THE EVIDENCE BASE FOR PARKING POLICIES – A REVIEW

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Abstract
Parking policy is one of the key links between transport and land-use policy. Parking policies are often compromised in their effectiveness due to the perceived tension between three of the objectives that parking supports: regeneration, restraint and revenue. In particular the belief that parking restraint measures could damage the attractiveness of city centres to both retail and commercial enterprises limits the political acceptability of pricing policies and planning.

This paper presents a review of the evidence base upon which commuter, leisure and shopping and residential parking policies are based. Whilst underdeveloped, the literature suggests that greater attention should be given to analysing and presenting the accessibility impacts that different parking restraint measures have on travelers of all modes. The research base in many instances does not support, or provides evidence counter to, the assumption that parking restraint makes centres less attractive. Further disaggregate work is needed to understand how context specific these findings might be.

Acknowledgements
The author would like to thank the many people that contributed suggested material for use in this article and to two anonymous referees for their comments.

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Introduction

Despite the fact that almost every private car trip involves two parking acts and that cars spend over 80% of the week parked (RAC Foundation, 2004), the transport research community has, for the most part, concentrated on the study of the problems of congestion, safety and the environment caused by vehicles in motion. Even though the application of parking pricing and supply restrictions is "the most widely accepted and readily accepted method" of limiting car use (IHT, 2005, p20) it is a topic that has received comparatively little study upon which to ground our development of policies for the future.

There are several theoretical reasons why the pursuit of research into road pricing and road space rationing is more appealing than that of parking pricing and supply management. Road pricing can be used to influence a wider range of trip characteristics than parking policies can such as "trip length, time of driving, route followed and vehicle used" and can therefore more adequately be used to tackle the full range of externalities (Verhoef, Nijkamp, and Rietveld 1995, p142). However, despite these disadvantages Verhoef et al. (*Ibid.*) note that, under the right conditions, parking policies can be used to tackle congestion effectively, a finding supported by a more recent theoretical exploration (Calthrop, Proost, and van Dender, 2000). In most circumstances however, the 'right conditions', where everyone pays the true cost for their parking, do not exist (Shoup, 2005a; IHT, 2005). Parking policy is at best an opaque balance between a revenue raising activity for local authorities, a desire to avoid deterring visitors and therefore damaging urban vitality and a need to manage transport demand.

This paper provides a review of the literature relating to the observed or stated behavioural response of travellers to a series of real and hypothetical parking policies with the aim of informing practitioners and researchers alike (more model-based approaches have been pursued and discussed elsewhere (e.g. Coombe et al., 1997; Bates et al., 1997; Dasgupta et al., 1994; and Young, Thompson and Taylor, 1991). The paper begins with a discussion of the objectives of parking policy which provides the context within which research needs to inform practice. Whilst most of the research on parking has focused on commuter parking in the urban central business district, an analysis of UK national statistics on 'car parking acts' shown in Table 1 (based on responses to journey purposes for trips identified in the National Travel Survey) suggests that commuter parking in the UK comprises a declining proportion of all parking acts at around 22% (Bayliss, 2002). The paper is therefore divided into three sections examining the three different policy contexts of commuter, non-commuter and residential parking. The paper concludes with some suggestions for how the research base can better inform practice and suggests a series of opportunities for further research.

Table 1: Estimates of "Car Parking Acts" in Great Britain by Journey Purpose (Source: Bayliss, 2002)

Travel Purpose	1985/86		1999/2001		2015	
	Million	% of total	Million	% of total	Million	% of total
Commuting	4730	28.5	5040	22.6	5250	20.5
Business	960	5.8	1370	6.1	1400	5.5
Education	90	0.5	170	0.8	250	1.0
Education escort	400	2.4	830	3.7	1100	4.3
Shopping	2880	17.4	4490	20.1	5140	20.1
Other escort	7200	43.5	2440	10.9	11780	46.0
Personal Business			2450	11.0		
Visiting friends at home			2800	12.5		
Visiting friends elsewhere			790	3.5		
Sports/entertainment			1400	6.3		
Holiday/day trip	450	2.7	510	2.3	600	2.3
Other	40	0.2	60	0.3	80	0.3
Total	16570	100	22350	100	25600	100

The Objectives of Parking Policy

The management of the provision and use of parking spaces initially emerged out of "important but rather narrow concerns about safety and the obstruction of traffic flow on the streets" (IHT, 2005, p19). This led to policies to manage parking on the highway, to consider parking standards at new developments and to provide off-street public car parks. Shoup (1999, 2005a) reviews the extent to which these parking policies have and continue to exacerbate urban sprawl by requiring the over provision of parking spaces, lowering the resultant density of commercial and residential development and encouraging further car dependence.

With the realization of the inability of cities to cope with unrestrained increases in car traffic those management goals have emerged into a consideration of the degree to which parking policy contributes to the wider economic, environmental and social policies of towns and cities (Valleley et al., 1997). Well designed parking policies, in various ways, contribute to the promotion of a more efficient use of the transport network, lower emissions, higher densities and better, more inclusive urban design (IHT, 2005; Shoup, 2005a; Stubbs, 2002; Valleley et al. 1997). Poorly designed policies can act in the opposite direction. Shoup (2005b) for example estimated from a recent review of 16 studies in 11 international cities that on average 30% of traffic is looking for a parking space with the average search time being 8.1 minutes. 48% of respondents to a recent survey on illegal parking acknowledged having parked illegally (RAC Foundation, 2004). Residential areas in parts of many cities are now so heavily parked (Balcombe and York, 1993) that there are no informal safe crossing points for children.

Parking policy should not be developed in isolation but as part of local and regional spatial and transport planning processes (Marsden and May, 2005). Parking policy acts as glue between the implementation of land-use and transport

policies. The objectives that it should fulfil therefore come from the overall objectives of urban policy that typically include:

- A strong and vibrant economy supported by an efficient transport system;
- Better accessibility;
- A clean and high quality urban environment;
- A safe and secure environment;
- A more equitable society. (May, 1996; Marsden and Wootton, 2000)

Local government also has to act within a framework of good governance and be fiscally responsible. The objectives above must live alongside the practical financial implications of balancing the revenues and costs of managing parking for an area. In considering the multiple objectives that exist three specific objectives that are frequently perceived to be in conflict have been identified:

- "The desire to use parking measures as a means of **regenerating** a specific part of the urban area such as the town centre (ie, providing more parking to attract business);
- The desire to use parking controls as a means of **restraining** vehicle traffic and improving environmental quality, or to encourage the use of non-car modes; and
- The need to secure sufficient **revenue** from the parking operation to cover costs or to make a surplus to fund other activities" (IHT, 2005, p64).

The debate about the true extent to which parking policy might really place these objectives in conflict can only be resolved by taking an objective look at the evidence base. The following analysis makes use of those studies that are either publicly available through bibliographic databases and web resources or reports that were volunteered for analysis from an open request. [1]

Commuting and Parking

Feeney (1989) identified several factors that make the interpretation of the findings of parking studies problematical, particularly with regards to determining elasticity estimates:

- Inconsistent definition of the demand variable (e.g. is it total car use or parking at a specific site);
- Possible substitution between different elements of parking demand (short vs. long-stay);
- The consideration of the non-monetary costs of parking;
- The money and time costs for competing travel options; and
- Possible supply effects where there are reasonable competing alternatives. (p242)

The US Transit Co-operative Research Program has recently updated its publications on the impact of parking prices and fees (TCRP, 2005) and parking

[1] It is accepted that many consultancy reports exist examining specific parking issues. Much of this material does not sit in the public domain and despite a global request for information little 'unpublished' material was forthcoming.

management and supply (TCRP, 2003). The reviews largely concentrate on US experience but include some international studies and include consideration of the limitations discussed above. The review of parking pricing found that "empirically derived as well as modeled parking demand elasticities (number of cars parking) for area wide changes in parking price generally range from -0.1 to -0.6, with -0.3 being the most frequently cited value" (TCRP, 2005, p13-4, parenthesis added). Substantial variations to this area-wide average were reported (both higher and lower) dependent on the local circumstance.[2] The review is consistent with Feeney's earlier conclusion that "out-of-vehicle costs, whether time or money, are substantially more important (than in-vehicle costs) in determining mode choice" (Feeney, 1989, p236, parenthesis added).

One of the objectives of commuter parking policy is to reduce the amount of single car commute trips to the problem area to achieve both environmental and congestion benefits. At least in the US context, a common response to parking restrictions, charges or cash-out initiatives is a switch to car pool. Shoup's review of the implementation of parking cash-out at eight firms (where commuters are offered the option of a cash alternative instead of their parking subsidy) found that "the number of solo drivers to work fell by 17 percent after cashing out. The number of carpoolers increased by 64 percent, the number of transit riders increased by 50% and the number who walk or bike to work increased by 39 percent. Vehicle-miles from commuting to the eight firms fell by 12 percent" (Shoup, 1997, p201).

The response to an increase in car pooling is also seen in area-wide initiatives. A comprehensive analysis of a combined strategy to reduce single-occupancy commuter trips into the Lloyd district, just outside the urban centre of Portland, Oregon is reported in Bianco (2000). The programme involved, as major elements of a package of TDM, the introduction of priced on-street meters and the availability of discounted transit passes. A before and after survey of 1000 employees found the principal behavioural shift to be a reduction in commuters driving alone (7%) with drive alone now forming 56% of the total commute trips and an increase in car pooling (38%) with car pooling now forming 17% of all commute trips (*Ibid*). Public transport mode share was reported to have experienced a slight decline although the validity of this result was questioned due to the limited sample of public transport users.

The TCRP review also examined changes to parking charging differentials. Fee surcharges or increases in prices for commuters were "found to decrease peak accumulation or reduce long-term parking by some 20 to 50 percent… much of the impact observed as a response to such strategies is often attributable to shifts in parking location or behaviour rather than changes in mode or travel demand" (TCRP, 2005, p13-5).

Less evidence is available on observed responses to excess-time, particularly the time taken between parking the vehicle and the final destination for commute

[2] Higher elasticities often correspond to site specific elasticity estimates where other parking options were available as a substitute. The determination of sound price elasticity estimates are also further complicated by the application of other supporting public transport measures as part of a package.

trips. A 1960s study of 111 cities in the US found that individuals parking for over 5 hours walked on average between 420 feet and 900 feet to access their CBD destination (TCRP, 2003). Taking a conservative estimate of an average walk speed of 1.5 miles per hour this equates to a walk time of between 3 and 7 minutes to access work, with the time tolerated increasing broadly with the size of urban area. However, these figures are likely to be substantially skewed by the large numbers of workers that are able to park on-site with low walk times. In a study of commuters in a CBD in Haifa, Israel, Shiftan (2002) reports 47% of auto users walking up to 5 minutes, 39% walking between 5 and 10 minutes and 14 percent walking over 11 minutes.

Rye, Cowan, and Ison (2004) examined the potential impacts of expanding the controlled parking zone around the city of Edinburgh, Scotland. Streets within a mile to a mile and a half radius of the city centre have been part of a controlled parking zone since 1974. Residents buy permits to park with other on-street parking in the area being pay and display. A survey of uncontrolled parking areas closest to the city centre (a 20-25 minute walk) found that "an average of 28% (and in some areas up to 42%) of those parked during the daytime arrived at around 0830 and left around 1700-1800, indicating that they are likely to be commuters" (*Ibid.*, p3).

Respondents to a questionnaire were asked about their likely response to an increase in zone size of 0.5, 1 and 1.5 miles. The responses suggested reductions in the proportions seeking a free on-street space of 26.5%, 69.4% and 75.5% respectively. Although based on a small sample, the study concludes that the size of the expansion of the zone is therefore critical. An expansion of 0.5 miles had a fairly limited effect on behaviour and would, in all probability, move the problem 0.5 miles further out from the city. The evidence does suggest however that some commuters are prepared to walk substantially further than previously considered to take advantage of free parking.

Given the difficulties of identifying the full range of responses of drivers to changes in parking supply and pricing, a number of studies have adopted a stated-preference or stated-response approach to determining the trade-offs individuals make when parking (Axhausen and Polak, 1991; Shiftan, 2002; Golias, Yannis and Harvatis, 2002; Lee et al., 2003; Guan et al., 2005). Such studies are themselves limited by the range of choices that can be offered to respondents (Axhausen and Polak, 1991). Despite the differences in methodology and sampling some common findings emerge from the observed and hypothetical approaches, namely:

- The principal choice options facing commuters are to change parking destination, mode of travel or departure time (Shiftan, 2002)
- Walking time to the destination is valued more highly than search time for a space which in turn is valued more highly than in-car access time (Axhausen and Polak, 1991)

The stated preference approach also highlights interesting differences between segments of the population that park with shoppers exhibiting different behaviour to commuters (discussed further below) and those that consider parking illegally

behaving differently to those that do not (*Ibid.*). The evidence base is however too thin to usefully generalise here.

In summary, a shift in parking location appears to be the primary behavioural response of commuters to parking restrictions. This underlines, as was the case in Portland, the need for an area-wide strategy if the problems are not simply to be moved elsewhere. The reported evidence on willingness to walk to take advantage of free parking spaces is surprising given the identification of the importance of out of vehicle costs in the mode-choice decision. This requires further investigation as it is critical to the consideration of the potential zone of impact of parking policies. One explanation could be the existence of a minority of drivers who feel constrained to drive and for whom the journey with a long walk still outweighs the best public transport alternative (for example those involved in trip-chaining) or for whom the walk is seen as a positive part of their journey.

Modal responses vary significantly from site to site. A shift to car pooling appears to be a particularly important response, at least in a US context. Any switch to public transport is highly context dependent and interlinked with the degree to which car pooling is viewed as a viable option. Where parking pricing and supply changes have been introduced as part of a well co-ordinated package of travel demand management measures, the shifts to public transport can be impressive (TCRP, 2005). Bringing forward departure times from home would appear to be the most limited response for commuters except at the margins for those in pursuit of free spaces or for parkers that pay for a 'license to hunt' rather than for access to a guaranteed space (Rye and Ison, 2005).

The responses discussed above would appear to suggest that city centre parking policies are unlikely to deter people from seeking to work in central areas, particularly when the accompanying public transport options are good. Are restraint-based parking policies likely to deter (non-retail) businesses from locating in urban centres thus conflicting with regeneration objectives? A recent review of the importance of transport in business' location decisions concluded that the following factors were seen to be most important:

- "the quality and scope of the physical and business infrastructures;
- Factor cost and supply, especially labour;
- Institutional infrastructure and networks;
- A 'culture' supporting 'civicness' and entrepreneurship;
- Indigenous company growth;
- Agglomeration economics;
- Technological development;
- As well as more social factors such as climate, lifestyle, image and crime rates." (McQuaid et al., 2004, p2)

McQuaid et al. confirmed the findings of other research which suggests that transport considerations become important at the point when the decision to re-locate has been taken rather than as a primary motivating factor for the move (Nelson et al., 1994; Gerrard, Still and Jopson, 2001; Scottish Executive, 2002). A survey in three historical cities in the UK (York, Cambridge and Nottingham) found that just over 19% of businesses were considering relocation principally

due to expansion, the need for newer premises, consolidation of existing sites or building leases being up for renewal (Gerrard et al., 2001). All 152 businesses in the sample were asked to state the "key influences on any future location choice subsequent to the decision to move having been taken" (*Ibid*., p1996); the results are shown in Table 2. The study also looked at the extent to which various characteristics of locations affected the propensity to consider relocating and found that "Perceptions of acute transport problems" added no significance to the model over and above other "general location-related effects" (*Ibid*., p1997).

Table 2: Factors influencing location choice (Source: Gerrard et al. 2001)

Factor	Percentage of businesses indicating factor as key influence on location choice
Road links	16
Staff parking	15
Lease or rent costs	15
Proximity to market or client	12
Customer or visitor parking	11
Proximity to labour supply	11
Rail or bus links	6
Proximity to goods or services	5
Traffic noise	3
Proximity to competitors	3
Air quality	3

van der Schaaf (2002) reports on a major implementation of city centre parking restraint in Amsterdam which forms part of a large area-wide mobility management plan. Most of the area inside the inner ring road is now subject to significant parking restraint. Car mileage in the historical core has reduced and public transport trips to the centre have increased. However, van der Schaaf notes that the congestion problem has migrated to areas outside the ring road due, in part, to the absence of strong land use policies and parking restraint in these areas. It is suggested that some employment has left the urban core for the periphery (*Ibid.*) although empirical supporting data is not provided and this phenomenon may be the result of the other non-transport factors described by Gerrard et al. (2002). There is also evidence that strict maximum parking standards in inner areas do not drive businesses out of city centres. Enoch (2002) describes a number of examples of parking cash-out type schemes applied in a UK context. The Orange telecommunications company recently relocated its offices to central Bristol and was allowed only 105 spaces for 700 staff. Staff that worked at the previous office were offered a four year package to give up their car with £1200 being offered in year one (reducing by £300 per year). The company budgeted for over 400 workers to give up their cars in year one (*Ibid*.). Further discussion of parking standards can be found in Shoup (2005a).

The evidence on the impact of parking (and other demand restraint) policies on business location decisions is weak. Integrated transport demand management strategies at a site and city level can do much to offset the impacts of reduced spaces or increased charges. A key factor in demonstrating the success of a

strategy to business would appear to be an improvement in the accessibility of the workforce (and potential workforce) to the site of employment. However, as the Amsterdam example suggests, the city centre policies must also be consistent with those put forward outside the urban core if issues of outward migration are to be avoided.

Parking for other commercial and leisure uses

This section reviews first the relatively limited evidence on the behavioural response from non-commuters and then looks at the more macro level evidence of the impact of parking policies on urban vitality.

Hensher and King (2001) conducted a stated preference study of casual visitors to the CBD in Sydney. They note that there is a "dearth of information, locally, nationally and internationally" to responses to changes in parking pricing, supply, security, access rules and in particular on their decision to select the retail centre to visit (*Ibid*., p177). In the study, different options were presented to respondents on where they might park (close in, on fringe or outside CBD), whether they would park and change mode, change mode or not travel to the CBD at all. A range of parking prices was presented to the respondents for the close in, fringe and outside CBD options as were a range of curfew options (after 06:30, after 09:30 or 24 hour parking). Different walk times were also assigned to the alternative parking options. The results are based on around 660 responses, around 200 of which were public transport users on the day. A nested logit model was constructed of mode and parking choices.

The implied parking price elasticities (i.e. a 1% increase in the hourly parking rate leads to an X% reduction in the probability of choosing to park in a given area) were as follows:

- Centre of Central Business District -0.54
- Elsewhere in CBD -1.02
- Outside CBD -0.48

Increases in tariffs would lead to a noticeable relocation of parkers from close in to elsewhere in the CBD. Other, more price sensitive parkers (already parking elsewhere in the CBD) have a greater tendency to park further out or shift to public transport use. Under all of the scenarios examined, there was very little reduction in the total number of journeys made to the CBD. The elasticities with respect to price are high. The authors conclude that "In general there is high sensitivity to parking prices, far higher than one finds for in-vehicle cost and even travel time in mode choice" (p191). A study in Cambridge (UK) reported on by Bain (2002) also found a willingness to trade-off convenience for price but low elasticities with respect to the numbers of individuals choosing to travel by car.

A stated intention study of non-work trips in Haifa, Israel (Shiftan, 2002) examined the results of parking price and walk time as shown in Figure 1. The parking prices shown are absolute prices relative to a fee at time of survey of survey 3.7 New Israeli Shekels (NIS). The walk time was used as a proxy measure for reducing the supply of spaces.

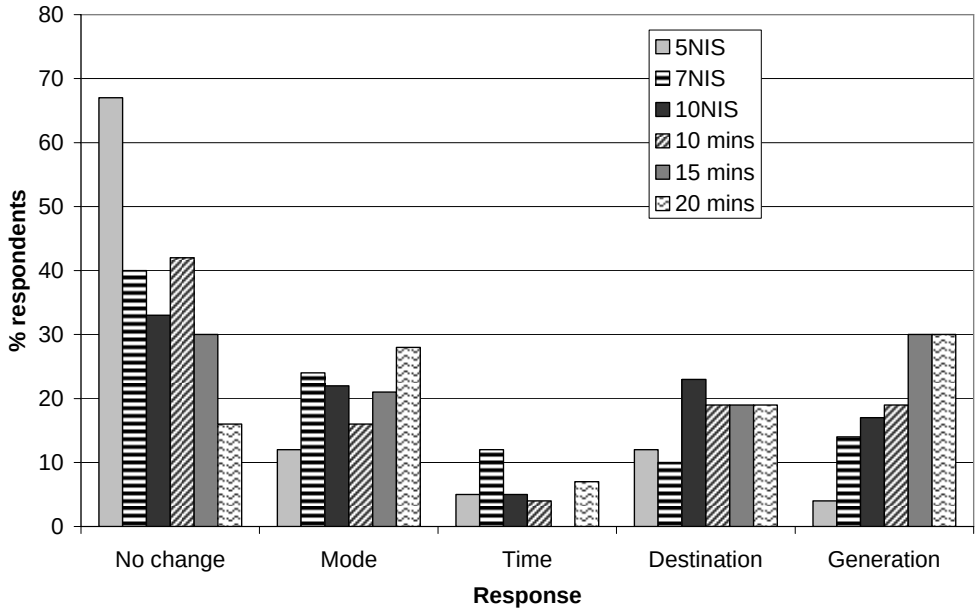

Figure 1: Responses to parking pricing and supply changes in Hiafa (Shiftan, 2002)

There is a far greater stated range of responses to parking pricing increases and supply restrictions from this non-work sample than form the corresponding work sample. Again, a greater stimulus to change behaviour appears to be provided by the supply restrictions rather than through pricing (although the study did not examine the details of how pricing changes would affect parking location choice within the centre). Under all scenarios substantial proportions of respondents indicated that they would either change destination or not make the trip at all. This finding contrasts with that of Hensher and King and Bain, perhaps because of local differences in the quality of the offer of competing destinations or, because respondents in Hensher and King's study were trading off between competing parking locations as well as between modes and whether or not to make a trip. However, even limited indications of destination change and reduced trip making as responses to parking restrictions is highly politically sensitive. In the UK for example it is explicit that parking restraint policies are introduced 'in ways which support the vitality of town and city centres and do not result in dispersal of development' (DETR, 1998, chapter 4).

Still and Simmonds (2000) reviewed the empirical and modelling evidence on the relationship between parking restraint policies and urban vitality. The study did not find substantial direct evidence of the impacts of parking policy on land-use as such responses are only likely to be seen in the long-term and "parking restraint policies have not been previously implemented with consistency and longevity" (*Ibid.*, p291). The authors found that "behavioural and attitudinal studies tend to conclude that strong relationships exist (between parking provision and economic vitality). Aggregate statistical studies on the contrary find only a very weak relationship" (*Ibid.*, p313). Modelling work conducted to augment the study suggested that where strong parking restraint is introduced in the city centre but not elsewhere in the city this can have negative impacts on the city centre.

Despite the prominent concerns of the impacts of parking restraint on urban vitality, little evidence exists to support such concerns. In the UK, the survey by Lockwood of town centre competitiveness examines the extent to which retail store sales are growing with respect to inflation or declining (growth below inflation). In 2002, this survey also included measures of the availability of parking spaces (spaces/1000sq m. of gross floor space), their convenience (% within 5 minutes of centre), price and % managed by pay and display (businesses strongly expressed a preference for pay as you leave type systems) (Lockwood, 2003). The survey considers five different types of centre: district; sub-regional; regional; major regional; and major city. The results for the economic performance of district, sub-regional and regional centres are shown below in Figures 2 and 3 plotted against parking spaces and convenience. The vertical bars represent the difference between the percentage of shops with growing and declining sales with a bar above the x-axis representing net growth.

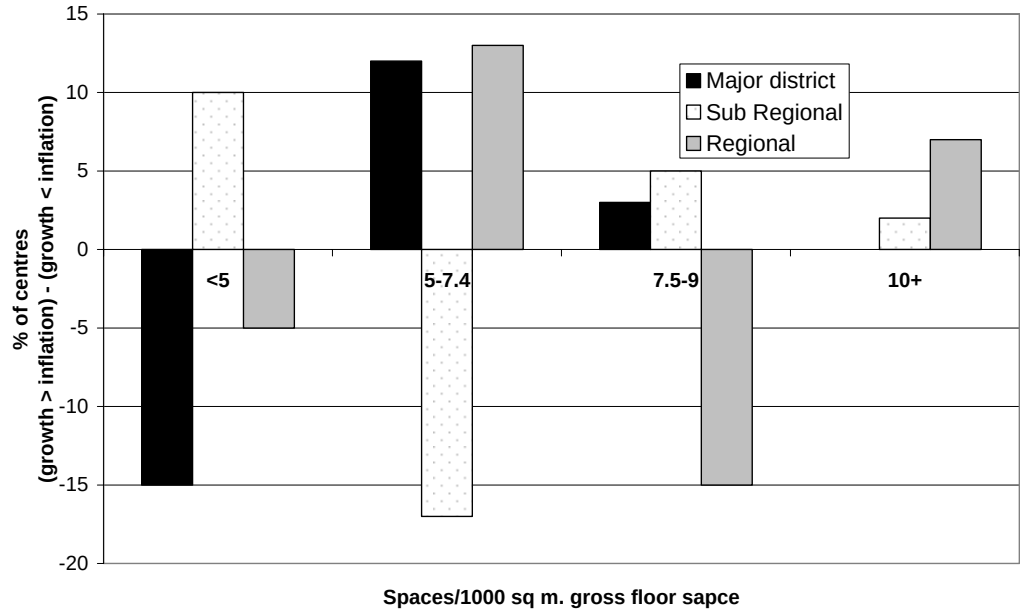

Figure 2: Parking spaces relative to development size compared to economic performance (Source: Lockwood, 2003)

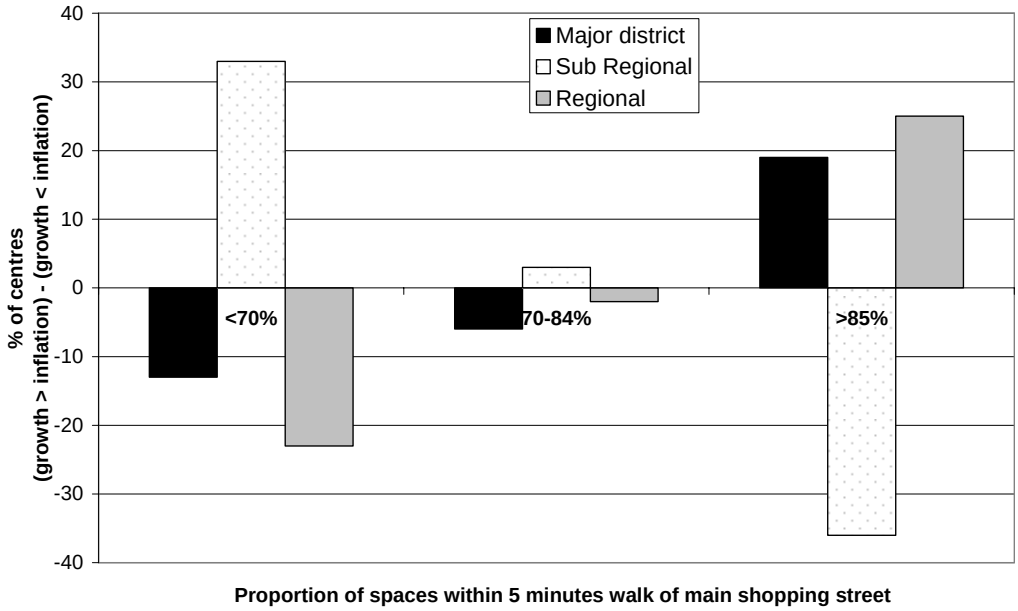

Figure 3: Percentage of convenient parking spaces compared to economic performance (Source: Lockwood, 2003)

Lockwood presents the analysis for the three types of centres separately and uses the charts to make recommendations about the optimum level of provision, convenience and charge for the different types of centre. Presenting the data for the three different types of centre alongside each other shows however that there appears to be no systematic relationship between the provision and convenience of parking spaces at different types of urban centres and their economic performance. This is consistent with other studies of economic vitality and parking in the UK (Sanderson, 1997; Kamali and Potter, 1997). Space constraints preclude a more detailed analysis of other aspects of the Lockwood study but evidence is also presented of the negative impacts of new out of town shopping provision on competing regional centres. Out of town centres are typically characterised by good road access with ample free parking.

The responses of non-commute drivers are similar in nature to those of commute drivers with the additional ability to modify parking duration to limit charges. Drivers seem most likely to trade off price, convenience and duration of parking when seeking a parking space and express a willingness to change mode where this is available, before seeking an alternate, and presumably less preferable, location. There is no systematic evidence to suggest that either lax parking standards encourage or that strict standards discourage economic growth. Further work is required to investigate the link between the quality of the retail offer, the accessibility of the retail centre by all modes and the parking restraint policies.

There is a perception that visitors to town centres by car spend more and are therefore critical to the strength of the urban centre. In London, a survey of over 3000 people visiting 11 shopping centres taken to be broadly representative of sites in central, main suburban and smaller suburban centres was undertaken. It found that whilst car drivers spend £64 per week on average, bus users spend £63 per week whilst those who walk spend £91 per week (Sharp, 2005). Although the disposable income of a typical bus user in London is higher than that found in

other cities in the UK the results at least present a challenge to the orthodoxy that providing good car access is the main factor in encouraging shopping in an urban context.

Residential Parking

The debate on residential parking concentrates on whether and where to provide off-street parking and how this provision should relate to demand. Research in North America has highlighted the extra costs that requirements for the provision of off-street parking, to at least minimum standards, have on housing costs and on the resultant social inequity that these extra costs bring to non-car owning households (Shoup, 1995; Jia and Wachs, 1999; Litman, 2004). In the UK, as part of a planning approach to encourage greater use of public transport, national guidance now recommends a maximum level of off-street parking provision for new houses of 1.5 spaces per house over the whole authority plan area. Those locations with better public transport links should have lower levels of provision. There are no legislative barriers to the development of car-free housing but very little has been constructed. This section examines why this might be and what impacts the continuation of current residential parking policies are likely to have in the future. The management of residential parking has been highlighted as a priority area of concern to transport planners particularly in inner-city and some suburban areas (Balcombe and York, 1993; Topp, 1991).

Table 3 gives an estimate of the way in which the UK fleet of 27 million vehicles is currently stored overnight. Table 4 shows the breakdown of the expected source and storage pattern for the extra 12 million vehicles forecast by 2030.

Table 3: Current patterns of overnight vehicle storage in UK (Source: RAC Foundation, 2004)

Where parked	**London %**	**Other urban %**	**Rural %**	**All areas %**
Garage	15	24	30	24
Private property (not garaged)	40	48	55	49
Street	42	24	12	23

Table 4: Overnight parking for extra vehicles by 2030 in UK (Source: RAC Foundation, 2004)

Parking for additional cars in 2030	**Additional cars Millions**	**Parked off street Millions**	**Parked on-street Millions**
New households	5	5	-
Households acquiring first car	4	2.4	1.6
Additional cars in household	3	1.8	1.2
Total	***12***	***9.2***	***2.8***

The research assumes that all new residences have adequate off-street parking to house all new vehicles so, to some extent, this represents a least worst estimate for on-street parking requirements. Assuming 6m parking allowed for each vehicle this would suggest a further 16800 kms of available kerb length required for parking in existing residential areas.

Balcombe and York (1993) examined parking behaviour at eight sites in the south of England that were experiencing parking problems in the early 1990s. All sites reported at least 10% of car owners normally parking more than 50 metres from the home with this being above 30% at three sites. The constraints on availability of parking spaces had several impacts. First, the distance that vehicles were parked from the home appears to deter the purchase of better vehicles with between 22 and 54 per cent of residents saying they did not buy a better vehicle due to fear of vandalism (*Ibid*., p10). Concerns over losing a parking space and the inconvenience of finding another also appears to deter car owners from making some trips, particularly shorter trips by car with "over 50 per cent of owners at the six older sites stating that they occasionally walked instead of using their car in order to reserve their parking space" (*Ibid.*, p10). Some substitution of car trips by public transport trips was also recorded although to a lesser extent. Figure 4 shows interviewees stated responses to an increase in parking congestion.

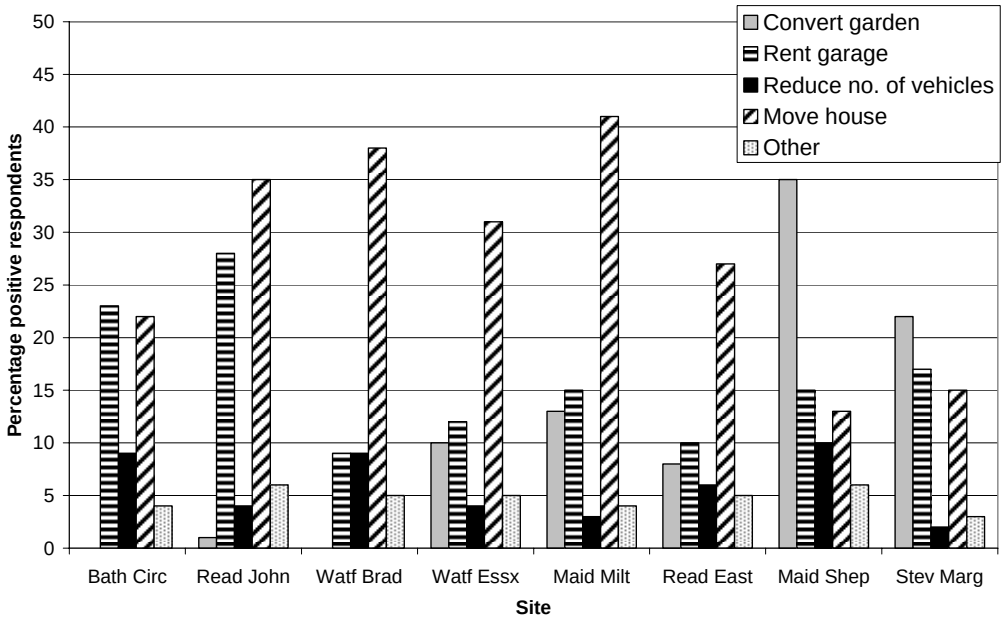

Figure 4: Responses to increased parking congestion (Source: Balcombe and York, 1993)

In most sites, the most likely response was to consider a house move. Between two and 10 per cent of respondents suggested they would reduce the number of vehicles held by the household. However, elsewhere in the interviews at least 10 per cent of residents were, at the time of survey, considering acquiring an extra vehicle. Five of the study areas already had parking restrictions in place for non-residents. It appears that whilst supply side restrictions alone have some restraint impacts, they also give rise to unwanted side effects such as degradation of the street environment and potentially act as a contributory factor to future relocation decisions with a push to suburban areas with greater parking provision.

Stubbs (2002) reports on the conflict between rising car ownership levels and urban planning aspirations that seek to provide maximum parking standards. Research conducted on behalf of the government department with planning

responsibilities found a perceived conflict between the design of housing with restricted parking levels in order to provide more livable communities and the consequent risks of on-street and fly-parking (ODPM, 2002).

The decision about how much car-free parking to provide is driven partly by an understanding of consumer perceptions of the attraction of off-street parking provision. Stubbs surveyed a small sample (47) of residents of South East London to determine their preferences on housing design and parking provision. Faced with the option of having their current property with extra living space provided instead of a garage, 83 per cent of respondents indicated that this would detract from the value of their property compared to 17 per cent that thought it would add value (Stubbs, 2002). 24 per cent of respondents thought they would drive more in the coming two decades, the same as thought that they would drive less. Despite this, 46 per cent of people would buy a house with more parking provision if they moved now with only 1.7 per cent buying one with less (*Ibid.*). Stubbs concludes from his review and survey that "…occupiers are reluctant to give up car parking provision. Even if they do not own a car…, the possession of a space is important in their perception of property value or investment. In similar vein, they may be frequent consumers of public transport, but still require the option of car ownership, with its associated benefits in terms of convenience and lifestyle." (*Ibid.*, p234). This is somewhat of a generalization given the limited sample however, both of the studies discussed above point to the need for better understanding of consumer motivations in house purchasing, including greater understanding of the segmentation of the market.

The absence of adequate parking provision in the existing housing stock does not appear to have a substantial limiting factor on the rise in car ownership. The exception to this occurs in parts of London (Whelan, 2003), an effect which is clouded by the high quality public transport alternatives and higher levels of congestion that are less likely to exist elsewhere. Supply restrictions have benefits for the design of more compact and livable urban developments. However, by themselves they appear to be an ineffective tool as they can generate substantial overspill on-street parking problems that detract from the quality of the local street environment. If supply-side restrictions alone are not sufficient then parking restraint policies will also be required. Current residential parking restrictions are typically established to manage commuter or event parking by non-resident commuters and therefore do little to address the pressures described above. The two principal barriers to tackling residential parking policies are enforcement costs and community acceptance. The former can increasingly be tackled by new technology. The latter might usefully be addressed through consultation where at least a common view on the existence of a problem should be possible to establish.

Conclusions

If the conflict between restraint policies and regeneration is a major cause of pragmatic politics rather than transport objectives dominating the setting of parking policies (IHT, 2005) then, this relationship needs to be understood. This paper has reviewed the behavioural response literature and the wider literature on the impacts of parking policy on the local economy. As with many previous reviews on parking, this review has found that the published evidence base is not

as strong as it should be. However, enough evidence exists to challenge the orthodoxy that exists amongst decision-makers that parking restraint will discourage economic development.

Commuter parking policies are rarely implemented in isolation. Where, a package of alternative options and new or improved transport alternatives are introduced alongside changes to parking supply or price substantial mode shift has been achieved. Access to the right mix of skills from within the labour market is essential to business. Such accessibility can as well, if not better, be provided in city centres for many industries as on out of town developments as practical experience demonstrates. Greater integration of social data, transport provision and spatial information is now possible and should be used to promote the accessibility impacts of alternative restraint and location policies to different sectors of the employment market.

The evidence base continues to confirm that out-of-pocket costs (fees and walk time) are more important to drivers than in-vehicle costs. Despite the observed sensitivity of drivers to increased walk time, there is evidence of unexpectedly long walk legs from free parking spaces being made indicating that the migration of parking problems will occur unless restrictions cover a wide area. As would be expected, restraint based policies in the urban core whilst lax parking standards exist in edge of town sites acts against the effectiveness of the city centre policies.

Drivers making leisure and shopping trips have a far greater range of options available to them to respond to parking restraint policies than commuters. These include reducing frequency of visits and changing destination as well as altering how and how long they visit a centre for if they still decide to go. The concerns that exist about the potential loss of trade to competing centres must have some foundation. People trade quality of offer against cost and convenience across many parts of their lives and large out of town centres have been observed to impact on city centre shopping in the period following their opening. Urban policy in developed countries is focusing on promoting town and city centre redevelopment so concerns about the impact of traffic restraint policies on competition between adjacent urban centres are at the forefront of political concern. It is surprising therefore to find that those studies conducted to date fail to demonstrate any clear effect of the impact of parking standards or prices on commercial vitality at an aggregate level. This suggests that parking policies may be of lower importance in determining the choice of centre to visit than other factors. The degree to which this statement is true will depend on the similarity of the quality and breadth of the retail offer between adjacent centres.

Residential parking policy suffers from the biggest dearth of research evidence. In many cities there is rising pressure on on-street parking spaces, particularly in areas with large amounts of housing constructed before the 1950s when car ownership began to rise sharply. There is a lack of clarity over the degree to which minimum and maximum parking standards should be applied. Over application of minimum standards disadvantages those with no need for a parking space whilst under provision in areas poorly served by public transport produces unwanted overspill effects. The interaction between parking standards,

resultant residential density and the viability of alternative modes of transport needs to be understood.

Parking policy will rise in importance over the coming decades as car ownership continues to grow. Even if road user charging is introduced in a small number of urban areas, effective parking policies, although different (ALG, 2005), will be required. Several areas requiring further research have been identified:

- The importance of out-of-vehicle costs and in particular walk-times on parking behaviour. Within this, greater attention should be paid to the segmentation of the parking market;
- Understanding the zones of influence of parking restraint policies, particularly for commuter traffic;
- The importance of the quality of the retail offer, public transport accessibility and parking policies in determining retail destination choice at a disaggregate level;
- The impacts of restricted residential parking on short-term transport adaptations and long-term housing location decisions;
- Evaluation of the impacts of residential new-build parking standards on mode choice.

We do not understand nearly enough about how individuals respond to parking policy interventions nor how these responses interact with local circumstances, the availability of alternative transport modes or alternative destinations. A continued failure to take on the research challenges in this area will surely see increased degradation of the residential environment and further imbalances in supply and demand in a variety of locations for work, shopping and leisure trips. Parking policy may not be theoretically appealing but it is practically essential.

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