visitors category there are different target groups, each with its own characteristics and sensitivities:
- *Fun shopping*: the longer a visitor stays in an area the more sensitive they will become to the tariff for parking on the street and will have less objection to walking a short distance. Shopping visits will be sensitive to the economic approach principles.
- *Essential shopping*: visitors to large supermarkets will park for a short space of time and want to park at the door. They also want the best possible parking spot. On the other hand, the consumer is sensitive to the cost of doing the essential shopping.
- Other visits: business visitors are less sensitive to the tariff and will always want to park as close as possible to their destination; a mixture of considerations will determine where people on social visits park.

The extent to which these groups deal differently with the value of time is taken into consideration in the approach. However, this approach does not distinguish between doing the essential shopping and going fun shopping. We will discuss this issue later (see section 3.4).

Figure 1:
Defining target groups for the economic approach

Type of parking		Place demands on the parking spot	Economic approach possible
Long-term parking (residential)		Regulated via permits / own spaces	No
Medium term (half-day)		Cheap spaces at some distance	Yes
Short stay parking (per hour)	Fun shopping	Spots with the more attractive location/price	Yes
	Essential shopping	Spots as close to the shop as possible	Yes
	Other	Depending on motive (business, social, appointment, culture)	Yes

Areas with a mix of paid parking and parking permits

The economic approach works well in areas with paid parking for visitors as well as parking permits, but the effect of increasing or decreasing the parking tariff will depend on the share of parking capacity that is used by visitors. After all, the parking tariff only influences the few drivers using short term parking. The effect that can be achieved by applying the economic approach does occur, but slowly disappears as more parking spaces are occupied by drivers with a parking permit.

These remarks on parking in mixed areas lead to a number of observations that are relevant to municipalities or operators, but at the moment can only be formulated as questions:

- Does it make sense to allow residents and workers (with a parking permit or season ticket) to occupy the parking spaces that are the most attractive to visitors?
- Despite the restrictions given, is it possible to influence parking by residents or workers with an economic approach, for example via the level of tariffs or issuing parking permits and parking season tickets?

The answer to these questions goes beyond the scope of this pilot.

2.3.2 The formula for the economic value

The core of the economic approach we are introducing here consists of an EVP formula which is easy to apply; EVP stands for Economic Value Parking tariff. This formula takes into account the most import external factors associated with parking including congestion due to traffic cruising for a place to park, walking time to the destination. In addition, consideration is given to the agglomeration effects arising from the attractive forces of economic clusters on new activities, and to the value of the land dedicated to parking facilities. The formula in its original form is derived from the work of Anderson & De Palma (2003) but contains a supplement and some simplifications. The formula gives insight into the desired differentiation of parking tariffs for various locations in an area.

Figure 2
The formula to determine the economic parking tariff

$$T_{area} = a \times U \times V\,(1+A) \times i_t$$

Tariff for an area = Alpha (0.23) × Utilisation rate × Value of time that people charge × (1 + attractiveness of the area) × inflation correction

In common language the formula reads as follows: the ideal parking tariff for an set of parking spaces (T area) is determined by:

A constant (a = Alpha)
The alpha is a constant to make the formula tally with the current situation in the Netherlands. The alpha was calculated in an area where a demand-oriented variable parking tariff was already in place. The situation in Rotterdam, in the Meent/Hoogstraat in 2006 was used as the 'reference neighbourhood'. There, the utilisation rate was calculated from research and of course, the prevailing street parking tariff. This resulted in an alpha provisionally set at 0.23.

To correct for the organic growth in the parking rate since then the factor it is included for the annual rate of inflation.

Use of the alpha and the link to the reference neighbourhood has significant consequences for the application of the formula. The formula allows calibration of all places in the Netherlands to a realistic situation, but cannot say anything about the desired absolute level of the parking tariff. The tariff in the Meent/Hoogstraat area in Rotterdam took the balance between supply and demand into account but naturally, was not based on new approach.

To sum up: the formula can be easily used as a benchmark between municipalities and between areas in a municipality but says less about the absolute level of the economically ideal tariff.

The utilisation rate (U)
U stands for the utilisation rate. The utilisation rate is a measure of the degree of delay that people encounter when searching for a parking space and then to reach their destination. As the utilisation rate increases there are fewer vacant parking spaces and the time taken to search for a space and to walk to the destination will increase. The reason for choosing 'percentage parking pressure' as part of the formula that actually stands for walking and driving times, is because this practical data about the utilisation rates is more readily available than data about walking and cruising times.

The translation of 'extra walking and cruising time' to 'utilisation rate' can be defended on pragmatic grounds. Further discussion and research will have to prove whether or not a better translation can be made that can also be applied in the majority of municipalities.

Value of time (V)
The value of time (or value of time) that people assign to their visit. For instance, business visitors work more on the principle that 'time is money' than other visitors. They are prepared to pay more for a parking space if that minimises the journey time to the front door of the destination. Parking tariffs are therefore higher in areas in great demand from business visitors.

The cost of time that people use varies per situation. Value of time plays an important role when calculating the costs and benefits of major investments in the infrastructure. Which groups benefit from the new connection and how can the improvement for them be expressed in monetary terms? In this pilot we use standards that are based on visiting the shops. These figures are derived from the OEI (Overview Effects of Infrastructure) methodology, the standard approach used in Netherlands for societal cost and benefit analyses.

The attractiveness of a spot (A)
In the original approach taken by Anderson & De Palma (2003) recognition was given to the fact that the area where people want to park has preferred parking places: most users want to park in the Central Business District (in the Netherlands: the city centre). As people have to park further away from the sought-after destination, the higher cost of walking is compensated in a lower parking tariff. When more people want to visit the spot, it is apparently considered more appealing. The best indicator for attractiveness is therefore the number of people that visit the spot daily, regardless of the mode of transport and corrected for the size of the spot. In our derivation we have operationalised the 'most popular location' to 'number of visitors per time and area unit' and via that to the retail rents at the location.

Since there are no national standard figures for the number of visitors per area, for the time being we have opted to operationalise the 'attractiveness' to the retail rents. Normally the retail rents are a reasonable reflection of the number of visitors to an area, and thus also the attractiveness.

A significant exception to this came to light in the pilots. This concerned newly developed parts of a centre with, according to those involved, the retail rent set too high. If the economic parking tariff would be linked to the too high a retail rent, the retailers would be faced with extra difficulties. To use this retail rent in the economic approach, the rent level should be corrected in the formula.

The description '1 + A' is used as 1 + the relative position of an area compared to a reference neighbourhood: if the retail rents in the area are assigned a factor 0.8 compared to the reference neighbourhood (see above under 'alpha') this results in '1 + A' = 1.8. In this form the formula gives the best approximation of the current relationship between the retail rents in Dutch cities and the parking tariff (see annex).

Summary

Because the EVP formula reflects the attractiveness of an area in the form of a parking tariff, this can be used to coordinate parking tariffs at various attractive locations in a municipality or between municipalities. In addition, it is an indicator for the level of the parking tariff relation to the performance of the area.

2.4 Practical examples

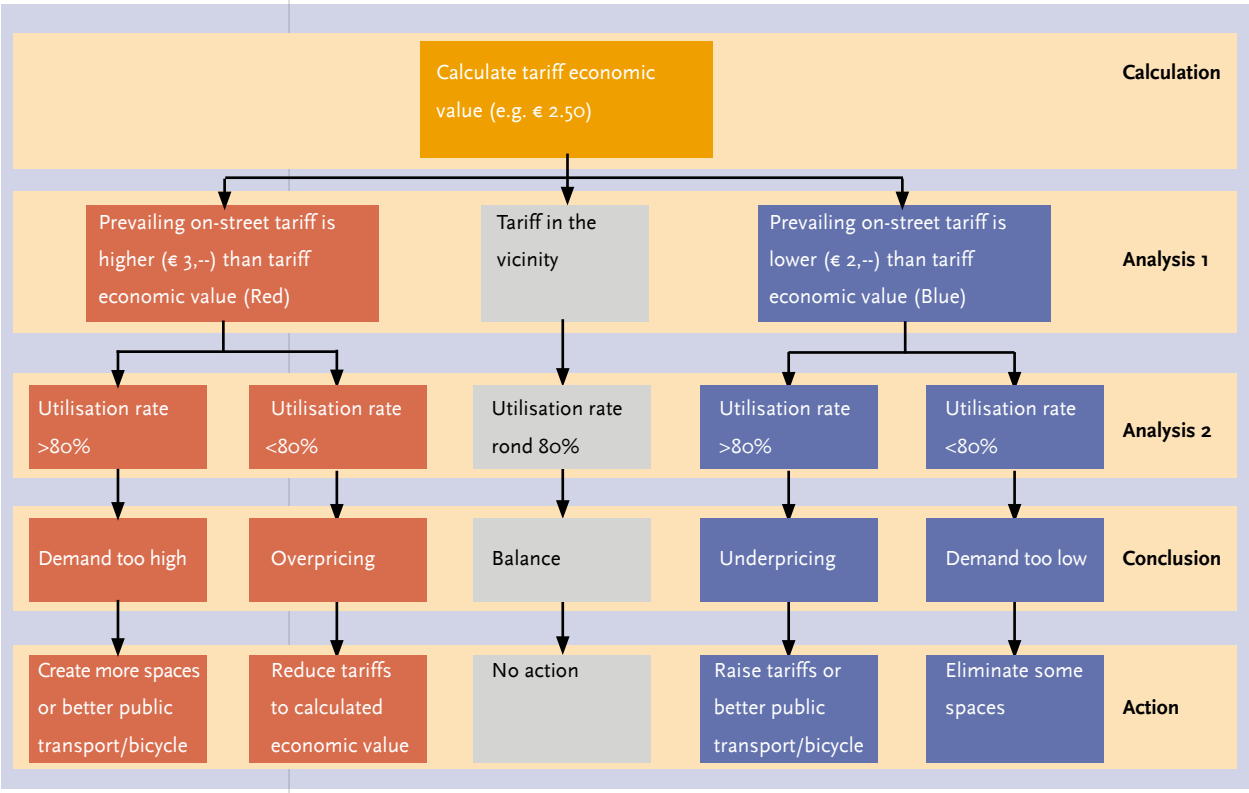
2.4.1 Example 1: application in situations where paid parking already exists

Because the starting point of the economic approach is the 'maximum benefit to society', this implies that more aspects are taken into account than just the utilisation. For example, this enable us to answer questions relevant to the parking policy, such as:

- How do you prevent too high a parking tariff from damaging the performance of the area so that not only cars but also customers stay away?
- What is the ideal number of parking spaces in a given situation?
- What is the ideal number of parking spaces and corresponding parking tariff for a sustainable and well-functioning centre?
- When is it better for an area to concentrate on good accessibility by public transport and bicycle than to create more parking spaces?

These are relevant questions for virtually every area that needs many visitors to survive. The economic approach helps to find answers to these questions, as is illustrated in figure 3.

Figure 3
Decision tree for the economic approach per situation



The decision tree in the figure is easy to apply in situations where a parking tariff is already in force and where the on-street and car park utilisation rates are known.

To take advantage of this diagram only knowledge of the applicable retail rents in the area and the parking pressure at the normative moments is required. The other elements can be completed with fixed numbers or by making a conscious choice. The latter is the case for the utilisation rates. The ideal price in the formula is derived from an ideal utilisation rate chosen by the municipality itself and that does not necessarily have to be measured. After all, the parking policy will aim to make the best possible use of the available parking capacity.

In this example, a utilisation rate of 80% is considered ideal, however, each municipality is free to be more welcoming with a lower utilisation rate (making more vacant spaces available on the street), or to focus more on the optimal utilisation of the capacity and to aim for a higher ideal utilisation rate. The utilisation rate applies to a normative period, as is customary in the parking equilibrium. This may be Saturday afternoon, but also a typical Tuesday afternoon; depending on the situation.

The decision tree in the figure 3 starts at the top by calculating the 'ideal parking tariff'. Using the formula, we can calculate the ideal parking tariff for the area that does justice to the area's attractiveness and that uses the utilisation rate of 80% (in this example). The decision tree results in a tariff of € 2.50 per hour.

We can then compare the tariff derived from the decision tree with the actual on-street and car park tariffs. If this is clearly higher (in the example in the left branch: € 3 instead of € 2.50) we can compare the actual utilisation rate with actual utilisation rate. This will often be higher or lower than the ideal presumed 80%. This leads to interesting conclusions:
- If the utilisation rate is clearly higher than 80% (and the parking tariff thus much higher than the ideal tariff) then demand is clearly too high; despite everything there are too many cars in relation to the capacity. There is reason to bring demand in balance with supply by expanding parking capacity and/or by improving the alternatives (public transport and bicycle) to considerably. A further increase in the parking tariff (to suppress demand and create space) will however be detrimental to the number of visitors.
- If the utilisation rate is clearly lower than 80% then the prevailing tariff (€ 3) is indeed too high. There is overpricing; cars and customers stay away. To bring the tariff in balance with the attractiveness of area, the tariff should be reduced to € 2.50. The available spaces will be used better and the area will perform better.

The decision tree in figure 3 can also be shown as follows:

Figure 4
Alternative decision tree layout

Calculate the economic tariff based on ideal utilisation rate		1) Is the parking tariff on the street:	
		... lower than calculated	... higher than calculated
2) Is the utilisation rate on the street:	... lower than ideal	Demand too low	Overpricing
	Approach	Eliminate some spaces	Reduce tariffs
	... higher than ideal	Underpricing	Demand too high
	Approach	More public transport/bicycle; increase tariff;	More public transport/bicycle or more parking capacity.

The same argumentation can also be applied to a lower on-street parking tariff, where there may be underpricing or too low a demand (the right side of the decision tree):
- In the case of *underpricing* the utilisation rate on street is much too high. Given the price is lower than the economic ideal, this problem will be reduced if the parking tariff is raised, without deterring visitors from the area.
- In the case of *demand being too low* parking spaces are poorly utilised despite the fact that the price is already too low. The conclusion is obvious: there are too many parking spaces in the area and there are opportunities to transform parking spaces into public space, which will benefit the quality of the area as a whole.

Besides resulting in lower income, further reduction in the tariff will not have much effect.

This example clarifies the link with other calculation methods. Suppose, in the example of overpricing that the cost-effective parking tariff was calculated at € 3 at a utilisation of 80%, then reducing the tariff has consequences for the financial feasibility of the parking facilities. At the same time a lower price is necessary to not lose visitors. By making these calculations before the parking facility is realised, the financial consequences of the pricing strategy can be recognised at an early stage.

2.4.2 Example 2: influence of extra parking spaces for bicycles on parking fees

The following practical example comes from a session with the representatives of the four major municipalities.

Suppose that the municipality of Rotterdam builds a set large bicycle parking facility in the Meent. There could be three effects:
1. *Visitors who previously came by car now come by bicycle*. The utilisation rate on the street will drop while the area remains just as attractive. Because the number of visitors (the attractiveness) remains the same there is no reason to adjust the parking tariff. The municipality could grasp the opportunity presented by structural vacancy of parking spaces to reduce the number of spaces and to redevelop the public space. This may cause the attractiveness of the area to rise so much that parking demand increases. That will then require a review of the ideal parking tariffs.
2. *The bicycle parking attracts mainly new visitors*. The attractiveness of the area has apparently increased since the new bicycle parking is available. In the meantime, the utilisation rate for cars on the street remains unchanged, no vacant parking spaces emerge.

Eventually, the parking tariffs can be adjusted upwards, in line with the increasing attractiveness of the area.

3. *The bicycle parking remains empty*: of course, there is always the chance that the project will fail, the bicycle parking remains empty. As far as the utilisation rate and attractiveness are concerned, nothing changes. If in the meantime, however, the parking tariffs on the street have been increased, for example to finance the bicycle parking, the area will enter a negative spiral. The rising tariffs will not only drive cars way, (at equal attractiveness) but also the visitors. The bicycle parking itself does not offer an alternative.

2.5 The economic approach in practice

2.5.1 Five steps

In practice, working with the formula to determine the economic tariff is quite simple:

Step 1
The utilisation rate on the normative moment can be derived from recent parking statistics. That may be for on-street parking, in a parking facility or both.

Step 2
Set the default value of time to € 6.65. This value of time is based on international standards and applies for an area in which 80% of the visitors are the general shopping public. The compound item of the visitors per areas may vary, which will result in an different value of time. At the same time, the value of time per motive is an average that does not always does justice to the nature of the visit. For instance, there is the discussion as to whether essential shopping and fun shopping have the same value of time (see section 3.4).

Step 3
The attractiveness can be derived from the retail rents. Sometimes these are known to the municipality, otherwise, these can be requested from the larger real estate agencies. Calculate the relative attractiveness by dividing the current retail rent by the standard rent for the 'Meent/Hoogstraat' area (adjusted for the correct year). This is the A in the (1+A) part of the formula.

Step 4
The constant in the formula is 0.23. The result of the formula with these values gives the economically determined tariff for the area.

Step 5
The result is the economically motivated tariff for the area and can be compared to the existing situation at the location concerned (see figure 3 section 2.4.1). To make this comparison, additional knowledge is needed about the current parking tariff and the current utilisation rate that now occurs at normative moments.

2.5.2 Sample calculation

The relative attractiveness of the area can be calculated as follows:

Average retail rent per square metre in the shopping area, covered by the parking area (without considerable walking distance))	€ 395
Average retail rent per square metre in the 'reference neighbourhood'	€ 525
Attractiveness (A)	0,75

The value of time is calculated in the following table. Ideally, the distribution of the motives for visit is derived from a questionnaire.

	Value of time 2010 (1)	Distribution of visitors in the area	Weighted value of time
Fun shopping	€ 6,50	80%	€ 5,20
Work	€ 8,98	0%	€ 0,00
Cafe visit	€ 6,50	10%	€ 0,65
Friends	€ 6,50	5%	€ 0,33
Business visit	€ 31,11	5%	€ 1,56
Value of time for the area			€ 7,73

Total formula for ideal utilisation rate of 80%:
P tariff = 0.23 (alpha) × € 7.73 (value of time) × 80% (utilisation) × (1 + 0.75 (attractiveness)) = € 2.49

In this example the ideal parking tariff is € 2.49. Obviously, this is not the tariff that should be applied to parking on the street but it gives a good indication.

In the pilots it transpired that applying the decision tree shown in figure 3 lead to some new, compelling insights regarding policy and operational aspects. This implies that the results should be treated with care. Naturally, it also argues for the necessity to always view 'the economic approach' as just one of the possible approaches to deriving an optimal parking tariff.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3 Applying the economic approach

3.1 Analysis of the situation

General check on parking tariff, capacity and utilisation
In almost all cases, the first activity the municipalities undertook was to examine the decision tree (see 2.3.1). This decision tree was used in all the pilots to form a general opinion about the parking situation. Are the parking tariffs too high or too low? Is there enough capacity?

The outcomes of this exercise provided recognisable conclusions for the municipalities. People could generally place the conclusions in their own professional experiences based on what they already knew about the situation. Thus the conclusions were certainly not invalidated. In a number of cases they offered new ammunition to put more strategic issues back on the agenda, such as the need for new parking facilities or pressure from retailers to reduce parking tariffs. In all cases, the municipalities indicated that, for the time being, they wanted to treat the conclusions as confidential. Thus implicitly, they acknowledged the importance of the economic approach.

At the same time, the municipalities did not bind strict conclusions to the absolute level of the calculated tariff. It was stressed that this is just one approach to the parking tariff. This economic approach proves its worth when it is compared to other approaches, for example the cost-effective rate (see section 4.5.1. for the details).

3.2 Tariff for parking at a distance

The economic approach provides an ideal economic parking tariff in an area. The same approach can be used for parking at a distance.
The attractiveness of the area has a considerable role to play in determining the ideal economic price. The more attractive an area is, the more people want to come and motorists will be prepared to pay more to have the best parking space. The best place is as close to the most attractive destination as possible; the most expensive parking spaces are located here. The parking situations in most Dutch municipalities reflect this: in 2011, Amsterdam charged € 5 per hour to park near the Kalverstraat and offered cheaper parking in the ring around the centre. In the centre of Rotterdam there is a refined system of tariff differentiation that takes these aspects into account.

The question that was repeatedly raised during the pilots was whether the economic approach could also say something about the ideal tariff for parking in a facility or on-street at some distance from the attractive centre. We also succeeded in developing an applicable formula for this.

3.2.1 Tariff formula for parking at a distance

Suppose someone wants to go to the 'most attractive' place, but does not necessarily need to park there. He is prepared to walk a short distance to save money. If he has the option of paying less for parking at a distance, in certain circumstances he will do that. Of course, he will compare the cost of parking at the location itself and at a distance. But this comparison alone will not be enough to make a choice. There are other factors involved:

- The extra travelling time to the destination. The further away from the final destination the parking space is, the less attractive it becomes. (This is about the net comparison: the extra travelling time in the chain compared to the time to drive on and cruise for a parking space.) In terms of the economic approach, this extra time can also be valued (value of time). A distinction can be made between situations where time = money (business people want to park at the door) and situations where time is much less critical.
- If people also have to pay for the journey to the final destination, this should also be taken into consideration.
- Finally, the length of stay has a role to play. The longer people stay at the final destination the less significant the extra travelling time will be. Parking at a distance if you want to do the essential shopping quickly is relatively senseless, however cheap it may be.

The starting point for the economic approach is the total cost for the visitor; this should be more or less the same for parking at the destination or at a distance. In other words, the sum of parking charges at a cheaper spot plus the value of time involved with the extra travelling time (plus any additional travelling expenses), must in any case be lower than the parking charges at the expensive spot.

Or: Po × (t + et) + C × et + V × t + Tclm is less than or equal to Pc × t

$$\text{Parking tariff at a distance} = \frac{\left(\text{Parking tariff centre} \times \text{Length of stay} - \text{value of time of visit} \times \text{extra travelling time} - \text{Travel costs last mile transport}\right)}{\left(\text{Length of stay + extra time}\right)}$$

A tariff for parking at a distance or in a P+R car park may increase as:
- the parking tariff at the destination is higher;
- the other transport is faster or cheaper (extra expense of bus);
- the marketing is more focused on a target group with a low value of time, so not visitors with a business motive;
- the marketing is more focused on people who want to stay longer at the destination;
- the marketing is more focused people who can reach the P+R car park on their way to their destination without significant loss of time.

The formula is much more than a theoretical derivation. Some of the key elements require an active choice on the part of the operator or municipality; the envisaged target group also have a say in the price charged. Further consideration of the key elements illustrates this.
- *Parking tariff outskirts* (Po): the maximum charge per hour acceptable to consumers for parking at a distance. In some cases the customer also incurs extra costs for the bus or train. These costs should be corrected on the total length of stay and in the formula are therefore in the denominator.
- *Parking tariff centre* (Pc): the actual parking tariff per hour at the destination.
- *Value of time* (V): the operator compiles a target mix of visitors. If this includes mainly shoppers, the value of time will be lower than for business visitors (see 2.2.2).
- *Length of stay* (t): the length of stay at the destination (to and from the spot where you park).
- *Extra travelling time parking at a distance* (et): the extra travelling time incurred when parking at a distance compared to driving on to the destination by car. In effect this is the difference between the 'P+R' travelling time and travelling time by car from the P+R car park to centre (driving on immediately).
- This formula enables the ideal *catchment area* for P+R location to be determined. After all, for people coming from the other side of the destination, the P+R location concerned will not offer any advantage because of the detour required. In such cases, the extra driving distance and driving time result in a negative outcome of the formula.
- *Travel costs last mile transport* (Clm): if the object is a P+R facility, the user will have to use other transport to reach the final destination. And he will consider these costs in the trade-off. Sometimes combined tickets (parking + public transport) are available. In that case, Clmt will be '0'.

3.2.2 Example

Parking at a distance increases the overall travelling time, and this will be traded off against the value of time. These higher costs must be compensated by lower parking tariffs. People will make such trade-offs intuitively. The financial translation of these considerations is shown in figure 5.

In the example two situations are compared for the fun shopping motive (value of time € 6.50 per hour). The first situation concerns parking in a shopping centre at a tariff of € 3 per hour for a period of 3 hours. The second situation concerns parking for 30 (= 2 × 15) minutes at a distance at a tariff of € 1.30 per hour for a period of 3.5 hours (3 hour length of stay plus 30 minutes extra travelling time). The cost for both situations is then comparable. Sometimes the visitor will opt for parking at a distance, and sometimes for parking in the centre. With bigger differences between the two parking tariffs, he will clearly opt for parking at a distance.

As can be deduced from the example, the maximum parking tariff at a distance must be lower if:
- on average the length of stay at the destination is shorter. The extra travelling time weighs more in terms of time and money. This can only be compensated by a lower tariff for parking at a distance.
- the extra travelling time becomes longer (see previous point). Here it should be noted that this concerns extra travelling time. Driving on to the destination and cruising for parking space also takes extra time.
- more visitors come with motives involving a higher value of time. Business visitors, for example.

Figure 5
Total configuration P+R – centre with situation in equilibrium

Parking location	Centre	At a distance
Value of time per hour (fun shopping)	€ 6,50	€ 6,50
Length of stay centre (hours)	3	3
Extra travelling time in hours (return)	0,0	0,5
Total value of time	€ 19,50	€22,75
Total parking duration	3	3,5
Parking tariff per hour	€ 3,00	€ 1,30
Extra travel costs last mile other transport (Clm)	€ 0,00	€ 1,00
Total other expenses	€ 9,00	€ 5,55
Parking plus other expenses	€ 28,50	€ 28,30

The role of the cost calculation in the choice between car and public transport

The cost of a car journey is equal to the sum of the value of time, car expenses (insurance, petrol, etc.) and the car park charges. This last element is, of course, determined by the parking duration. For the train, the cost is the sum of the train fare, the metro in Amsterdam and the higher costs of time. The journey takes longer by public transport and people include this in their trade-off. In the following example, the calculation is made for a journey from Houten to Amsterdam outside the rush hour.

Figure 6
Comparison of total cost of public transport and car

Means of transport	Car	Train
Value of time per hour (fun shopping)	€ 6,50	€ 6,50
Journey time (hours)	1,1	2
Car park charges	€ 9,00	€ 0,00
Total costs of stay (time + money)	€ 16,50	€13,00
Car expenses (90 * 0.15) and train	€ 13,50	€ 9,40
Cost of metro and tram	€ 0,00	€ 2,00
Total cost of journey (time + money)	€ 13,50	€ 11,40
Total cost of journey and stay	€ 29,65	€ 24,40

In this example we see that it is cheaper to travel this journey by train than by car. The considerably higher value of time due to the long travelling time by train is more than compensated by the slightly higher travelling expenses and particularly the car park charges. With car park charges of € 4 instead of € 9 both alternatives are equally expensive (the P+R tariff for a whole day parking in Amsterdam is € 8). In the example it also transpires that the car becomes cheaper as more people travel together in the car. Not only do the train costs increase, but also the value of time for traveling by public transport per passenger. The cost of P+R plus other transport remain even with more people in the car.

3.2.3 Consequences for the parking policy

The economic approach demonstrates - perhaps unnecessarily - that parking at a distance is not attractive to all people parking or in all situations. The municipality must therefore ask itself when planning for P+R or parking facilities further away from the city centre for which category of visitors it is intended. Key questions here are: who are the P+R users, where do they come from, how long will they want to park on average, what will their value of time be. And of course: what is the cost of parking in the centre itself?

The formula clearly illustrates that P+R is more attractive for day trippers (or commuters) than for the visitor who just wants to visit the city. Pricing and profiling can offer an extra response in this case.

Indicative calculations performed with the formula resulted in a negative parking tariff for certain planned P+R car parks. This situation soon arises in the smaller cities with relatively cheap parking in the centre and without good other transport facilities. Free parking at a distance is then only attractive if the parking tariffs at the destination itself are higher. After drawing this conclusion, the tendency is to abandon further plans for such P+R car parks. However, this is still a model. Pilots specifically aimed at these types of situation will have to demonstrate whether these conclusions can really be drawn so decisively.

Naturally the motorist's world is not black and white. City centre car parks will not remain empty as long as the total trade-off results in a positive price difference for P+R. However, the chances of well-used car parks at a distance increase as the tariff takes the economic approach into consideration. An additional advantage of applying this approach is that the profile of those parking at a distance becomes clearer (this helps with communication) and that the quality of the other transport is also given serious consideration as part of the policy.

3.3 Paid parking at neighbourhood shopping centres

In two cities there were plans for introducing some form of parking regulation in shopping centres outside the city centre. In these cities parking at these locations is still free. To date, paid parking at such locations has only been applied in the largest cities. However, a number of developments are playing to the hand for introducing paid parking even in these areas:
- The unchecked spread of paid parking in central areas causing additional inconvenience in these areas: parking at tram stops (spontaneous P+R) and at the boundaries of areas with paid parking.
- The need to redevelop the shopping centre with more features, for instance, an expensive underground car park. It would seem obvious to cover at least some of the costs of the car park from parking revenues.
- The growing use of cars in proportion to the scarce parking resources. This is particularly a problem in the other shopping centres and leads to accessibility problems ('there's just nowhere to park there anymore') and regarding inconvenience ('I live here and get all those strange cars in front of my house').

It is clear that the economic approach cannot provide the ultimate solution to all these issues. Yet, the results of the pilots offer a number of interesting clues. The following conclusions can be drawn:
- An economically motivated parking tariff can reduce the competition between shopping centres based on 'free parking'. Each shopping centre is given the tariff that reflects its attractiveness and the parking capacity available. This prevents shopping centres attracting extra cars with parking spaces that are free or too cheap, with all the associated negative consequences.
- The economic approach provides an additional motivation to seriously consider paid parking in these centres. Essentially, these are the same kind of attractions as the centre and why should there be paid parking at one shopping centre and free parking in another?
- A separate aspect of parking in these areas is the inconvenience to the neighbourhood. The introduction of paid parking (whether or not it is based on the economic approach) will at least have to give consideration to the unintended effect: that more people will go to an area where parking is still free.

It is difficult to estimate the immediate effects of implementing an economically motivated parking tariff. The decision tree does not work properly because the parking is currently free and the car parks are overcrowded. This leads to high calculated parking tariffs which are difficult to adopt without considerable problems with retailers and those living in the neighbourhood.

3.4 The difference between essential shopping and fun shopping

Fun shopping is different from doing the essential shopping (fun shopping compared to run shopping as they say in Dordrecht). The question was whether the economic approach could also say something about parking for doing the essential shopping.

3.4.1 The value of time when shopping

The economic approach not only takes the characteristics of the area and the parking situation on the spot into account, it also considers the needs of the visitors. This last element is incorporated in the value of time: what are people prepared to pay in monetary terms to save time? Business drivers are more pressed for time (and have money to spend to save time) than people on their way to a cafe. The value of time plays an important part when calculating the social desirability of investing in new motorways or railways. This is about the economic variables which are fixed per motive and economic scenario. Per motive, they offer no leeway, for example to vary per type of shopping. Determining these factors will require new research.

However there are various perspectives to shopping: essential shopping ('run shopping') is quite different than relaxed fun shopping. This should be reflected in the value of time. Unfortunately, that is currently not the case; you cannot simply differentiate the value of time.

However, we comment on the way in which people deal with the value of time within the shopping motive:
- People by far prefer to do the essential shopping by car, they want to get it done quickly and therefore want to park as close to the supermarket exit as possible. For most people it is an obligation and not an excursion. It has a high 'must' factor. Doing the essential shopping therefore has all the ingredients that justify a higher amount for the value of time (= high tariff).
- On the other hand, supermarket shopping is extremely sensitive to competition, because there is considerable choice of shopping centres and supermarkets and the retailers mostly differentiate on price. City centres have often still an unique offering and ambiance; this is much less the case for shopping centres. The level of the parking tariff at a location is often a major part of the trade-off in deciding where to do the essential shopping. Consideration should also be given to whether the level of the tariff or the extra action people have to take is the root of the problem.
- The other form of shopping ('fun shopping') is much calmer and more voluntary; people take more time for this kind of shopping. People do not <i>have to park in front of their favourite department store; parking at a distance is even one of the options. So the car park charges for fun shopping can increase more quickly; shopping trips are hardly ever shorter than 3 hours and sometimes a meal or evening cinema are tagged onto the day out.

3.4.2 Conclusions

With practical reasoning towards possible solutions, we can state:
- Essential shopping ('run shopping') is sensitive to a form of parking regulation that deters parking for longer periods, but that presents hardly any discouragement for short stay parking (in the level of the tariff but probably above all in the effort required to pay). This is separate from any other value of time or the economic approach.
- Fun shopping benefits form parking spaces being available for more hours. The tariff should correspond to the attractiveness of the area. In addition, in contrast to essential shopping, parking at a distance at lower cost is an alternative. P+R with a parking tariff according to distance, as described section 3.2, is an good example.


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4 Experiences and subjects for debate

4.1 Intrinsic subjects for debate

4.1.1 The relationship to other approaches to a parking tariff

In one of the pilots a comparison was made between the economic tariff and a cost-effective commercial operation tariff for a built parking facility. The calculation yielded some interesting additional information that we can translate as follows:
- If the economic tariff is higher than the cost-effective tariff, the latter can be applied without a problem and is unlikely to lead to less demand. Increasing the tariff further to the economic tariff is possible but is not necessarily required.
- If the economic tariff is much lower than the cost-effective tariff, then there is a problem. Implementing the cost-effective tariff may result is reduced demand and an empty car park. On the other hand, applying the economic tariff may generate much too little revenue to get the car park to an exploitable status.

If these issues come to light in the planning phase for the construction of car park, the outcome of the first situation points to viable commercial operation. The car park can be realised from this point of view. If the second situation occurs, cost-effective commercial operation is not feasible. One must then ask whether the parking issues should be solved in this way.

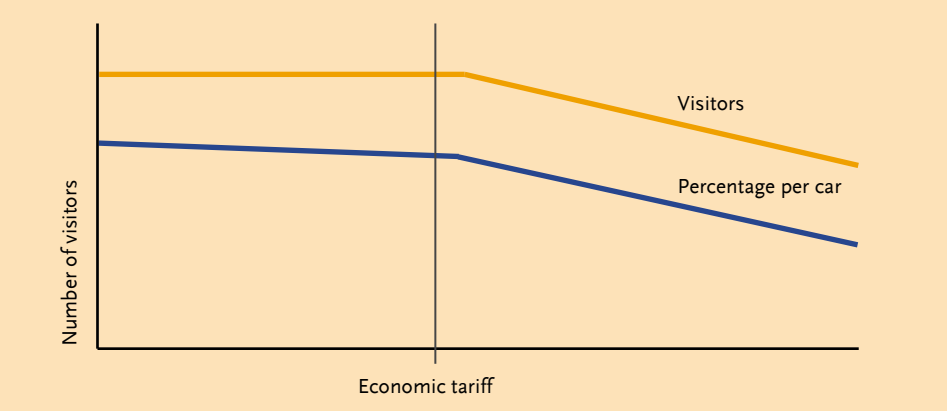
4.1.2 Behavioural effects and price elasticity

Price elasticity is always important when considering the effect of a parking tariff. The economic approach says nothing about demand elasticity. However, price elasticity plays an indirect role in the approach, because the roots of the decision tree are in the current situation, thus with known behavioural effects on the combination of parking tariffs and free capacity. The result is a judgment about whether the right balance has been found. And there are recommendations linked to this judgement: increase or decrease the price, increase the capacity or invest in alternatives. Nothing more and nothing less.

At the moment, the effect of implementing the recommendations is not part of the economic approach. So we do not know whether an economically motivated parking tariff leads to other behavioural effects than another tariff would. Actually, there are only two facts known about the price elasticity of parking tariffs:
- there is a connection between the level of the tariff and the willingness to continue using the car and to pay the tariff;
- after a scare effect in the first few months the effects are limited.

The economic approach appears to add two conclusions:
- The elasticity varies per target group. This hypothesis has been put forward in the past. Because the level of the tariff is related to the value of time, this works out as such in practice. Knowledge about the target group is needed to set the correct parking tariff.

- Until the economic tariff has been reached, the price elasticity (reduced demand) is very limited; if the tariff is set above the economic tariff then demand diminishes proportionally. The following graph illustrates the second hypothesis which requires further research:
- Up to the economic tariff the total number of visitors will remain stable, while the percentage of cars may drop slightly.
- Further increase above the economic tariff will result in a decline of the number of visitors per car which will have a direct impact on the total number of visitors.



4.1.3 The alpha constant

In the pilots questions were often raised about the constant alpha in the formula (see section 2.2.2.). The value of this constant (0.23), represented by alpha in the formula, was derived after it was calibrated in the fully researched situation in Rotterdam (in the Meent/Hoogstraat area). Surveys and censuses were conducted there, the retail rents were analysed and not to forget, this was a situation in which differentiation of parking tariffs was already being applied.

The recurring question is whether alpha is always and everywhere 0.23. The only answer that we can give at the moment is that we don't know. No systematic research has been conducted into the alpha in different situations. It seems plausible that the alpha will vary according to the situation or time. Changes in the value of alpha may tell us a great deal about parking in general. Unfortunately, at the moment this is only speculation and we observe that the formula (with the alpha) still works at present.

4.2 Complexity and recognition: what can the municipality do with this?

The work in the five municipalities has also provided us with information about the economic approach as a whole. The pilots have benefited directly from these experiences. These experiences can be summarised under three headings:

1. Is it not too labour-intensive to provide meaningful results?
2. Are the results recognisable?
3. How should we deal with the results?

4.2.1 The input: is using the formula too complex?

Central to the economic approach is a formula to derive an economic tariff and a decision tree to compare this result to the existing situation on the street (see section 2.3.1). Most municipalities are familiar with paid parking in the centre with a known effect on the parking pressure. To work properly, the formula must be entered correctly. The necessary data must be available and easy to use for a municipality. Specifically, this concerns the following data:

- utilisation figures for car parks and on-street parking;
- parking tariffs for car parks and on-street parking:
- retail rents in the areas concerned (from Dutch Investment property Almanac 2010-2011);
- options, bottlenecks and issues.

Ecorys maintained intensive contacts with all five municipalities. Some detective work within the municipalities was needed to unearth all the required data. Sometimes, no up-to-date data was available. In those cases, the work was based on assumptions, if possible, based on older data. However, the greatest problem were the retail rents. These are not always known within the municipality. To resolve this problem reference was made to the Dutch Investment property Almanac 2010 – 2011).

Peak and off-peak tariffs

For the municipalities where no actual utilisation data was available, the values for Saturday afternoons was estimated. Generally, the Saturday afternoon utilisation is easy to estimate by those involved based on their experience and knowledge of the local situation.

Incidentally, in those municipalities where the figures were known, this also included Saturday afternoons. In both cases, this means that in the pilots we could only make statements about the peak moments, and not about tariffs or capacity during the week or in the evenings. In situations with considerable differences between peak utilisation and off-peak 'during the week' utilisation, applying the economic approach inevitably leads to implementing separate tariffs for weekdays and evenings

4.2.2 The output: are the results recognisable?

Does working with the economic approach provide output that the municipalities concerned recognise? And is the result acceptable (in other words, does the economic approach make a legitimate contribution to the discussion)?

Initially the municipalities were a little uneasy with the economic approach.
At the start of the pilots it was difficult to identify a clear problem and develop an approach. Subsequently there was intensive contact, which mostly concerned the data required. The approach really came to life with the discussion of the interim results and when, during the discussion, the conclusions would be directly linked to practical applications. The conclusions provided a recognisable picture of the local parking situation. Even after the pilots were completed, the material remained complex, but within the context of the increasing need for professionalism this was not considered problematic.

The question of how to communicate the results of the research was also raised. As already stated, the methodology works with a theoretical model of the situation. It has provided insights that people had suspected without this methodology, but that could not be proven. The calculated values, however, need some interpretation. The result of the calculations is not an absolute truth, but it provides a frame of reference. In that sense, it is similar to a traffic model or other calculation methodology. The means of communicating results of such an exercise is therefore similar to communicating the results of any calculation model.

Most of the municipalities considered the final results to be so sensitive that they did not wish to disclose them.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Annex: Formula used and level of parking tariffs

In theory the link to the 'reference neighbourhood' should ensure that the outcome of the EVP formula does not deviate substantially from the actual tariffs elsewhere. The EVP formula does not calculate the desired level of parking tariffs based on a theory.

It calculates the ideal tariff compared to a reference neighbourhood and therefore relative to the tariffs currently applicable in the Netherlands. This principle means that discussions concerning the exact input for part of the formula have not yet been concluded. Besides a theoretically correct approximation, the EVP formula will also have to generate a result that is recognisable in practice. For example, when writing this report, a discussion arose about the use of 1 + A: does this stand for '1 + the relative score compared to the reference neighbourhood' or for '1 + the relative deviation compared to the reference neighbourhood'? This annex offers a brief justification of the chosen value for A.

An example clarifies the difference. Suppose that the retail rents are 40% higher in the area we are researching than in the reference neighbourhood.
- In the case '1 + the relative score' is A0 (reference neighbourhood) = 1 and Ax (research area) = 1.4 (40% more attractive). Then the impact of this higher attractiveness compared to the reference neighbourhood:
(1+ Ax) : (1 + A0) = (1 + 1.4) : (1+1) = 1.2.
- In the case that the relative variance compared to the reference neighbourhood is calculated, then A0 = 0 and Ax = 0.4.
The impact is then (1 + 0.4) : (1 + 0) = 1.4.

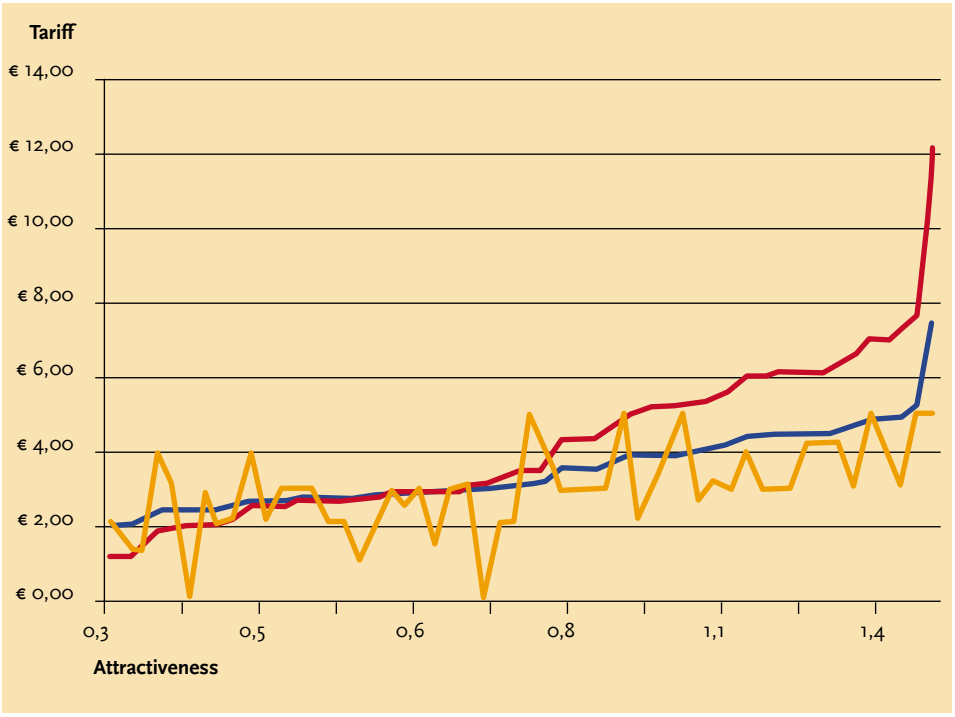
These outcomes are clearly different. It is not completely clear which use is theoretically correct. Based on the relative score it provides a reasonable reflection of the actual situation. This is demonstrated with a pragmatic check. The current retail rents (attractiveness) and parking tariffs for a large number of shopping streets was investigated, as well as the tariff that can be calculated with 80% utilisation and a standard profile for the visitors' value of time. The result is shown in the following graph. As the graph shows, 1 + A, where A stands for the 'relative score' (the blue line) gives a better approximation of the current practice in the Netherlands than the second (red) line.

The alternative interpretation of 1 + A, where A stands for the 'relative deviation', results in extreme values.

For the time being, pending further research, we will therefore stick to an EVP approximation in which A stands for the 'relative score' compared to the reference neighbourhood.

Tariff versus attractiveness

- *EVP tariff*
- *Tariff 1+A*
- *Actual tariff*



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