Pricing accessibility

(Urban form, missing markets and the efficient allocation of property rights over shared urban resources)

Urban Buzz Position paper

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1. The problem summarised

Urban design has had a renaissance in recent decades. This has something to do with the scale and quantity of redevelopment opportunities in cities around the world – in the revitalised cities of the developed world and in the emerging economies. It also reflects rising incomes, changing demographics, new options for urban living, re-structuring of the property industry, shifting professional roles and many other influences. Urban design happens at a variety of scales – individual sites, streets, neighbourhoods, infrastructure projects, whole cities. At any of these scales, the benefits of good design spill over to a wider set of individuals than those with a direct interest in the project – land owners, developers, financiers, consultants and government officials. Indeed, urban design becomes an issue precisely because of these wider benefits. So we would like, in principle, to maximise the quantity of well designed urban form. One way of achieving this would be to attach a price to it. How to do this is not straight forward, however. Well designed urban form is what economists call a public good. It is consumed by a large number of people and therefore is difficult to price. The discussion does not have to stop there, however.

The purpose of this paper is to take the argument as far as it will go in various directions. To facilitate this, I convert the idea of well designed urban form to the idea of accessible urban form. *Accessibility* is a somewhat easier concept to deal with. There is a well established scientific literature to draw upon – in the fields of economic geography, spatial economics, spatial analysis and geo-computation. The term has a singular common sense meaning; and when applied to urban social science, breaks down into a small number of more specific and well-define concepts.

So I take as the principal question of the paper: can accessibility be priced?

Accessibility – proximity to benefit-enhancing resources such as people, firms and natural resources – develops naturally as cities evolve spontaneously. It is also shaped by design. It is central to the tasks of spatial planning and urban management at all scales. Architect-planners and urban designers optimise micro-level accessibility - typically but not exclusively pedestrian accessibility - when they design the spaces

between buildings. At the city scale, regulatory land use plans and visionary spatial strategy plans optimise an unwieldy mix of accessibility parameters. They minimise journeys to work, distance to schools and distance to open spaces. They maximise the stock of green infrastructure, the number of people living near transit nodes and the synergies between land-uses. Accessibility is one of the few ideas that can help us abstract the complex practical processes of urban design and place-making. In lay terms, something is accessible if it is within reach. As a design and performance parameter of a city, it concerns the efficiency with which people interact with each other as they go about the tasks of consuming and producing things. As an abstract noun it is deceptively simple in meaning.

As a real world phenomenon it is not simple, however, since different people want to be near different things. Much of this paper is concerned with exploring this premise. It starts with a simple abstraction, treating accessibility as an unproblematic performance parameter. The bulk of the paper then elaborates the abstraction before returning to it in the concluding section.

Why would we want to price accessibility? To answer this, consider what a price is. A price is an exchange value. It reflects the value a producer is prepared to sell at or the value a buyer is prepared to buy at. The *floor price* for a plot of land is the minimum exchange value a seller is willing to receive in compensation for giving up property rights over that plot. Its *ceiling price* is the maximum value a buyer is prepared to bid to obtain the rights. The actual price paid by a successful bidder usually lies somewhere between floor and ceiling price, depending on the kind of market at the time of bidding.

In a buyers' market with a glut of houses for sale, a buyer might secure a property at the vendor's floor price. In a seller's market where many buyers chase a few purchases, buyers might have to extend to their ceiling price to clinch a deal. Ceiling and floor prices are both set in relation to what economists term opportunity cost. A vendor will give up ownership of a landed asset (or any asset) if the value of the buyer's bid yields greater benefit than the vendor would achieve through retaining the asset. This involves a comparison of the alternative uses to which the money on offer could be put. Similarly, a buyer will give up ownership of cash if the value of the

landed asset bid for is greater than the benefit derived from the cash when invested in some other way (left in an interest-earning bank account or invested in the stock market for example).

A price is therefore a mediator or signal of value. It signals the benefit of a commodity to both parties in a transaction. If accessibility could be priced, it could be allocated more efficiently. Pricing could recover the costs of accessibility enhancing infrastructure investment and lead to the supply of more accessibility when it is needed. When it is not needed, pricing would reduce wasteful investment in public goods and services. If accessibility within a master plan could be priced, its designers could more readily maximise the value of the plan and weigh objectively between alternative designs. If there were a more explicit link between the benefits and costs of particular infrastructure investment, then more citizens would have more choice and a greater degree of satisfaction with their living and working environment. Where accessibility is priced, more efficient patterns of land use will emerge over time – meaning that there will be fewer unrealised gains from trade in buying and selling land and from changing the location of a business or a home.

2. The role of markets

To develop the idea further, it will help to be more explicit about the role of markets. Markets use prices to allocate society's scarce resources and they are particularly effective institutions in doing so. This is because they leave the decision making to individual buyers and sellers. Imagine how difficult it would be for the Mayor of London to decide how much each potential buyer and seller of every plot of land in the city values those plots. Centrally planned economies of the twentieth century attempted to organise social transactions in this way and they ultimately failed. Urban planning has sometimes courted an equivalent deception – that the optimal land use pattern of a city can somehow be discovered and produced by centralised specialist knowledge. The fatal flaw in this approach is that no amount of central objective intelligence derived from surveys, modelling and evaluation can substitute for the local subjective knowledge of individual buyers and sellers of land and properties when making decisions about how best to use land.

There is a limitation to this logic, however. It is true from the point of view of the parties to a transaction but not from the perspective of third parties – individuals who bear some cost (or some benefit) as a result of the private transactions of others. I deal with this caveat later when considering externalities and public goods. For now, we should note that those charged with preserving the interests of the general public as cities take shape through land development and conversion, have a very particular role. This is to optimise the third party effects of private transactions (minimise the negative effects and maximise the positive effects). Minimising negative effects means designing physical and institutional solutions to reduce the costs imposed by one land user on another. Maximising positive effects means physical and institutional solutions that improve flows, synergise between land uses and increase the attraction and sustainability of cities and spaces within them.

Many professionals who help engineer urban accessibility hold an antipathy towards markets, equating markets with private interests and government with public interest. This distinction is only partially true and leads to a dangerous bias in the management of accessibility. We should never lose site of the fact that private transactions nearly always provide public benefits. A developer building apartments on an inner city brown-field site formerly occupied by a factory is organising the subdivision of ownership from one to many and increasing the stock of accessible living spaces. This provides wider benefits to the people who acquire rights to those locations as well as to those who employ them and supply services to them. Markets facilitate a mass process of social exchange by which many individuals meet the needs of many other individuals. Markets are, in this sense, benevolent. They are social institutions and price is the information signal that makes them work.

So price is an institution that decentralises decision making about the deployment of scarce resources. It allows individuals who possess knowledge about how to turn accessibility into profit, to meet the needs of others for greater accessibility.

Now return to the question – why would we want to price accessibility? The fundamental answer is that accessibility is a scarce resource. If it is scarce, it needs rationing in some way. Those who produce it – by investing in land, buildings,

infrastructure and services – need to know how much to produce, where, for whom and with what benefits. Ideally, investment costs should be matched with benefits arising – otherwise accessibility will be oversupplied or undersupplied. The former is wasteful since the resources could be invested in some other way to greater social benefit. The latter leaves gains form trade unexhausted and social benefits unrealised.

Typically government has assumed the role of organising the enhancement of a city's accessibility – by the planning of land use and infrastructure. Because of its information handicap compared to markets, however, urban planning has a notoriously patchy experience in getting this right. If accessibility could be priced, then a better fit between supply and demand might be achieved. Consider this in more detail by reflecting on the different kinds of demands that people place on accessibility.

3. Accessibility as a scarce resource

In what way can accessibility be said to be scarce? There is a geometric and an economic answer to this question.

Geometric scarcity

Geometrically, if the centre of a city is the point at which most transport routes converge then it is, by definition, likely to be the point of maximum accessibility. If people live in cities because of the benefits of exchange (preferring not to disperse through the land), then the location of greatest demand will tend to be the point of maximal connectivity. This tended to be the case in the industrial city, which was typically monocentric. The most people-intensive land uses tended to dominate these points of maximum accessibility – shops and craft manufacturing in the pre-industrial town; commerce in the industrial town (people being the main factor of production for commercial firms).

As a city expands, for reasons of geometry alone the amount of accessible land increases at a slower rate than does the amount of less accessible land. The geometric rule applies whether one thinks of accessibility in planar terms (measured by crow-fly

distance or by time) or in network terms (measured by the cost of traversing a road, rail, cycle or pedestrian network).

Extending the logic to the post-industrial city, sub-centres form and grow around transport nodes at all scales and within the field of influence of any subcentre, the area of more connected land grows more slowly than the area of less connected land. At all spatial scales and at all hierarchical levels in networks, the supply of more accessible locations is less *elastic* than the supply of less accessible locations. In other words, as a city grows outwards and upwards the rate of increase in locations with higher accessibility value will be lower than the rate of increase in locations with lower accessibility value. This is a natural law.

However, the relative rates at which these change – the *elasticity of supply of accessibility*, can be shaped by planning and design. But connectivity alone does not confer benefit. It does so by virtue of particular demands made of it. Consider, therefore, the *economic* reasons why accessibility is a scarce resource.

Economic scarcity

Geometric scarcity would have no significance if it were not for the fact that a city is made up of interacting individuals. It is the demand for social interaction – in economic terms, for cooperation via exchange – that gives human value to space.

If a city was populated entirely by contemplative monks with a preference for isolation, who could obtain the necessities of life by wandering out of the city to forage in the surrounding forest, then geometric centrality would have little economic significance. In fact, proximity to the urban fringe would be the most economically significant type of accessibility. A land market might emerge in which monks bid for better locations on the basis of time saved when travelling to the forest. Land values would peak on the urban edge and an urban planner employed by the monastic authority might design a donut shape city that gave an optimal balance between proximity to the forest (minimised) and distance between monk-cells (maximised). The donut's centre might also be planted to forest. Such a population is unlikely to choose to co-locate, of course. Or if co-location were necessary in order to secure the provision of basic necessities such as security and simple food, then a settlement

system of many small central places (fortified villages perhaps) is likely to emerge, not large cities.

In the real world, people and firms are attracted to cities because of scale economies – costs saved and benefits gained through numbers. Fundamentally, it is beneficial for individuals to live near other people because of pooled demand. Pooling demand for schools, buses, parks and other facilities leads to better quality facilities and more variety – economies of scale and economies of scope.

Larger clusters of individuals also tend to attract a greater variety of employers, so an appropriate job is generally easier to find in a city than in a small town and people in large cities will, other things being equal, tend to be out of work for shorter periods of time compared to their equivalents in small towns.

It is also beneficial for firms to co-locate. As a business strategy, it helps them secure technical inputs and labour more cheaply and more rapidly. Compared to an equivalent firm in a small town, a firm in a city will have access to cheaper and a greater variety of labour and have vacancies for shorter periods of time. Being in a city also allows a firm to acquire knowledge about production processes, inputs, products and customers. A city location reduces the costs of searching for inputs (labour and suppliers) and searching for customers (be they the individuals who work in the city or other firms).

The blessing of the city, and its underlying generative dynamic, is therefore it's so-called agglomeration economies: economies in production and economies in consumption. To the extent that access to other people confers general benefits regardless of their particular exchange needs, then geometric accessibility has general economic significance. Economic geography scholars have tended to call this *general accessibility* (Harvey J 1996, McCann P 2001) and it corresponds to the general network accessibility measured in *space syntax* and other network analytical formalisms (Hillier 1999, Penn 2003). To the extent that different groups of individuals need special access to particular kinds of other individuals, then the general value of connectivity becomes overlain with more specific patterns – *specific accessibility*.

Accessibility, the division of labour and the emergence of land use patterns

The reason why general (geometric) accessibility has economic significance is, as is implied by the illustration of the city of monks, the *division of labour*. In a primitive agricultural economy, the division of labour is coarse; households practice subsistence activities and there is minimal exchange. An economy grows by the division or labour into different economic roles. The reason for this is that knowledge and skill specialisation yields efficiency gains and raises the wealth of society. In anything but the simplest of subsistence agricultural economies, central places will evolve, being the locations from which specialised labour services are organised. These ideas have been well understood and formalised by classical and then neo-classical economists for over 200 years (see for example, Adam Smith 1776, on the division of labour and August Losche 1954 and Masahisa Fujita, Paul Krugman and Anthony Venables 1999 on the development of central places). Modern cities are characterised by an amazingly fine division of labour – as a thumb through a Yellow Pages directory will testify to. Each of London's 8 million residents is a cooperative economic agent who needs the specialised services of others. Many of them are producers as well as consumers, turning their own specialised knowledge into goods and services that meet the wants of others. Each individual has specialised tastes and preferences as a consumer and as a producer. These preferences are not locationally neutral. Space matters. London's residents each have a unique set of locational preferences determined by their unique combinations of consumer and producer attributes, values and demands.

Individually unique valuation of space does not lead to randomness in locational behaviour, however. Strong patterns in land value and land use characterise settlements of all types and sizes. The patterns are emergent phenomena, resisting and shaping the designs of city planners and evolving in interactive ways over time. Residents and firms sharing common characteristics tend to prefer similar locations because of their common valuation of accessibility. Consider the following examples.

Producers selling goods and services that can compete on attributes other than price, tend to cluster. As a strategy, clustering with similar producers, as shops do in a high

street, helps reduce the cost of searching for customers - especially customers who engage in comparative shopping. Differentiating very similar products by small differences in quality or variety allows for co-location without the risk of a price war. Sellers of products that cannot easily be thus differentiated tend not to cluster, preferring a dispersed set of locations. Fuel stations rarely co-locate for this reason, unless it is on opposite sides of a motorway.

Broad land use patterns emerge from differences in the specific value attached to accessibility, therefore. Finer regularities emerge too. Legal firms might cluster around a city's law courts or around a government agency that regulates company accounts. High-end shops cluster near the homes of high-spend customers and so on.

Similar households may be found at many points along London's Central Line tube route. Those working in the City and choosing to live in the neighbouring East End, trade lower commute costs for higher density living and higher unit land price (per square meter). Those City workers living around the leafy suburban stations beyond Woodford further along the Central Line to the east, trade a higher quantity of land consumption per capita and lower unit land price for higher travel costs. Such trade-offs show that different groups (distinguished by stage-of-life, age, income, ethnicity, values and tastes) place different values on a city's basic geometric accessibility. The seminal work on spatial trade-offs of this nature was done by the 19th century German economist von Thunen (1826) and later, in the context of modern cities, by William Alonso (1964).

Generalising, we can say that economic agents tend to seek to reduce the costs of transacting with particular 'others'. The fuel station operator seeks price insensitive customers and the place that minimises the cost of searching for this kind of driver is a location that is (a) on a busy road network and (b) as far away as possible from other fuel stations. Maximising accessibility to a particular customer base (or supplier network) is the flipside of minimising specific search costs. A relocating household choosing between neighbourhoods that are equidistant to a place of work on the basis of proximity to a good school, grandparents and a good riding school (the child is a rising equestrian star) are maximising a specific set of accessibility criteria. On the flipside, they are minimising the costs of 'transacting' with a specific set of 'exchange

partners' – those with whom they cooperate most frequently (including horse riding instructors, those who know how to manage a riding school, school teachers and school managers, parents with similar attitudes towards education, work colleagues of all types, and of course, the grand parents with whom they exchange social capital).

As a result of their accessibility-maximising (or transaction cost minimising) calculus, each individual places a unique valuation on the geometry of a city. A location tends to be occupied by the use that values it most highly. For most of the 20th century commerce tended to outbid industry in a city's most generally accessible locations because of the higher revenue per square meter that commercial operators could obtain there. From the 1980s onwards residential investors began to outbid office users for many central city sites because of the bull-market in apartments and the changing requirements of office buildings: expected yields on apartments exceeded current office rental yields.

The highest bidder does not always get the land because it may have made a successful bid in some other location. But as a general rule, higher bidding uses outbid lower bidding uses and thus cities develop morphologies of land use that reflect underlying patterns of demand for special accessibility. Special accessibility values can be measured by land values within particular market sectors and segments and can be understood to be 'interpreted' general accessibility. Technically, special accessibility is weighted general accessibility, with weights defined by the locational preferences of particular groups.

It is not only the highest money value that secures an accessible spot, however. If enough people value a location for some shared – typically recreational or symbolic - use, then provided that there is an effective mechanism for collective action, the 'public' use may prevail. Note, however, that if it were possible to add up the value placed by individuals on such a location, perhaps by asking people their willingness to pay to keep it or by organising a system of entry fees, then the total 'public' value aggregated over many thousands of individuals may well turn out to be as much as, or more than, some alternative commercial value as reflected in a private bid.

It is wrong, therefore, to think of shared space like parks and roads as not being subject to the same laws of demand and supply as privately consumed space. The difference is the information available to secure a balance between demand and supply. This takes us back to the question of pricing accessibility and leads us to the idea of public goods. But first, consider more generally, the means by which accessibility may be enhanced.

4. Enhancing accessibility

If accessibility is scarce, then we might expect that entrepreneurs would discover ways of increasing its supply. This does indeed happen and all cities can be said to evolve under the influence of entrepreneurs who specialise in creating and re-engineering accessibility. There are two ways in which this happens: by many individual spontaneous actions and by organised collective action (for a major treatise on the way cities evolve at the interface of these two very different dynamics see Webster and Lai 2003).

Spontaneously enhanced accessibility

By relocating, a moving household or firm changes the accessibility value of the city for other households and firms. A large polluting firm may catastrophically change land values. The impact of most individual movers on the value of land for others will, however, be marginal and imperceptible. But small changes under some conditions can trigger fundamental changes to a city's social, economic and physical morphology. Nobel Economics Laureate Thomas Schelling noted that even when individuals have a mild preference for living in neighbourhoods of similar people (tolerating heterogeneity so long as 'others' do not exceed, say, 49%), a small number of random movements can tip a whole city into extreme social segregation (Schelling 1971). Individuals start leaving a neighbourhood that has accidentally shifted to 50% or more 'others' and neighbourhoods start to homogenise.

Spontaneous homogenisation occurs through pull effects as well as push effects. Clustering households create special accessibility via market power. One more Polish immigrant moving into a neighbourhood adds to the demand for Polish food stores

which marginally raises the neighbourhood's economic accessibility value to Polish people (and to those who like Polish food).

Organised accessibility enhancement

This can be distinguished from spontaneous enhancement by its collective purpose, collective action and explicitly articulated joint consumption benefits. Enhancements may be organised by public or private sector agencies. A private company may build a railway, as many did in London in the second half of the nineteenth century financed from private equity, share distribution, loans and future ticket sales. A private-public partnership organisation may build a trunk road financed by toll fees - as many are currently doing in China. A municipal government may build a new school financed by local taxation. A home owners association may levy a special assessment on its members to invest in a landscape project on land collectively owned by residents. A leisure club may invest in a new swimming pool, financed by membership fees. An office developer may build a new public plaza as a condition of planning permission, financed from its development profit. A national government agency may designate land as a site of special scientific interest and prevent its conversion to an urban use. It may manage it on the basis of national taxation, hypothecated landfill tax or entry fees. The mosque in a poor squatter community in an African city may organise a low-cost water reticulation system on the basis of a mixture of user fees and charitable donations. All these examples involve an explicit collective purpose, joint consumption, collective action and collective payment. And note that the collective purpose may be profit-making for investors as well as non-monitory benefits for a group sharing some common interest. They all involve organised adjustments to the social and economic value placed on a city's geometric accessibility.

Making such adjustments is not without problems, however. The 'togetherness' that makes a city attractive is also something of a curse. The city has to pedal ever faster to keep going without falling off. Agglomerations of people and firms cannot live cheek-by-jowl without organising continual enhancements to accessibility; and taking collective action is costly. It is impossible to avoid costly collective action in cities: at least, if cities are to be sustainable. Even if everyone were to individually contract to secure their own urban infrastructure privately, there would still be a need for

collective action to coordinate these private actions. Without coordination, nuisance costs would spill-over from one person to another. There would be wasteful duplication of some facilities; under supply of others; and congestion. I explore these problems in the next two sections: first, introducing the idea of missing markets and then probing further the technical debate on public goods and externalities as modifiers of accessibility values.

5. Urban infrastructure, missing markets and collective action

The problem with accessibility-creating urban infrastructure is that it is shared by many people. Why should this be a problem? After all, individual ticketing can be an appropriate business model for organising a shared bus service. The problem is one of missing markets. A missing market exists where there is a demand for something but for some reason a market does not emerge to supply it. There can be many reasons for this, but in the end they all come down to an inability to assign (and trade) individual property rights.

Shared facilities are not a problem if they can be divided up in some way between the individuals who share them and individuals charged for access. If this is possible, a market can be created – as with bus tickets. The problem comes when individuals each consume the same facility (or more generally, resource) and it is not possible to subdivide property rights. In such circumstances individuals can be thought of as jointly consuming that resource. For example, the amount of pavement consumed by each of twenty households in a 200 meter long cul-de-sac is not 10 meters, it is the full 200 meters (or some substantial part of it). They each consume the total amount. Maintenance and re-investment in the pavement, road and landscaping that comprise the cul-de-sac therefore requires collective action. If there is demand for a new road surface, additional security, more and better-maintained landscaping or some rearrangement of rights to road space to make parking easier, then unless property rights are clarified, there will be a missing market problem.

The problems arising from sharing a street are typically solved either through local government taking ownership of the street, or through the creation of a resident's *club* (residents association or home owner association), which owns and manages the street via the collection of fees. The idea solving missing market problems via residential clubs is developed in Webster and Lai 2003 Chs 5-7 and Webster 2002. Note that the initial task of designing and building the road is typically achieved while the land is under unitary ownership (of a developer or landlord) prior to subdivision and that there is no missing market here. If the municipal government takes ownership ('adopts' the road), a missing market is replaced with a political market: residents have to lobby to try and secure their demands for environmental enhancement. If residents form a private neighbourhood association, so long as they can agree (a different scale of politics) they can solve the joint-consumption demand though the market, with the neighbourhood organisation, like the local authority, becoming a buyer in the market for road improvements.

It is clear from this example that the organisation governing jointly consumed civic goods is of crucial importance for their efficient provision. Organisations permit the legal constitution of shared rights and reduce the costs of collective action. To work, a collective organisation, be it a residents' association, local government or indeed a privately owned or joint stock company, will have to specify rules for the allocation of rights among its stakeholders. One of the most thorough analyses of organisational frameworks for collective action problems in cities is by the American economist Fred Foldvary (1994).

It stands to reason that an organisation set up for one kind of urban infrastructure collective action problem might not perform as well for some other kind of infrastructure. In Sections 7 and 8, I examine the specific problems and organisational solutions for a variety of missing market problems in cities. First, however, it will help to be more specific about the nature of the problems encountered as a result of missing markets.

6. Public goods, externalities and property rights ambiguity

Missing market problems are endemic in society but particularly in cities where many different types of people and firms locate in close proximity. Economists have traditionally defined two types of missing market problem: externalities and public goods.

Simply stated, externalities are the costs or benefits of a transaction conferred on parties other than those transacting – like the costs to society from car engine emissions or the customer volume benefits that an anchor store like M&S confer on nearby stores. Public goods appear in the economics lexicon as a way of recognising that some goods are intrinsically difficult to price because they are consumed by many people at the same time. If you think about it however, the public goods and the externality problem are essentially one and the same: amounting to a problem of ambiguous property rights. This is clearly an important perspective when considering the possibility of pricing accessibility. It converts the question to 'how can property rights over accessibility be made clearer?'

Conventionally, externalities and public goods are viewed as a problem of *market failure*; a view attributed to Arthur Pigou's seminal analysis of externalities (Pigou, 1932). The idea of market failure has provided the rationale for most of the functions and programmes of modern urban governments throughout the world. Markets over-supply goods that yield third party costs and under-supply or fail to supply goods that yield third party benefits. They over supply negative externalities and undersupply public goods (goods with positive externalities). Municipal governments therefore seek to regulate production and exchanges that yield social costs – land development, traffic movement, air and water quality, noise, street-trading, waste disposal – and supply goods and services that might not otherwise be in sufficient supply – social housing, open space, security, transportation infrastructure.

Externality and public goods problems may also be understood to be problems of underdeveloped institutions. They arise when resources have a value but there are no institutions to govern their allocation, or the institutions that do exist are inadequate to allocate without contention and wasteful personal cost. The idea of missing markets is

a special case of this general idea – i.e. in the absence of a pricing mechanism, rights to a scarce resource are likely to be inefficiently allocated. Inefficiency in this sense simply means that gains from trade are not exhausted.

Externalities

The first theorem of welfare economics, also known as the *invisible hand theorem* (after the Scottish philosopher Adam Smith), states that under conditions of perfect competition, market-based exchange leads to an equilibrium state in which all gains from trade are exhausted. Markets, in other words, can be shown under certain restrictive conditions, to be socially efficient in the sense that they allow individuals and society as a whole to concurrently maximise gains from trading property rights over resources. What is in the interest of individuals is also in the interest of society. Adam Smith stated this prosaically in the famous quote:

> *As every individual… endeavours as much as he can… to maximise his own economic wellbeing, every individual necessarily labours to render the annual revenue of the society as great he can. He generally, indeed, neither intends to promote the public interest, nor knows by how much he is promoting it… by directing… industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, led as if by an invisible hand to promote an end which was no part of his intention* (Adam Smith, 1776).

Perfect competition is not, however, a reality in many, if any, markets, particularly not in the markets for urban infrastructure and services that create and shape accessibility.

Several key assumptions need to hold in order to obtain the first theorem of welfare economics. First, consumers view the products sold by different firms in an industry as perfect substitutes so that firms have to compete with each other for customers. Second, consumers and firms are all price-takers, none being individually powerful enough to influence prices. Third, entry and exit of firms into an industry is unrestricted in the long run by start-up costs, regulation or other constraints. Fourth, information is perfect and symmetrically distributed to sellers and buyers such that all

parties to an exchange can weigh up all alternative uses of a resource. Fifth, transaction costs are zero, meaning that there is no friction of cost to inhibit the movement of resources to their highest value uses. Sixth, property rights are completely assigned, meaning that there are no resources valued (either negatively or positively) by society that are not priced.

The fourth and the fifth assumptions are essentially the same since transaction costs arise principally as a result of imperfect information. If consumers and producers can see into the future and have all knowledge necessary for perfectly efficient decisions, then there will be no transaction costs (costs of searching for customers and suppliers, costs of making and monitoring contracts and so on).

Arthur Pigou's critique of the invisible hand in *The Economics of Welfare* (1932) amounts to a challenge to the 'full assignment of property rights' assumption. Pigou argued that production and exchange invariably impose costs – and benefits – on individuals and firms not party to the production or exchange decisions. In the presence of externalities, private costs and social costs diverge and an equilibrium allocation of resources arising from private contractual market decisions may not, therefore, exhaust gains from trade. Compared to the 'perfectly competitive' neo-classical economy, the ubiquitous presence of externalities means that the market fails to produce an optimal allocation of society's resources. Pigou saw markets as failing, therefore, and proposed a corrective mechanism in the form of taxes equal to the marginal value of externalities – the cost imposed on society, or on some third party, as a result of one more unit of output. This, he proposed, would induce those responsible for generating externalities to cut back production or consumption to a socially optimal quantity.

Applying this to the question of how to achieve an efficient supply of accessibility, we might say, for example, that a *polluter-pays* tax or a fee can help achieve more efficient economic accessibility on a city's road network. With road pricing, congestion in Central London is reduced and the roads passing through it and the destinations within it become more accessible. Road pricing therefore has the effect of changing the value placed upon the city's geometric accessibility. Without road

pricing, central locations become relatively less accessible as places to work, shop, live and travel through.

The idea of a market-correcting tax implicitly recognises the property rights issue at the heart of the externality problem. A Pigovian pollution tax has the effect of pricing the unpriced. Clean air, rivers and road space are congested by unpriced use in a production process or in the course of consumption because those resources typically lie un-owned and up-for-grabs in the public domain. A Pigouvian tax imposes a price and, in effect, assigns a liability to a would-be user of a public domain resource. With the tax, use of the public domain resource has an opportunity cost and as a result, individuals react with restraint.

The traditional Pigovian analysis is not based on a full and balanced analysis of property rights, however. It is one-sided. An influential argument to address this problem was advanced by Nobel economics laureate Ronald Coase in his famous paper 'The problem of social costs' (Coase, 1960). Coase argued that Pigou's view is flawed because it fails to appreciate the reciprocal nature of externality problems and because it fails to understand the implication of full information and zero transaction costs. He pointed out that if transaction costs are zero, as assumed by Pigou and the neo-classical economists, then the generators and recipients of an externality would come to an agreement that balances their respective interests. With perfect information about the value of pollution to the polluted and about the value of polluting production to a producer, bargaining would lead to externalities stabilising at levels from which no further gains from trade are possible.

If the markets for building and using urban infrastructure and services were perfect, with perfect knowledge about external costs and benefits, then users and suppliers of accessibility would negotiate and accessibility would be perfectly configured. If there was perfect and costless knowledge about the impact of London's Cross-Rail (a long awaited new east-west underground line) on land and property values along the route, then property owners could be asked for a contribution that exactly equalled the net windfall benefit and land value expected from the enhanced accessibility of their locations. If the benefits of the Tube system to each London-based firm and household and indeed, to those across the UK, was known, then contributions could

be (costlessly) collected and a perfectly configured and perfectly maintained capital transit system created. The endemic and chronic underinvestment that has built up since nationalisation of the Tube system, would not have happened.

But it did happen and information about the wider social demand for the Tube is not perfect. Even if it were, the cost of collecting contributions is not costless. The result is that, like virtually all capital transit systems in the world (with the possible exception of some privately-run lines in Asian cities), a heavy subsidy is required to make the infrastructure pay. When the current private public partnership deal was being negotiated to reverse the decades of underinvestment in the London Underground, the public subsidy requirement was estimated at over one billion pounds annually.

The fictitious idea of perfect information and zero transaction costs is useful only to make the point that there are beneficiaries of urban infrastructure who have a demand (in principle would be willing to pay) but from whom it is technically, legally and economically impossible to collect payments. This is the problem of missing markets and in essence, it is a problem of undefined property rights.

Just as perfectly informed and costlessly interacting consumers and producers could bargain about the efficient supply of so called public goods, so could the producers and recipients of externalities. Coase noted in his 1960 paper that under Pigou's unrealistic perfect market assumptions, an efficient solution to so called externality problems would result whether producers have the right to pollute or whether the polluted have a right to be free from pollution. Where producers have unfettered rights to use public domain resources, third parties bearing the costs of externalities have an incentive to compensate producers to cut back production. This remains true so long as the cost of pollution to third parties arising from one additional unit of production is greater than the benefit to the producer of one additional unit of production. Perfectly informed residents in a leafy suburb of London who could costlessly negotiate with the trucking firms that degrade their high street with diesel, accident risk and damaging vibrations, could pay the firms to use another route. This would yield net benefit to the villagers so long as the payments were less than the value they placed on the externality problems. In this fictitious world, there would, in

fact, be no externalities. Residents would be able to price the reduction in economic accessibility created by trucking firms and for that matter by any other economic agents that impose nuisance costs through jointly consuming common resources (fresh air, views, schools, parks) with the villagers.

The same logic applies to the flipside of the symmetrical relationship between polluted and polluter. Where a producer's right to use a common resource is constrained by some form of institution such as convention or regulation, the producer will have an incentive to compensate third parties so long as his marginal gains exceed the marginal externality costs imposed on the third parties. Although a light industrial factory proposed on a site neighbouring a residential estate may reduce the economic accessibility value for the estate's residents, they may be happy to be bought off. If the payment compensates for any expected losses in house price and any nuisance value, for example from spoiled view or delivery lorries, then the accessibility reduction will have been perfectly priced.

Coase thus demonstrated that the equilibrium resource allocation arising from bargaining is identical, whichever way the property rights fall. Pigou was wrong: with perfect information, the market does not fail. With full information about the size and spread of social costs from private land investments, special accessibility would be perfectly configured.

It is an absurdity, however, to propose that information is anywhere near perfect in any – even the very simplest of - externality situation. The principal illustration in Coase's 1960 paper is a land-use spill-over problem: neighbouring cattle and wheat farmers consider alternative courses of action including paying and receiving compensation for trampled grain, erecting fences and shifting production to something else or somewhere else. Even in this simple agricultural parable, the assumption that each party has perfect information about its own and the other party's valuation of costs and benefits is unrealistic, particularly when the opportunity costs of alternative production processes and relocation are thrown into the calculation. In cities, externalities are everywhere and dense, and the possibilities for efficient voluntarily negotiated solutions to externality problems that involve complicated specificities, are limited. Most attempts will be confounded by the inhibiting

transaction costs of bringing together multiple third parties and multiple polluters. The problem of pricing externally-imposed devaluation or enhancement of a location's accessibility is particularly intractable when the third party beneficiaries or sufferers are geographically dispersed.

That leaves us with missing markets.

Beyond Coase's intellectual game with Pigou is his more profound insight about the importance of property rights. If information is incomplete or is not perfectly distributed and transaction costs are not therefore zero, then the outcome for any externality problem will depend on the distribution of property rights. In this situation, the state has a role to play. But more than that, it means that we should approach externality and public goods problems by asking questions about institutional design. Institutions (i.e. rules) have the function of assigning property rights. The question posed by Coase is what institutional arrangements can more effectively resolve a missing market problem? What organisational arrangement, what system of laws and rules and what kinds of contract might lead to a more responsive market in accessibility?

When faced with the task of improving accessibility in a city, at whatever scale and for whichever particular or more general set of users, it will be useful therefore to think about institutional design as well as physical design. The two should go hand in hand. Furthermore, both should be evaluated comparatively – in comparison with alternative physical and institutional designs. Just as an urban designer's street layout or a transport planner's route design is arrived at by comparison with many alternatives, the matching institutional design should be arrived at by comparison of alternative approaches to allocating rights over the shared spaces and facilities in the physical design.

In the last twenty years or so, there has been a healthy proliferation of institutional models for solving urban accessibility problems in the UK. Partnerships of all kinds have emerged. Urban planning is still dominated, however, by a presumption that government is the best agent for organising the collective action necessary to enhance urban accessibility. The mistake made is analogous to Pigou's. The market is deemed

to have failed by comparing some existing state of affairs with an imaginary idea and only government has the power to make the correction. The reality is that there are many alternatives ways of rearranging property rights to secure creative (and sometimes surprising) solutions to the scarcity problems that reduce the economic value of a city's natural geometric accessibility.

Following Coase's critique of Pigou, a vast literature developed debating the scope, technical definition and properties of externalities. It was another Nobel Laureate, Kenneth Arrow (1970), who conceptualised externalities as commodities for which markets are missing. His technical purpose in so doing was to facilitate analysis of joint-consumption problems using the tools of mathematical neo-classical economics. Apart from bequeathing the intuitive idea of a missing market, his approach did not lead very far, however.

Where it led was to the abstract practice of analysing equilibrium quantities of 'commodities' that are theoretically separable (one attribute of a resource is consumed as a private good, another as a public good) but not separable in reality. For an essay that purposely takes this to an absurd extreme in specifying public goods supply quantities for a perfectly configured sustainable city see Webster 1998. Arrow's approach to analysing the supply of good layout design might, for example, be to break down layout design into its component attributes: time saving, defensibility, systemic permeability, texture, bulk, cost of maintenance, aesthetics and so on, and to examine ways of setting up a market for each. This is an enlightened approach if the purpose is to look for practical ways of pricing such attributes. But if the purpose is more obtusely to build analytical models to specify the market clearing price of each, then this is just an academic distraction. The general approach is only helpful if attributes are, in fact, separable from the point of view of charging, usage and supply. I return to this later when discussing specific pricing mechanisms.

Meade (1973) represents a contrasting approach in the debate, defining externalities much more broadly and independently of particular institutions: merely as discrepancies in the way different individuals value marginal changes in the quantity of commodities. They are in other words, third party effects. Discrepancies arise whatever the institutions that govern transactions. Government allocation, altruistic

giving, primitive bartering and well developed competitive markets all make resource allocations that confer a wide range of costs or benefits on individuals directly or indirectly affected by the allocation. So too do the master plans of an urban designer and the strategic plans of the urban planner. Planners' attempts to improve accessibility are shaped by political briefs but politicians' values are not shared by all those affected. Master plans too, therefore create externality costs for those whose accessibility they decrease in particular ways.

Third party costs and benefits arise due to the inability of a government, an altruist, bartering parties, members of a household or a club, or a master planning agency to contract with all parties with whom mutually beneficial transactions may be made. The inability is due to the absence of clear property rights over resources that are valued differently by the affected parties. This in turn is due to imperfect information and to the high transaction costs of assigning property rights and negotiating deals. We may conclude *a priori*, therefore, that accessibility can never be priced perfectly.

It may be possible to price some third party effects, however, and the options are explored in relation to specific types of investment later in this report. Before that, however, I continue with the technical review of joint-consumption. Although public goods and externalities are two sides of a coin, there is a strong tradition in analysing this special category of goods and it will be worth reviewing the ideas that this literature has contributed.

Public Goods

The problem of joint consumption (or third party effects) was formally recognised long before Pigou discussed externalities. Adam Smith (1776) identified certain types of good that the invisible hand of market-based exchange would not provide adequately. These included national security and schools. Before him, David Hume (1739) had succinctly portrayed the underlying behaviour that accounts for the public goods problem, the latter being one of the most thorough modern expositions of the problems of collectively consumed goods:

> *Two neighbours may agree to drain a meadow, which they possess in common; because it is easy for them to know each other's mind; and each must perceive, that*

> *the immediate consequences of his failing in his part, is, the abandoning of the whole project. But 'tis very difficult, and indeed impossible, that a thousand persons should agree in any such action; it being difficult for them to concert so complicated a design, and still more difficult for them to execute it; while each seeks a pretext to free himself of the trouble and expense. And would lay the whole burden on others. Political society remedies both these inconveniences* (Hume, 1739: 538).

Hume's statement exposes the fundamental difficulty in securing an efficient supply of accessibility. Paul Samuelson's analysis of the conditions required for the efficient provision of so called *capacious* goods produced a public goods literature that parallels and overlaps the externalities debate started by Pigou. Samuelson (1954) characterised a pure public good as being non-excludable and as being in infinite supply such that consumption is non-rivalrous or non-exclusive. With such a good, the collective amount consumed by a group of individuals equals the amount consumed by each, and the efficient quantity to supply is given by equating the summation of each individual's price (the collective willingness to pay for one additional unit) with the cost of providing one additional unit of the good. This contrasts with a pure private good, where quantity (not price) is summed to get collective demand and efficient supply requires each individual's marginal benefit to be equated to price and to the marginal cost of producing the good.

James Buchanan (1965) generalised Samuelson's analysis by showing that pure public and pure private goods are special cases of a more general class of good that he called 'club goods'. Buchanan's great contribution was to bring the number of consumers into the efficiency analysis such that an individual's utility depends not only on quantity consumed but the numbers of co-consumers too. This produced a theory of co-operative membership in which a pure private good lies at one extreme (n=1) and a pure public good lies at the other (n=infinity). In between, (1<n<infinity), lie most public goods of practical interest – those which are consumed by a finite set of individuals and can in principle be priced, so long as appropriate exclusion mechanism can be designed.

This idea should be of great interest to urban managers, planners, entrepreneurs and designers. It gives an economic framework for analysing both the physical and institutional features of a solution. Buchanan's club theory suggests that some elements of accessibility (or good urban design) can be priced so long as an exclusion mechanism can be set up.

Mancur Olson published his own *theory of groups* in the same year as Buchanan's paper (Olson, 1965) which was more extensive in scope but less general in its analysis of the efficiency conditions for optimal group formation and group size. These two contributions resulted in a literature on so called *impure public goods* – public goods which are both congestible and excludable under certain conditions but remain uncongested and/or non-excludable under other conditions. This is also highly pertinent to the analysis of urbanists, since most urban infrastructure is easily congestible and much of it can, in fact, be made excludable. Like Buchanan's analysis, it points to the idea of a mechanism that keeps the number of joint-consumers to a limit determined by carrying capacity.

One way of doing this is through the natural deterrence of distance. Ten years before Buchanan published his theory of clubs, Charles Tiebout (1956) had suggested that local public goods might be supplied efficiently if a sufficient number of competing cities supplied different bundles of community goods from which mobile individuals can choose. Local public goods are public goods for which consumption benefits fall off with distance – hence they are also known as spatially impure public goods. With perfect information and mobility, individuals might be expected to select the bundle that best suites them. Tiebout proposed that people are attracted to cities in which community goods are not yet congested (cost per resident has not yet reached a minimum) and avoid congested cities, in which the cost per resident has risen beyond the minimum.

There are similarities between Tiebout's spatial 'municipal clubs' and Buchanan's entrepreneurial clubs. Both are models of institutional arrangements for the efficient supply of collective goods other than Samuelson's two extremes: private goods that are efficiently supplied by a perfectly competitive market and public goods efficiently supplied by state-organised collective action. Tiebout's idea is that local governments

can supply local public goods efficiently if there is sufficient choice between jurisdictions. People vote with their feet, selecting the city with the bundle of public goods and tax price that suits their specific needs for accessibility of various kinds. Buchanan's idea was that entrepreneurial clubs can supply excludable public goods efficiently, providing that there is competition between clubs. The latter exclude by membership and fee; the former exclude by citizenship and distance.

When the institutional context for Samuelson's, Buchanan's, Tiebout's and derivative analysis is generalised beyond the perfectly competitive market, the public good problem is essentially the same as the externality problem: ill-defined property rights, imperfect information and high transaction costs. A thorough synthesis by Cornes and Sandler (1996) views pure public goods, local public goods, club goods and common resources as special cases of the more general externality problem. Externalities to Cornes and Sandler are, from the point of view of an individual consumer, goods that are consumed by others but which raise or lower an individual's utility (similar to Meade's view). They are third party effects that remain non-excludable, unpriced and in the public domain. Anyone can choose to benefit (or disbenefit) from the set of goods consumed by others by exerting an economic right, for example by moving into a city or locality. Pure public goods are a class of externalities in which everyone's individual quantities of goods demanded combine together into a single collective good which all co-consume. Local public goods and club goods are externalities where the influence of other people's consumption is moderated by the number of co-consumers and in the case of the former, by distance from the source of the public good.

All are problems of public domain order and the differences between them are differences in the way costs and benefits are apportioned, and ultimately, differences in the way information and transaction costs are distributed. These different information and cost structures determine the shape of the institutions best suited to creating order in any particular public domain problem. I elaborate and apply these ideas in the next section, which considers different types of mechanism that may be used to organise, and in some instances price, accessibility enhancements.

7. Mechanisms for pricing and organising accessibility enhancements

The previous sections consider at length why accessibility and good urban design and planning cannot easily be priced by the market. The reason is the unclear allocation of property rights to the co-location benefits and disbenefits created when people live together in cities. It follows that any improvement in a city's spatial configuration must be achieved by the clarification of property rights over these urban attributes. In this section I consider institutional options for clarifying property rights over urban public goods. By clarifying property rights they can help achieve a better fit between demand and supply of accessibility. They are not equally efficient or equitable. Each is biased in some way towards some interest or other. They vary in the cost of administration; the accuracy with which they gauge demand; and the scale at which they can operate.

Surrogate markets

A large urban park might be valued highly by most residents of a city but more so by those who live nearby. Those living nearby might have a particularly strong demand for greater maintenance expenditure and a rolling programme of investments. Although the aggregate demand from the park's neighbours might be more than sufficient to maintain and improve the facility to their own benefit and that of the whole city, collecting payment is fraught with difficulties. Neighbouring households may not express their true preferences. They may refuse to contribute at all, hoping that others will pay. The cost of securing payments might be prohibitive or there may not be a suitable institution on the statute books to organise such payment. Even if there were, neighbours may feel that since the park is open to all, then any improvements they make might be degraded by the wider city public and therefore decide that the benefits of any personal investment will leak away.

One way of overcoming this problem is to make a local park the contractual property of surrounding home owners, with rights to use it and obligations to fund its management bundled into to ownership deeds. But this is only suitable for certain

configurations of urban design. I explore the idea further when considering club-based mechanisms.

In the more normal circumstance of open access and publicly maintained parks, notwithstanding the problems of preference revelation, there is, in fact, a mechanism through which residents quite accurately express their valuation of accessibility to the park. It is the housing market.

Urban housing markets are segmented according to three important sets of factors: attributes of buildings; attributes of people who occupy them (or more generally, attributes of uses and users of the buildings); and attributes of public goods (and externalities) – i.e. 'off-site attributes. The last of these contributes significantly to the price an individual or firm will bid for a house or workspace.

In many British cities, the house price premium for a home in the catchment area of a popular state high school, when compared to a similar house outside the catchment, is roughly equivalent to the cost of putting the average number of children per household through seven years of private education. This means that the housing market works as a very efficient surrogate market for scarce good quality public education. Parents have a choice: they can pay an inflated house price and secure access to 'public' education that local government rations through distance and residency rules. Or they can pay for private education and buy an equivalent house more cheaply elsewhere in the city. That the house price premium and the private school bill often looks pretty similar is evidence that (a) relocating parents make rational decisions when putting a price on school accessibility and (b) the surrogate market is an efficient institution (albeit a grossly unfair one).

The same can be said of many other kinds of special (economic) accessibility: access to good views (locations on a hill, apartments on upper floors of a tower, water-side locations); access to similar kinds of people; access to health care; good local urban design; secure local services supplied through home owner associations. All tend to generate price premiums in the property market.

What is true of special accessibility is also true of general accessibility: land value profiles fall sharply from most city centres, with local peaks that fall off sharply from sub centres and from high value public goods like green belts. These spatial rent profiles are an abiding feature of cities. Urban geometry is obviously a very strong determinant of intra urban land price differentials. In other words, the land market tends to yield reliable surrogate prices for general accessibility, as it does for specific accessibility.

In sum, urban housing markets tend to contain an implicit price for accessibility – general and specific. The greater the scarcity value of a particular type of accessibility the higher the property price premium.

The problem with surrogate pricing is that individuals selling land blessed with accessibility value are in receipt of an unearned windfall. In economic terms, they find themselves with rights to 'rent' generated by someone else's investment. This is viewed by some as inequitable. It is also likely to be inefficient. If the agency that generates the accessibility were to have some share in the rent it creates, the agency would be likely to supply more. This brings us to the idea of land tax.

Land tax

There is a long standing argument that because the vast majority of land value is created by other people – by society at large via publicly and privately organised public goods and the positive externalities (agglomeration effects) that flow from all private transactions – then land value should belong to the public at large. The idea was promoted by the 19th American thinker and tax reformer Henry George. In *Progress and poverty* (George 1879), he proposed that the returns from land (termed 'rent' in classical economics and distinguished from 'profit', which is the returns from capital and from 'wages', the returns from labour) should belong to society. He proposed an annual tax on land value as an alternative to all other taxes (so that income tax, capital gains tax and trade 'tariff' taxes could all be abolished). Such a tax would give labourers greater incentive to invest in their labour; give owners of capital greater incentive to invest their assets; and would prevent what he saw as idle land speculators from growing rich on the basis of rising land value without having to do any real work. The principal rationale behind the land tax proposal was to redistribute

wealth from land owners to the honest labouring and capitalist class and thus to reduce the risk of economic depression and poverty. What he proposed was, in effect, the exaction of an *accessibility premium*.

George's taxable premium can also be thought of as a price. In a fast growing town, a piece of land sold ten years after its purchase will make its owner a huge surplus ('rent'). A buyer offering the inflated price is making a bid that reflects his valuation of the many investments made over the 10 years throughout the town. The town is now a better location for a firm to search for employees; the site may now be in a premium residential neighbourhood benefiting from the co-location of wealthy factory owners; and so on. The premium made over the ten years can thus be thought of as the price the bidder is willing to pay for the site's improved accessibility.

George's extreme proposal was to expropriate the full value of this premium through an annual tax on land value increase. This therefore amounted to government assessing the price of annual increments to accessibility value and then taxing it.

The idea has great theoretical and moral merit but is fraught with practical difficulties. Many governments have experimented with it from time to time – under the label betterment tax, land value tax and similar. A 1909 attempt by Prime Minster Herbert Asquith's Liberal government to use Georgist ideas in a radically redistributive *people's budget* led to constitutional crisis and a reform of the relationship between the House of Commons and the House of Lords. The proposal was too radical for the established land owners. Having achieved an equally radical redistribution of development rights in the 1947 Town and Country Planning Act, however, the British government tried a 100% tax on the unearned value of land in the immediate post-War years. The development industry unsurprisingly ground to a halt.

This reveals a fundamental problem with the idea: taxing the full unearned increment takes away an important incentive for individuals to invest in private land and thereby has the effect of reducing the supply of the very investments that create land value for everyone else. Taxing the complete accessibility premium is not an efficient mechanism since it drastically reduces the supply of accessibility improvements.

In fact, the logical counterpart of 100% betterment tax is an urban economy in which the state organises all urban infrastructure investment, including investment on private land. This is the model that has worked so well for contemporary China – although it is achieved through state land ownership and land leasing (see next section) not through a betterment tax on privately transacted land. In China, the government – specifically, municipal government – has a monopoly over the primary land market. Only the state can legally convert rural land to urban. And since it is the state that organises and bears the risk of that conversion (through investing in urban infrastructure), there is a natural justice in the state taking all of the land value uplift. The government pays compensation to villagers displaced by such land conversion and the amount is set at a level designed to compensate for lost agricultural earnings plus elements for the costs of relocating, resettlement and (since 2005) establishing alternative income sources. The claims of displaced farmers for a cut in betterment value of their former farming land is dismissed on the grounds that it was not they, but society as a whole, that bore the capital, organisational and risk costs of creating urban land values.

The incentive problem resulting from a 100% land value tax reveals more about betterment as a price on accessibility and is therefore worth pursuing it a little further. When a prospective buyer bids a price for the right to own land in order to operate a business on it, the price can be thought of as equalling all of some portion of the anticipated net profit from operating the business at that location. In a relatively competitive market with many users bidding for a fixed supply of sites, users will in principle be willing to bid away all their surplus profit in order to gain the right to produce at that location. Under these circumstances, land rent equals the net surplus from using the land in some productive way. This is the basic land economic theory of classical economists David Ricardo (1817) and Johann Heinrich von Thunen (1826). Different types of users are able to bid different amounts, depending on their net surplus and certain types of land use tend to outbid others, creating regular land use patterns, as already noted. These patterns can also be seen as reflecting the relative prices different users are willing to pay for the accessibility conferred by particular locations. Under a competitive market that price becomes land rent and the rent possibility facing a land owner equals the accessibility price bid by the highest bidder.

So if government taxes locational premium – that part of a producer's revenue that is net of production costs and available to bid as locational rent – producers will have nothing left over to offer land owners as rent. This is what happens with a 100% betterment tax. What if government takes less than the full accessibility premium producers are willing to bid? This resolves the problem. The tax will reduce land values but providing not all of a producer's surplus is taxed away, the producer is still able to bid for land. Rents fall – the tax is deflationary - but so long as they cover the land owner and developer/user's respective transaction costs the land market will continue to function.

A general and crucial question raised by the problem of implementing a land tax is therefore:

How are the rights to betterment gains best allocated to the various contributors of betterment value?

Or synonymously:

How are the rights to accessibility premiums best distributed to the suppliers of accessibility?

Clearly it is inefficient for the state to own the rights in full. On the other hand it seems unjust for individuals to own the rights to the full accessibility premium. Not only unfair, but as I have noted already, possibly inefficient as well if rights could be redistributed in such a way that agents with the capacity to increase accessibility also had the incentive to do so. This would require agents who generate a particular type of accessibility benefit to be given a degree of rights to that benefit. I return to this idea – the principle of good contract design or in political speak, subsidiarity – later in the report. For now, we can note that if the various components of betterment could be distinguished and their various contributions isolated, then we could perhaps apportion rights more efficiently.

The two extreme mechanisms of unfettered surrogate markets and 100% land tax result in an inefficient distribution of rights over accessibility. Leaving the rights in

the public domain, to be captured by individuals through surrogate markets reduces the supply of accessibility since benefits created by those investing in infrastructure and services leak away to private individuals, reducing the incentive to invest. Assigning all rights to the state has the same effect, with benefits leaking away to society at large (or more precisely, to governments and those to whom they direct the benefits thus captured).

Land leasing

An alternative and equivalent to Henry George's land tax is the nationalisation of land and its subsequent leasing. This meets George's requirement for the ownership of land rent to be in the hands of society in a more radical way than is achieved by land taxation. It is an approach to land management adopted in Hong Kong and one that has underpinned, if not driven, China's breathtaking urban-based economic development.

With land leasing, the state takes ownership of land and organises the investments that deliver accessibility improvements. It might do this by acting itself as developer, directly investing in roads, utilities and so on. Or it may lease land to developers to build the infrastructure. Either way it organises land improvements and then leases out the improved land. In a mature system, leasing is by competitive bids so that the lease price bid by a would-be lessee can be viewed as the accessibility price – as with a 'normal' land market in which land is in the hands of private individuals.

One of the significant differences between state-organised land leasing and private land markets is the role of planning in creating improved accessibility. In the former, the state can make plans – collective action mechanisms to achieve specific improvements in accessibility – and contractually oblige lessee land users to abide by or to implement those plans. In a private land market, improvements to the spatial configuration of cities have to rely on a mix of regulation and government and privately supplied trunk infrastructure; with a large proportion of the benefits created by public investments leaking away to private land owners in windfall land value premiums. Regulation generally turns out to be a blunter instrument than a contract in delivering infrastructure and morphological improvements. In this sense, land leasing is probably a more efficient method of both pricing and delivering accessibility

improvements. At pricing, because agents bidding for land leases know more precisely what they are bidding for if planning conditions and requirements are contractually specified. More efficient at delivering, also because of their contractual basis.

Tax-funded general purpose local government

This leads naturally to a consideration of what in the 20th century, became the normal mechanism for improving urban accessibility.

With Keynesianism being the dominant political-economic doctrine governing the developed west during and after World War II, municipal socialism expanded and with it, the size and functional diversity of municipal governments. The now dominant model by which civic goods are organised is through general taxation. Locally organised general taxes levied on properties and businesses and in some countries, retail sales, tourism and other tax bases, provide revenue for local governments to invest in infrastructure and services. These are supplemented by transfers from higher levels of government, funded from other sources of general taxation such as income, corporate and road taxes.

What can be said about the price of accessibility under this kind of regime? If price is taken to mean the amount paid per unit of a good or service, then strictly speaking, accessibility organised by the state is not priced. In fact, the very reason for the state supplying an urban planning service and organising urban infrastructure developments is because it is thought to be too difficult to price the benefits. Price as a measure of benefit (strictly speaking, price is a measure of the 'marginal' benefit of using one more unit of a commodity) is absent from this delivery mechanism and other means have to be resorted to when measuring benefit. There are three important kinds of demand measures, all of them surrogates of price: political signals, survey data and simulated model data.

Lobbying, complaints and single-issue voting are all ways of gauging the level of demand for accessibility improvements of various kinds. They are surrogates of prices in the political market just as house prices are surrogate prices in the land market. The problem is that the surrogate signals of demand created in the political system are

very imprecise. They are ‘noisy’ signals since people lobby and vote on many issues. They are also biased by access to the political system, with more powerful, wealthy and better organised individuals and groups tending to wield more influence. The political market is also open to corruption and self seeking by bureaucrats and politicians.

The same kind of comments can be made about survey data used to inform political decisions. Surveys of housing need, demand for green space, transit ridership and so on, should reduce the noise in political decisions. They don’t always do this of course, since surveys are used for various purposes – including supporting bad decisions.

Simulation model data is another attempt to increase the evidence base of government-organised city planning. Traffic models, for example, may try to optimise network configuration, mode-split and land-use transport interactions (for example minimising aggregate travel in the city). They do this on the basis of assumptions about preferences for various attributes of alternative transportation modes, the cost of time, the purpose of travel and so on. Shopping models estimate flows of people and sales between retail centres and residential areas on the basis of surveyed behaviour and assumptions about the trade-off between the comparative draw of certain shopping centre features and the deterrence of distance.

A general purpose accessibility model like Space Syntax (Hillier 1996) makes assumptions about the mapping between economic accessibility and geometric accessibility. Space Syntax is a network model that can be used to grade locations (links on the network) according to their connectivity to other locations in a city or in a system of cities. This is a simple but powerful tool. If the indicators of general accessibility derived from the network can be correlated with different kinds of land uses then the model may, in principle, be used to estimate the land use demand arising from alternative configurations of network infrastructure. Put another way, modelled geometric accessibility measures can be used as implicit indicators of demand. There is much scope for elaborating such methods – especially converting general geometric accessibility measures into indicators of various forms of economic accessibility.

Since governments play such an important role in urban planning, such techniques are necessary. As tools of government planning they are second best to markets however. Indicators from models, surveys and political processes are often poor surrogates for market price as measures of demand. But for many kinds of accessibility, they are all we have got and we need to refine them.

For all these reasons, government organised supply of urban public goods is typically far from balanced with demand. Generally speaking, the more 'trunk' the infrastructure (the greater number of co-consumers), the more appropriate it will be that general purpose government organises.

This is true at all scales. The Planning Bill going through the UK Parliament at the time of writing is controversial because it proposes a national agency for handling the planning of nationally important infrastructure projects such as airports and main line railways. The background to the proposed change in law is the unreasonable (and uncompetitive) amounts of time typically taken to negotiate such projects through a planning system that confers strong property rights to local communities on such matters. The new powers would transfer rights to the national government. The justification is plausible – that the national government is the appropriate level at which to take collective action given the number of people using and otherwise benefiting from the accessibility created by these projects.

The same can be said within cities. Ring roads, green belts, major parks and plazas, trunk road realignments, transit systems and so on all undisputedly confer accessibility benefits on citizens throughout the city and it is inefficient to allow sub-municipal governments and other organised local interests, powers to block such developments. (That is not to say that such interests should have no say at all).

However, with many other types of civic goods, general purpose government is not necessarily the best mechanism for collective action. This is either because the spatial scale over which the goods are co-consumed is much smaller than the city as a whole or because the good is jointly consumed only by a subset of the urban population. If either of these is true, then if technology and laws permit, alternative institutions may be more efficient at pricing and delivering accessibility improvements. This leads to a

discussion of, on the one hand, fiscal decentralisation and special tax districts; and on the other, private neighbourhood governments and club goods.

Fiscal decentralisation and special tax districts

Government competencies tend to gravitate to particular hierarchical and spatial scales over time as society experiments with laws and administration. For obvious reasons, primary and secondary education tends to be a local rather than a central government matter in most countries, for example. The idea of organising tax at the level most appropriate to any particular tax base and purpose is referred to as fiscal decentralisation or fiscal federalism (the latter term is sometimes more specifically used to refer to a system in which centrally organised taxes are transferred to the most appropriate lower levels of government to spend). This is taken to its extreme in the so called Special Tax Districts of the United States. While most UK citizens see just a few headings itemised in their Council Tax bill, the property tax bills of many US citizens have a long list of services delivered by specialist agencies, each of which may cover a different geographical area. The School District a household lives in may not have the same spatial boundary as its Fire District, Parks District or Hospital District. And none of these may exactly coincide with the general purpose municipal government governing the neighbourhood. Each Tax District is a specialised organisation created to fund a particular kind of facility or service. Most are mandated to fund their activities by levying taxes or raising debt. Some, such as transit and flood control districts, cannot tax however, having to rely on revenue generating activities. Special Tax Districts are organisations in the business of providing specific kinds of special accessibility. The price is set by agreement, for example by voting on alternative proposals for new investments such as a new school, fire station or hospital.

Fiscal decentralisation potentially provide efficiencies over general purpose local governments in pricing special accessibility since demand and supply can be more readily equated with a single product funded by a dedicated revenue source. However, economies of scale in inter-service delivery are less easy to realise and Special Tax Districts are often alleged to be poorly run and unaccountable. Their governing commissioners are often elected in uncontested elections with poor voter turnout.

In terms of pricing accessibility, they are in principle, an efficient collective action mechanism. Not only do relocating households know what they are getting for their dollars but they can vote to change the level of special accessibility. A similar effect can be achieved in general purpose local government either through holding referenda on specific infrastructure investments or by creating very localised government jurisdictions (Swiss Cantons are a good example).

France's peri-urban communes are another example of very localised jurisdictions. These are general purpose local governments each serving a few thousand people. They have a 'price' efficiency that UK local governments do not because of their decentralised fiscal model. The mayors of these communes receive transfer funds from higher levels of government and set budgets after discussion with their towns, which are small enough to resemble clubs.

Comparing the web site of a commune like Loroux Bottereau, a town of about 5,000 in the Loire Valley just outside the city of Nantes, with a town of equivalent size in the UK, Cowbridge, just outside Cardiff, public goods value for money is far clearer in the former. The commune's budget and residents' tax liabilities are very clearly laid out; making locational choice more informed in the way that it is in American tax districts or in private Home Owner Association governed communities. Local tax and expenditure details for Cowbridge, in contrast, are deeply embedded in the web site of the parent local authority (Vale of Glamorgan) and there is no easy way of working out the tax 'price' charged for the facilities available in one of its towns. In business terms, the town is not a cost centre and it is therefore impossible for a non-local resident to get an accurate picture of the net value of special accessibility benefits to be found in it.

As a result, one would expect house prices (and the accessibility premium components thereof) to be more accurate measures of locational benefit in French peri-urban communes than British ex-urban communities. The clearer information regarding net value of accessibility in the French communes allows home buyers to be more discriminating when bidding a price - just as intra-urban house price differentials accurately reflect the catchment boundaries of good schools. For an interesting study on the efficiency effects of small governments see Feld et al (2004).

Club neighbourhoods

As I noted when comparing the ideas of Charles Tiebout and James Buchanan, there is a fine line between a politically organised club and an entrepreneurial club. This is all the more so when special tax districts and highly decentralised local governments are considered. The Business Improvement Districts (BIDs) currently being experimented with in the UK are a version of American style Special Tax Districts. Local businesses can vote (with a super-majority) to raise a levy to reinvest in shared infrastructure and services –with the aim of enhancing custom and revenue that might eventually cover the cost of the levy. Is this public, private or club activity? The label doesn't matter very much. What matters is that a group of economic agents agree to set up an institution designed to increase specific kinds of special accessibility.

Other kinds of club organisations that organise local public goods include the Home Owners Associations that govern what the Americans call Common Interest Developments (CIDs); Condominium and other commonhold tenure organisations; and cooperatives. CIDs with Home Owner Assocation governments are typically set up as companies, under company law, where neighbourhood home owners are share holders of a company that owns, manages and finances collective facilities and services such as refuse removal, road maintenance, parks and schools. In a condominium (or Commonhold Association in the UK), home owners (flat owners) have an undivided joint share of the common property and facilities, bundled into the title deeds of their individual homes. In a coop, the collective owns the individual homes as well as the common areas and homes are allocated by collective decision.

The same type of legal structures are used to govern residential, industrial, commercial and recreational neighbourhoods and facilities. What they have in common is their contractual approach to organising the configuration of local accessibility. One important effect of this is that specific accessibility is more accurately priced. The argument has already been made in the discussion of special tax districts, decentralised local governments and school catchment areas. If the amount, variety and quality of local neighbourhood goods and services is subject to contractual agreement (between home owner or condo association and incoming resident or a science park association and an incoming firm), then it is much easier for

a buyer to bid a price for the special accessibility that the location confers. Neighbourhood organisation of the infrastructure that creates the accessibility means that the facilities can be appropriately scaled to demand – in terms of number of co-consumers and the price they are willing to pay. By enclosing territory in this way, Arrow's missing markets in public goods disappear. Contractual joint consumption and joint production arrangements create a market for public goods and the accessibility they confer.

Multi-tenant property

The final category in the line-up is private firms that own and manage space in cities that is rented out to tenants on short-term leases. This includes shopping malls, science and office parks and some residential buildings and neighbourhoods. The shopping mall as a private version of the traditional high street has been successful because it is able to manage space highly efficiently, rapidly responding to demands from tenants and their customers and continually reinvesting. This is possible because of unitary ownership and the short term property rights of tenants. Mall owners review rents periodically against more general market intelligence and make decision about investments and about the tenant mix likely to maximise footfall and customer spend to the mall as a whole. Tenants not wanting to pay for upgraded special accessibility move to a lower rent location. The rent that retailers bid for space in the mall is a price on the accessibility created by the mall owner and its property management company.

With varying degrees of cost effectiveness, these various mechanisms promote positive changes to the accessibility of a city. There is another set of mechanisms that are used to reduce negative changes to accessibility – particularly to reduce the congestion costs of shared space and other shared urban assets. These institutions include regulations, taxation and subsidies. They attempt to mitigate the effect of and reduce the quantity of negative externalities. The provision of public goods and the control of congestion cannot be separated, however. Both are equally important in maximising the shared benefits of living together in cities. The two issues come together nicely in a discussion of urban open space, which is an appropriate subject to turn to having arrived at the shopping mall.

It may be all very well to regard the multi-tenanted mall as a highly efficient institution for pricing and delivering retail accessibility, but does it not do this at a cost – the privatisation of the public realm?

This is such an important debate in urbanism that it is worth exploring the tension in some depth as part of a general discussion about pricing accessibility. In the next section I argue that the public domain is, in fact, an unstable category of land and that there is an inexorable dynamic in cities that turns public domains into club domains and thence into private domains. Like it or not, cities develop by the fractal subdivision of property rights. Failing to understand this, leads to poor governance; unsustainable urban design; irrelevant policies and plans; and useless urban planning institutions and systems.

Urbanists therefore face a paradox that has already surfaced in the discussion: to maximise overall accessibility, property rights have to be clarified. Privatisation (and certain forms of collectivisation) tends to preserve scarce, degradable, non-renewable or expensive-to-renew resources. Therefore to retain and enhance the accessibility value of cities, property rights tend to become progressively well defined. That inevitably means a diminishment in the public realm. That is not to say urban planners should not seek to increase and improve the public domain by design. Sometimes less is more, however. 'Institutionally smart' is also more – paying attention to institutional design in parallel to physical design adds value to urban form.

8. Public urban space[1]

This section explores the evolution of accessibility from first principles, using the example of urban space. In doing so, it draws on conceptual arguments made in earlier sections of the paper and extends them to develop the hypothesis that accessibility is a constantly changing attribute of a city. A location's accessibility value is never static.

[1] Parts of this section have been adapted from Webster CJ (2007) Property rights, public space and urban design. *Town Planning Review* 78(1) 81-101

Public urban space is a collectively consumed good. It differs from private space (like bedrooms) in that many people co-consume the same quantity. Their co-consumption is non-rivalrous at levels of consumption below a congestion threshold. Over time, collectively consumed goods tend to reach and surpass the congestion threshold, however. They become over-used through unrestrained competition. This is particularly so in cities, where people live at high densities. It happens with public space, roads, parking space, clean air, waterfront views, lakes, schools, space within transit systems and so on. Re-investment and resource management can help avoid the degradation and depletion of a congested space (or of any local public good) but at a cost.

Most public spaces and many other kinds of civic infrastructure are not well tended, however. It may generally be assumed that public space tends toward degradation over time because individual users enjoy the full benefits but bear only a fraction of the costs. The so called free rider problem leads to something like biologist Garett Hardin's *tragedy of the commons* (Hardin 1968), which is an endemic problem in cities.

Tragedy of the urban commons

Matching the supply of urban public space with demand is not a guaranteed outcome of either market or government based exchange. There are many metaphors useful for understanding the problem. I have already discussed at length the predominant metaphor of the 20th century: *market failure*. The market is said to fail in the efficient provision of public goods because of information problems and the problems of organising collective action. It may not supply at all if everyone free rides or it may undersupply if individuals fail to reveal their true willingness to pay.

A tragedy of the urban commons unfolds as too little public space is created. Everyone wants more (or better) open space and is willing to contribute but in the absence of a price mechanism, demand is not met with suitable supply. Translating the economic metaphor to an ecological one, we can call this a Type I tragedy: land is over-developed to the detriment of all. Cities are built at inhuman densities and urban land is 'over-grazed' because of a lack of effective mechanisms to reveal citizens'

true preferences for open space and other environmental goods. The problem is not one of individuals' unwillingness to pay for more open space (or lower density) but a problem of information and co-ordination. The undersupply of urban design (as a professional service) is also a Type I tragedy of the commons. All stand to benefit but the property development and house building industry tends to undersupply urban design because it is not efficiently priced. One important reason why we might be interested in pricing urban accessibility more effectively is to induce a greater supply of urban design.

A second type of tragedy unfolds on whatever public domain spaces have emerged in the course of a city's development history. Hardin put it this way:

"As a rational being, each herdsman seeks to maximise his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component.

1. *The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.*
2. *The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision-making herdsman is only a fraction of -1"* (Hardin, 1968, p.115).

Individuals tend to make choices about how and when to use open space without regard to their own contribution to its degradation. The latter effect is usually too small to be perceived. Even if it is perceptible, the fact that it is shared by many others means that individuals feel absolved of personal responsibility. The quantity of grass eaten by one more animal is unavailable for the individual farmer's herd the next day, but if the reduced grass area is shared by 100 farmers, the effective cost is the total area remaining divided by that number. The herder can choose between a day's worth of feed now or the loss of a days worth of food / 100 tomorrow. The same calculus applies to drivers' use of public roads, graffiti artists' consumption of clean walls, litterers in public parks, tourists in historic town squares, skate boarders damaging

public monuments and citizens who impose everyday wear and tear on public infrastructure.

The current state of Britain's suburbs illustrates Type I and II tragedies of the urban commons. Large parts of British inner and suburban city neighbourhoods are degraded by over-use and underinvestment (ODPM, 2000; Green et al., 2005). Over 80% of England's population live in suburbs. Created by successive waves of mass house building made possible by innovations in transport technology, these have long been ignored in urban policy. A recent series of research and policy reports shows that all is not well (eg. Hampshire CC 2002). Although many suburbs work well (particularly those inhabited by the more wealthy), there are many suffering from environmental degradation; underinvestment in shared goods and services; poor access to public transport; poor access to local commercial services; declining sense of community; public order problems; poor schools; underinvestment in private housing maintenance; under-occupancy of housing; inefficient use of space with too much poor quality open space and houses at relatively low densities; and problem estates suffering from enduring multiple deprivation.

At the heart of the problem is an inappropriate ownership model. The state owns everything in between the freehold plots sold as private space but does not have sufficient incentive or capacity to maintain adequate investment in this shared space, leading to Type II tragedy of the urban commons.

If a tragedy of the commons can be explained by the individual behaviour of many consumers, its rectification requires co-ordination. An overview of generic mechanisms for collective action over civic goods was given in section 7 of this report. In section 9, I speculate on alternative co-ordination models for increasing the supply of new accessibility and reducing the degradation of accessibility.

The evolution of public space

Paradoxically, the over-consumption problem in cities also implies an over-supply problem: in a congested open space, common accessibility rights are allocated to too many individuals. Congestion may be resolved by restricting these rights by institutional and physical design.

The result of congestion, degradation and depletion of a particular source of accessibility is as predictable as the congestion itself: a demand for the reassignment of property rights. Most collectively consumed goods are scarce goods. They are not the fictitious 'public goods' of the economics text book or the utopian 'public' realms of planning literature. Urban space tends to be consumed by particular individuals and groups – by 'small publics' (Webster 2002). Debates about public goods in applied economics and debates about public space in urban planning and architecture tend to use static categories: public goods (open spaces) are non-excludable and consumed without rivalry and private goods (private spaces) are excludable and consumed with rivalry. In reality, excludability and contestability are continuously variable not discrete attributes of an open space. This leads to the idea that urban space tends to evolve over time. This is illustrated in Figure 1, which is a contingency table cross classifying urban space by the two criteria commonly used to distinguish private and public goods.

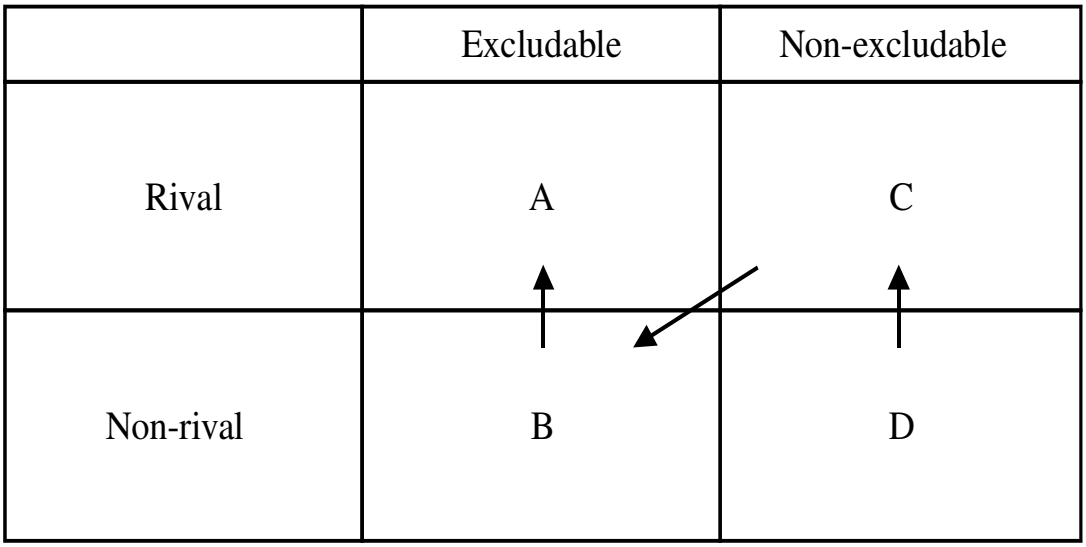

Figure 1: the evolution of urban space from public to private domain

Source: Webster C and Lai LWC (2003), Figure 6.4 p136.

The figure hypothesises that land tends to change from being non-excludable and non-rivalrous (category D urban space); to non-excludable and rivalrous (category C); to excludable and non-rivalrous (category B); and eventually to excludable and rivalrous (category A). Category A urban space is a pure private good; category D space a pure

public good. Category C space is institutionally unstable, providing an unpredictable level of accessibility, and in need of property rights reassignment. Category B space is a 'club good' and provides a stable accessibility value so long as the club's governing organisation (political or entrepreneurial) can continue to control (a) the quantity and quality of the various attributes of space vulnerable to congestion and (b) the numbers of consumers. When these get out of balance, property rights will tend to be reallocated within the club, creating smaller and more efficient category B spaces or transforming parts into clubs with fewer people, tending toward the limit of (but not necessarily reaching) category A private spaces.

The evolution of access rights will tend to have the effect of reducing co-operation costs (congestion costs, conflict costs etc), with any efficiency gains stacked in favour of parties with the greatest power to influence institutional change. Any class of space in the Figure may change to any other class but the dynamics of congestion and rights will tend to mean a long term evolution in the direction of the arrows. Readers are invited to test this proposition against illustrations in this report and their own evidence. The evolution of public spaces and the accessibility value they create, can be understood more clearly by focusing on the type of attributes of space that become subject to competitive use. Consider the following examples.

The micro-urban dynamics of public space

World famous city squares like Piazza San Marco in Venice are public spaces consumed by such a large number of people that they may safely be considered to be pure public goods. There are many people who value San Marco for its so called *existence value* (they would perhaps donate something to a 'save Venice' fund it if it were under threat from a rapid rise in sea level). They might also make the donation because the Square has *reservation value* for them – they hope to visit it one day. Unlike visit-based consumption, consumption of the future possibility of a visit or of the symbolic value of the Square is non-rivalrous: any one person's valuation of its existence does not reduce the amount of the Square available to others. These are pure public goods attributes. San Marco (and other places on UNESCO's World Heritage list) has massive value on this count. This type of locational value might be thought of as *potential or symbolic accessibility value*.

The Square also has massive value for those who actually visit it, but this value varies with the number of consumers. So too does the manner in which space within the square is consumed. Visitors join together to consume scarce pavement space, restaurant seats, hotel beds, church and museum space, queuing space and boat seats. Once a visitor has rented a hotel space, booked a restaurant seat for the evening or occupied a place in a queue, a certain portion of the Piazza has become private space – for the duration of the 'rental' agreement. Similarly, vendors who occupy stands on the Piazza and the streets that lead from it, make parts of the space private for the duration and their tenancies. The institutions of hotel room pricing, pricing of restaurant tables, ticketing, queuing and vending stall licensing have emerged to cope with the congestibility of this open space and the spaces in buildings located near it.

For what may seem a clear example of a public good, there is, therefore, on closer inspection, a mixture of different types of consumption. Similarly, what might be considered to be private good space has many attributes, some of which might be jointly consumed. Urban space can be classed as a pure private good if it is consumed by one individual, whose consumption renders it unavailable to others. A garden attached to a house has acquired some of the characteristics of a private good. It has been enclosed and once an individual acquires property rights over it, the right of others to freely use the space is removed. Few urban spaces are purely private, however. A garden would have to be enclosed from view and insects and consumed by a single recluse to make it purely private. So long as its flowers are pollinated by and provide food for someone else's bees or it adds to the view from neighbouring properties, then certain of its attributes are jointly consumed.

This illustrates that of themselves, the categories of public and private goods are of limited value. More powerful is the idea of the public domain. A public domain may be defined as a sphere of resource consumption within which consumption rights remain unallocated (Alchian and Demsetz 1973; Barzel, 1997). Consider the case of a theatre.

If tickets are all one price, the public space within the theatre is not graded and its 'quality' attributes remain in the public domain. Where demand is high, theatre goers will adopt their own strategies for capturing the public domain resources of viewing

angle, elevation, audibility, comfort, privacy and access to an exit. As well as queuing, they might arrive early to get the better seats, camp over night, fight or devise their own allocating institutions. If the quality of seats is sufficiently variable and theatre goers find it too costly to engage in non-price competition, then so long as there are competitor theatres that could do likewise, the theatre is likely to assume the cost of grading seats and to charge theatre goers for the administrative and technological costs of so doing. If the theatre space is potentially congestible (more demand for good seats than supply) then rationing by price will help achieve order and reduce the costs of competing for better parts of the auditorium.

What is true of public domain space within a building is also true of a city's outside spaces. To preserve and enhance the accessibility and value of urban spaces of many kinds, owners will look for ways of rationing; and if technology and design allows, pricing will prove to be the most efficient rationing device.

Mechanisms for allocating access to a scarce resource change according to levels of congestion. When fuel runs out at the pumps at a time of crisis, price is no longer an efficient mechanism. Queues develop as a spontaneous ordering device – based on the temporary and unplanned acquisition of rights to space in the queue. Queues work well only within certain bounds of scarcity. As the stakes get higher, queue-allocated rights easily slip into the public domain. If scarcity is very high - queue space is taken without following the rules, order quickly becomes unstable and can break down. This might lead to a change from voluntary non-price rationing behaviour (the queue) to regulated behaviour (elaborate rules for eligibility in the distribution of tickets, for example).

The governance of public space

The dynamic typology in Figure 1 makes explicit the idea that access to public spaces can be and should be governed according to their consumption characteristics. The question is how best to allocate property rights over the different types of space to preserve or enhance their accessibility value.

Public goods can be provided by private suppliers and private goods can be provided by the state. Many of Britain's great urban parks were originally supplied privately

by wealthy families. The pleasant and reassuring environment of a wealthy suburb is mostly privately supplied by individual home owners investing in their houses and gardens and maintaining certain behavioural norms. Shopping malls provide a private version of the high street, supplying weather-proofed and privately financed public recreational spaces on privately owned land. State-provided social housing, by contrast, publicly supplies private space to individuals.

Municipal government has generally become viewed as the rightful supplier of urban open space and the space it generally provided is assumed to be category D space. Where open space is provided by entrepreneurs as part of a development made up mostly of category A space, the municipal government typically ensures by regulation that it is supplied as category D space (even though it is technically feasible to make it excludable and convert it into a category B space with more sustainable special accessibility value).

If urban open space were to be de-politicised, as is private urban space, then planners and designers would be freer to deliver sustainable urban spaces – in which institutional and physical designs are better aligned. There is no reason why the institutional design of open spaces should not reflect their carrying capacity and the specific nature of the demand to which they are principally targeted.

Some spaces might be owned by the neighbourhood communities they serve, with rights of access and liabilities for their government bundled into private property deeds. These spaces may be legally excludable but not necessarily physically excludable. What matters is the right to exclude if the value of the space is threatened. Achieving this might even mean that privately governed open spaces foster civic virtues – greater respect from users (because the space belongs to someone not to everyone) and a sense of responsibility among the providers. A commercial version of this happens in malls, which are financed from private land rent and legally excludable but provided free to all who obey private behavioural rules. Mall managers have the incentive to make their private spaces as attractive and accessible as possible to the general public but also need to invest in means of preventing despoliation by individuals.

Other spaces might need to be made exclusive to those for whom they are designed. For example, home-zones that prohibit through traffic; communal gardens that would quickly lose their recreational value for residents if open access was permitted; and university halls of residence that erect gates to provide security. Most people accept the need for front doors on homes and for security desks in commercial buildings in order to prevent over-consumption of private space (by intruders). If residents of a housing estate wish to invest in their shared public domain space they should perhaps be able to form a firm and have the same right to protect their assets by appropriate exclusionary devices – so long as this does not significantly reduce the accessibility value of other spaces or of the city as a whole (through, for example, reducing permeability and raising travel times).

Other spaces may be open to all, but governed by pricing – parks with entry fees and paid-for facilities within parks. Where some private use is made of parts of a public space, it may be technically feasible to price it – as in the pricing of road space used for on-street parking via parking meters or ticketing; or the pricing of deck-chairs on a beach.

Any space moving from category C to B or B to A, involves a degree of enclosure and exclusion, raising questions about equity. It may be more efficient to enclose spaces in the sense of reducing congestion costs and averting degradation but is it fair? There are three answers to this. One is that it makes little sense to allow a space to degrade for the sake of maintaining open access to all. Eventually there will be nothing valuable for the 'all' to consume. Second, if there is a demonstrable demand for a particular space to be retained for open access to all, then it might be possible via general taxation to finance the space's proper management and investment. Third, even if a facility is priced at the point of entry (museums for example), equity issues (exclusion of certain groups) can be dealt with by subsidy.

A city with a hierarchy of open spaces delivered as a set of carefully designed and governed club spaces would be more efficient, liveable and sustainable. Some spaces would be open to the entire city 'club' and appropriately manages. Others would be accessible only to smaller neighbourhood 'clubs'; and others owned by neighbourhoods and private firms would grant access to others s long as they behave

civilly. We are accustomed to thinking in terms a hierarchy of open spaces in the physical and functional sense. We should also think of a hierarchy of open spaces in the institutional sense: which institutions can most effectively preserve the accessibility value of different kinds of physical and functional spaces?

Institutional design parameters for accessible and sustainable open spaces

Drawing together and extending these ideas, three important performance attributes of public domain space may be identified: level of congestion, separability of the attributes that contribute to value, and ownership. The interrelationships between these three affect the stability, quality, sustainability and accessibility value of urban public spaces.

Congestion: The degree of over-use (congestion) within a public domain is a function of the quantity of the resource (or its capaciousness), the numbers of individuals who jointly consume it, and the range of preferences of those individuals. If a shared resource is not congested, it can be said to be efficiently supplied. If congestion generates excessive costs - of queuing, avoiding conflict, resolving conflict etc. - then there is likely to be pressure to reform property rights and subdivide the public domain into either private domains or smaller public domains. The former happens whenever land is subdivided to provide living space for more individuals – for example the demolition of a large house to make way for an apartment block. The latter happens when the use of a shared good is reorganised, for example, when a congested recreational lake is allocated to different users by time and location zones or by tickets and pricing or by the outright banning of certain uses.

Separability of attributes: If it is cost effective and technologically and legally feasible to separate the rights over theatre seats according to quality of upholstery and clarity of view, then this may help resolve a problem of unrestrained competition, as we have seen. If it is feasible to create separate ownership of flood damage risk to a building, of use rights to separate floors, or of rights to use different parts of a lake or public square, then with sufficient demand these rights are likely to be established. The right to access the Victorian greenhouses standing in some of Britain's open access urban parks is typically charged for. This is because it is technologically, legally and financially feasible to make these parts of the park excludable. Rights

pertaining to different attributes of a lake that create specific kinds of accessibility value (recreational space for wind surfers, a transportation route from one side to the other, a habitat for fish, a power boat racing venue, premium water-front real estate, and so on) are likely to be separated and allocated to various groups where the benefits exceed the costs of establishing and policing the rights.

This is another way of understanding the formation of various kinds of special accessibility in a city. In fact it is the process of property rights subdivision that overlays a city's general accessibility profile with a finer pattern of special accessibility values.

Some rights are allocated by price, some by administration and regulation, others by convention and voluntary exchange. The ability to separate the rights to various valuable and congestible attributes of an urban space is the first step to good physical and institutional urban design. The exercise determines a set of feasible design and governance solutions in pursuit if greater accessibility.

Ownership: The governance of a public domain space should be thought of as a design parameter, which like other aspects of design needs to be aligned with form and function. Here we return to the idea that co-operation between individuals can be organised either by central planning or by decentralised bi-lateral transactions: by hierarchy or by market. Is a particular public domain space best organised by a public entity or a private one? Is it best left unorganised? Is the shared domain designed with a specific 'public' in mind or has it evolved spontaneously over time? If the latter, what provision needs to be made for changing tastes, demand and conflicts? Is it under threat from numbers and preferences that are inconsistent with its carrying capacity?

The general accessibility of a city's spaces takes on particular value for particular users according to the spatial pattern of demand for various kinds of use, modified by the enhancing or detracting effect of the presence of other users and proximate land uses. The pattern of ownership of the valuable attributes of an open space is as important as physical design in maintaining that space's accessibility value.

9. Pricing urban form: summarising the possibilities

There are two ways of summarising possibilities for accessibility pricing. First, is to identify different kinds of price mechanisms that mediate the provision and consumption of accessible urban form. Second, is to identify separable attributes of urban form that could be subject to pricing. This gives two sets of categories: urban form attributes and pricing mechanisms. In Table 1, I summarise the potential of price systems appropriate to selected attributes of urban form (offering different kinds of accessibility). In discussing each pricing mechanism I select examples of urban form elements that may be allocated using that mechanism. Table 1 is speculative and is included to help the reader visualise the range of pricing possibilities. It requires some explanation. The asterisks indicate the possibility that the price mechanism denoted by the row can help allocate the urban form component denoted by the column. A double asterisk indicates a strong role for the price mechanism. A single asterisk indicates a weaker role. An empty cell indicates that the price is unlikely to be a workable or acceptable mechanism for allocating that element of urban form.

So for example, it is assumed that a land tax price could be exacted for clearly defined elements of urban infrastructure that yield measurable benefits. These include major new open spaces, high density development permits, major facilities such as transit stations and major improvements to a location's connectivity.

On the other hand, it is assumed that it would be difficult to levy a land tax for something as difficult to measure as improved security, improvements in layout or road space or a reduction in externalities. Land prices bid in the property markets are also assumed to be more sensitive to certain elements of urban form (certain types of accessibility) including open space and other specific facilities, security, general connectivity, density and local externalities. Layout has a single asterisk because it is assumed that compared to these other elements of urban design, property buyers have a relatively weak preference for one particular layout over another.

	Layout	Open space	Density	Road space	Facilities	Security	Connectivity	Externalities
Land price	*	**	**	*	**	**	**	**
Land taxed price		**	**		**		**	
Neighbourhood pricing	**	**	**	**	**	**	**	**
Road pricing				**			**	
Facilities pricing					**			
Density pricing			**					*
Externality pricing		**	**	**	**			**

Table 1: Pricing mechanism for selected elements of urban form

Land prices

House prices reflect a bidder's valuation of all kinds of urban form and accessibility attribute as I have argued. They may reflect the quality and accessibility of housing layout; proximity and quality of open space; density; connectivity to local and trunk road systems; quantity and quality of accessible social, educational, medical and recreational facilities; access to work opportunities; liveliness and viability of a neighbourhood; the social makeup of the community and neighbouring communities; real and perceived security; and so on.

Take layout as an example. In principle, layout quality may be priced surrogately in the housing market – but not necessarily very strongly. Buyers' sensitivity to layout may vary with land use. Commercial renters may well find it in their interest to pay a premium for a more attractive layout – a layout that confers some advantage in terms of local level accessibility. Layout sensitive users will pay a layout premium for a new or second-hand property if the layout confers significant benefits. If the utility of a layout declines, for example, through congestion or changes in demand, then a land user will move if this effect is significant – if it exceeds the transaction costs of moving. The user may end up having 'negative equity' in the layout – its current value being less than that part of locational price notionally paid for it. So long as the transaction costs of moving exceed the net disbenefit caused by the layout's degradation, then the negative equity problem remains.

Layout alone, especially for small developments, may not confer sufficiently significant benefits to induce a price effect, however. The larger the scale, the more likely it is that complementarities between layout and other elements of urban form will yield significant advantages and therefore command a stronger price effect. If scale and complementarities are important in producing a price effect, then price differences will be most clearly discerned at the neighbourhood level. This is clearly the case in the housing market.

Intra-urban housing market demarcation emerges as property buyers express a valuation for bundles of property and neighbourhood attributes, many of the latter of which are complements, each mutually enhancing the value of the other. However, although property buyers are willing to bid a neighbourhood premium in their offer price, this does not necessarily mean that layout will be supplied efficiently. This is because many urban neighbourhoods develop in a piecemeal fashion. The neighbourhood premium is for the neighbourhood as a whole but any one developer only supplies part of the neighbourhood. This introduces the possibility of free-riding among developers; in the extreme, each developer choosing to undersupply good layout, expecting that others will supply it. This will be less of a problem with master planned neighbourhoods and this leads to the idea of neighbourhood pricing. But first, land value tax should be considered as an extension of land pricing.

Land value tax

As I have already argued, open market land price and land value tax are conceptually equivalent. They are surplus bid for a location. The difference is in the pricing mechanism.

In a competitive property market, buyers reveal the marginal benefit that a building and its location will yield them by bidding in competition. Where the value of a locational attribute is distinct and separable in the mind of a bidder, or where there is no building or an existing structure is to be demolished, price can be a relatively accurate indicator of accessibility. Even when the locational value is not clearly articulated by bidders, when many bids are decomposed statistically using a hedonic house price model, it is often possible to separate the components of house price

associated with particular public goods. This shows that there are clear patterns in the way buyers value locational attributes.

On the other hand, land value tax requires an administrative assessment of land value increment and this is more problematic. However, if a government can enact legislation to forcibly exact a portion of the expected windfall land rent increment created by some public investment such as London's Cross Rail, then it can, in principle, levy a portion of the accessibility price that market players are willing to bid. If a government can do this then it will have an increased incentive and ability to supply such infrastructure more efficiently and a price system of sorts can be said to be partially operative.

Neighbourhood pricing.

It is increasingly common, for developers to market not just homes (or commercial or industrial buildings) but entire neighbourhoods. This is a move towards a packaged neighbourhood industry that is equivalent to the packaged holiday industry in the tourism market. It is a move from a market in commoditised individual properties to a commoditised neighbourhood market.

Locational search is highly risky and location is what economists call an *experience good*. Its true value can only be discovered through experience. The same is true of holidays. It is not true of a mass produced car, the value of which can easily be communicated by suppliers and assessed by buyers in advance of purchase. In the face of high risk when spending relatively large amounts on experience goods, it is rational for a supplier to assume the cost of bundling attributes and selling a package with contractually guaranteed features. This saves the excessive consumer-search costs of exploring almost infinite combinations of commodity attributes (of holidays or a home or office location) with limited information and time.

So a master planned community, or gated community or science park or shopping mall is marketed as a bundle of rights to specific commodities – layout and configuration of land uses; type of neighbour; level of services; set of facilities; and so on. Packaging also involves labelling and these kinds of neighbourhood are marketed

using strong themes, images and metaphors. Commoditised neighbourhoods have two advantages over the non-managed neighbourhood.

First, it makes it easier for buyers to discriminate between neighbourhoods when bidding a property price. For this reason, the locational component of a property price will be more consciously articulated and easier to identify. If it is easier to identify, then it will be easier for developers to take note of when deciding on urban form configurations. So packaged neighbourhoods means clearer pricing through the surrogate housing market and a better match of demand and supply when delivering various forms of accessibility by design.

Second, if a master-planned community is given governance as well as physical infrastructure then the direct pricing of certain neighbourhood public goods is made possible via the collection of fees and assessments. Not only is the initial supply of urban form more clearly priced through property price, but subsequent investments in infrastructure, services and facilities can be delivered as club goods – via 'territorial clubs'. This is typically organised through voting on investment proposals made by property owner associations.

The ability to price ongoing investment in urban form and accessibility is a very important advantage of a neighbourhood market over the traditional property market. In the latter, the delivery of new urban space is disciplined to some extent by price signals in the property markets. Degradation of urban form resulting from overuse, devaluation and underinvestment results in lower property prices and in this respect is also priced. But the demand-supply relationship mediated by price is monotonic. It can only go down. Market mechanisms alone do not allow falling prices to generate investment. Political signals may do the equivalent job, of course, but politically allocated regeneration funds are, by definition, limited, lumpy and redistributional. A market solution would be preferable in many ways. In a master-planned community with decentralised governance institutions that permit the raising of assessments from community members, urban form degradation can be priced. Remedial and re-investment measures can be voted on and a price set by agreement. This has the advantage of localising governance decisions about local urban form and inducing a private supply of urban management and regeneration funds. Scarce tax-based funds

can be reserved for regenerating areas that for one reason or another cannot be subject to neighbourhood pricing.

Facilities charging

Many of the facilities that feature in well designed urban spaces can be priced. There are three constraints on the pricing of shared space and facilities: the technical, legal and political feasibility of exclusion. If excludability is feasible in all three senses then a facility can be priced by user fees, or membership subscription, the latter creating a non-territorial club.

An increasing number of recreational facilities in cities around the world are organised as clubs. Congested urban green spaces, like congested museums, are in most cases excludable technically. In fact, many urban parks are made excludable after dusk as a security measure. If the demand is high enough, entry fees could be charged. Equity issues can be dealt with via subsidy to low income households, perhaps through local tax rebate. Where it is genuinely politically infeasible to enclose and charge for a facility (because of the intensity and ubiquity of its social value, or because there is a social value to private consumption, as is the case with education) then funding its management and re-investment through taxation may be the better option. For many public facilities in cities, however, the improved quality and reduced congestion that comes with pricing is likely to be looked upon favourably in time.

Road pricing

Five types of road pricing are of potentially great importance in improving the economic value of geometric connectivity: trunk roads, bridges and tunnels, local roads, parking and central-area pricing.

Trunk roads, including cross-urban motorways, urban ring roads, city-to-airport highways and so on, are often technically excludable; meaning that land is available for toll gates plus queuing areas. Major bridges and tunnels often are too. If a road developer, be it private of public, can anticipate the price that users are willing to pay and can plan to recoup development costs from toll fees, then the road is likely to be supplied to an appropriate specification. Individual large road and bridge schemes

developed by governments responding to political signals without the discipline of price, are typically over specified (over-supplied). On the other hand, roads would generally be under-supplied without government action. The ability to price the use of roads and thus to price new road projects, can therefore lead to more responsive reconfigurations of a cities connectivity.

On-road parking in cities is increasingly subject to pricing – typically at the request of users. An annual parking charge in a residents' only parking zone is a small price for the convenience of predictable parking. Graded price zones in city centres permit drivers to make trade-offs between time and money and ensure, for example, that there is always a space for someone for whom the urgency of short term on-road parking is worth a high price. Developers in the UK increasingly bundle the rights to an on-road parking space into the deeds of houses they sell. In a few years time, the idea of the free use of urban roads for parking will seem a quaint idea from the past.

Central-area road pricing has been proved feasible and efficacious by early pioneers such as Singapore and now, on a world-city scale, London (notwithstanding recent discussions about the extent of the charged-for zone). Electronic access and pricing opens the way to many other types of road space market. For example, the local roads in a neighbourhood may be limited to residents and their visitors by auto-controlled boom gate and electronic tagging and tagging may make it technically feasible to price smaller bridges and tunnels. The latter could yield massive gains to urban environments and urban form improvements by putting more of a road network underground.

Density pricing

If urban development is tightly controlled by a system of planning permissions or zoning permits, then there is a possibility of another form of pricing.

Imagine an inner city arterial road leading out of a city centre and which is subject to a policy of density control via height restriction and floor area ratio. The regulations are justified on the grounds of traffic generation and limited road capacity rather than aesthetics. A blanket restriction will be an inefficient assignment of rights if some land owners could make profitable use of higher densities while others cannot use all

that is allocated. This is very likely in most density or height control zones. It would make more sense, therefore, to allocate a flat quota of density to all land in the zone and then permit trade. Tradeable density quotas would result in a price for density. A more efficient pattern of land use would emerge, raising special accessibility value as firms make the most profitable use of their location. It would also have the effect of optimising property tax revenue from the zone.

Externality pricing

Density pricing is just one kind of externality pricing. Strong planning regulations mean that much more than density can be traded, however.

A form of trading commonly occurs between the developer of a project that imposes some kind of externality costs onto a community and the government representing that community. Section 106 Agreements in British planning law permit the negotiated compensation for congestion and other kinds of externality imposed by developments. Compensation may be paid in kind (a community centre or low cost housing); or in cash (contribution to a low cost housing fund). The negotiation may also ask for investments that lower the externality problem (widening a road). All are examples of a community setting a price for specific externalities arising from modifications to urban form.

Each of these mechanisms permit a price to be attached to some important congestible urban resource: land, shared neighbourhood infrastructure, services and facilities, road space and airspace. They permit pricing of the factors that modify a city's geometric general accessibility. They can thus help ensure a responsive supply of spaces and places endowed with the range and quantity of special accessibility demanded by a heterogeneous population.

10. Conclusion: pricing general and special accessibility

Clearly it is possible to price some of the elements of good urban design. Not all components of urban form are intrinsically public goods. Markets can be created.

It will never be possible to price all sources of accessibility, however, and there will always be missing markets. It will be instructive, in concluding this report, to consider again the most basic of urban public goods: connectivity. Everywhere in a city is connected to everywhere else and this general accessibility of individuals to other individuals is the city's fundamental advantage.

Could general accessibility ever be priced? This is the fundamental question raised at the start of the discussion. If it cannot, what might be a second best institution for optimising its supply? Consider two extremes, the first fictitious; the second common place. The city under unitary private ownership and run as a hotel; and the city under public government and run as a polity.

As a territory, a hotel is under unitary ownership and rights to consume its various local public goods are allocated by very short term rental contracts. So long as the tourist and business travel markets are buoyant and the hotel is well located and managed, then it works well as a contractually governed urban territory. Office towers, cruise ships and shopping malls all operate successfully under a multi-tenanted property model. As a thought experiment, extend the idea to the whole city.

The city as a hotel, could precisely engineer accessibility and could price it through locational rentals. Just as property buyers express the value for location through offer price, tenants would reveal their preferences for different kind of accessibility through rental prices. The hotel management could use these prices to manage the city's infrastructure, constantly investing in ways that improve accessibility for different kinds of guest. With good management, the cost of every new investment could be recouped and direct links between design, accessibility, cost and price means that the incentives are well aligned to optimise the value of the hotel-city.

What is the difference between this arrangement and a conventional municipal government? The distinction is blurred in enterprises like Disneyland, which render the thought experiment less fictitious than might at first be thought. The difference lies in the governing agency's access to land rent generated by investments. If a higher rental price can be charged after an investment, then the investment costs can be recovered with profit, giving the agency incentive to continually invest in urban

development, maintenance and regeneration. With the hotel, the constraints on a rolling programme of investment are access to credit, information about the business in the diverse quarters of the hotel and management capacity. Investment is not capped by political agenda, taxation capacity and is not intrinsically redistributive. Every neighbourhood can win at the same time and the performance of the entire hotel-city can, in principle, be optimised through price information.

What can be learned from this model is that cities would benefit from better aligned investment incentives. This means better information about the benefits arising from accessibility-improving investments; more local decision making; easier access to finance at the local level; and crucially, a more contractual relationship between those who bear the risks of investment and those who benefit from those investments.

Now compare the fully-contractual city with the conventional politically organised city. The first point to note is that the equivalent to rental prices is the property tax (council tax in the UK), supplemented by tax revenue transfers from higher levels of government and by user fees. In other countries, local governments are sometimes given greater freedom to raise revenue from capital markets, including issuing municipal bonds. Where the state owns all or a lot of the land (by constitution as in China or through historical legacy elsewhere) then land leasing is also an additional source – but this is not a conventional situation.

A local tax system can, under certain circumstances, be a kind of second-best pricing mechanism for general accessibility. In the UK, for example, council tax is banded according to house price assessed at period intervals. If a local government can estimate the tax revenue from a new development it might be inclined to design the new settlement to optimise accessibility and benefits. Local government urban planners may indeed rationalise their role partly in terms of optimising the distribution of benefits from land investments. But in the UK and many other countries, they have very weak ‘price’ signals to work with. While they might estimate the land value increment and property prices in a new urban extension or along a new transit route, these values do not necessarily incentivise investment or shape urban design decisions in the same way that the design of a master plan on private land will be strictly shaped to maximise land value (within certain parameters). The incentive misalignment is

particularly problematic in the UK as a result of the system of local taxation. One of the reasons why the congested south-east of England has such difficulty accommodating new urban growth is that local government communities face most of the costs of new growth and only a portion of the benefits – at least in the short term. This is because of the formula which allocates local residential and business taxes to local government. A reformed local taxation system (currently under discussion in the UK) would improve property tax as a second-best pricing system for general accessibility.

However, even with a clearer link between infrastructure investment and revenue, as found in American and French suburban communities for example, local tax revenue is still not a very accurate price signal for general accessibility. It is only partly linked to land price and even this link is calibrated at very infrequent intervals.

A local authority in this position is like a hotel with a revenue stream made up partly of transfers from a parent company and linked loosely to performance; partly from room rates that are set every 10 years or so; and partly from services that are charged for separately from the room tariff. It has to rely on the equivalent of guest's satisfaction forms to guide its investments, management and planning. But in this type of business, the satisfaction forms are only collected every few years and guests are only permitted to express their satisfaction with the hotel's board of management; not on individual matters relating to performance, specification and design of the hotel. Many of the crucial attributes of the city lie in the public domain as a result.

Things are not quite as bad as this, however. Markets can be created, as we have seen. Many of the public goods can be rendered into well managed club goods or private goods. Travelled-to facilities delivered at a point can be priced by entry fee. Services delivered to the door can be priced by metering and user fee. Trunk roads can be priced by tolls. Local roads and whole parts of the network can be priced by tagging or number-plate recognition technology, or cards and boom gates.

And where contractual neighbourhoods can be established in shopping streets, industrial, commercial and leisure parks and in residential estates, then it is not just

road usage that can be priced. Legal enclosure of a neighbourhood creates a territorial market for all manner of local public goods.

Where there are several competing malls in a city's central area, then local environmental design and management within them is enhanced through competition, with rental price providing the signal for the right quantity and quality of urban form investments. Where contractual residential developments compete for home-buyers or renters, local urban design and the quality and mix of local facilities provided is enhanced through competition and supplied in response to price signals.

Imagine a map of London's road, rail and pedestrian networks. The networks give each location in the city a particular connectivity value. Each part of the city, each road, each plot of land and each building has its own value as a point of access to other places, people and organisations. The paper started off by saying that general network connectivity is a public good. It is created by all, consumed by all and benefits all. We have seen, however, that this does not mean to say that it is wholly impossible to price. For most part, general connectivity is valued because of specific economic and social advantages it confers. Individuals value a location's general connectivity for many very specific reasons. Where those reasons come together to form a potential customer base, then under the right conditions, markets can be established for urban public goods.

The networks of London, though in themselves a public good, can support markets in many of the local public goods that constitute urban form. This happens as collective consumption is organised and priced within individual links, subsets of links and the neighbourhoods that the network links provide access to.

The amalgam of the multiple specific valuations of a city's networks leads to a general pattern of land values that is highly correlated with general systemic connectivity. It is a striking finding that for all the many and varied specific demands made on a location, general accessibility conferred by geometry, connectivity and topology seems to powerfully shape a city's land value surface. In other words, even though the dominant accessibility demanded by many types of uses is proximity to similar uses rather than the city centre; and even though each type of land user has its

particular locational calculus that is far more complex than simply wanting to be close to the points of high network connectivity, land values still peak strongly at these points of maximum connectivity.

There are two important reasons for this. First, all individuals living and working in a city make multiple transactions daily and many others at other periodic frequencies. Everyone, whether they are a factory owner, office worker, home owner or travelling sales person, has a demand for general connectivity as well as specific connectivity. Topological and geometric connectivity shapes the ambient demand for space while the specific locational preferences of different groups shape the contours of land rent and patterns of uses around the peaks. Second, competitive bidding between land users ensures that those able to make more profitable use of more connected locations tend to secure them.

Land value is therefore an indicator of the benefit derived from general connectivity – it prices general accessibility. But only where a country has a workable system of land value taxation or a system of state land ownership and land-leasing can these values work as a price to help match accessibility supply with demand. Where land ownership, including the right to land value increments, is fragmented into the hands of many individuals, as it is in mature property-owing democracies, then the potential of using land value increment as a price cannot generally be realised. The separation of investment risk from investment benefit removes a crucial incentive.

And herein lies the direction of travel that needs to be taken in pursuit of more accessible and more sustainable cities. The more erasures there are in the missing market map, the more efficiently will the city's greatest asset – accessibility to other people – be optimised.

To illustrate what this could mean, consider two institutional innovations: transit impact zones and land readjustment. The latter has a long history in Germany, Japan, Korea, India and elsewhere. The former has been used more recently in the USA, the Far East and South East Asia. Each redistributes property rights to land value in a way that addresses the incentive problem. They are good examples of new institutions that could be added to the market-making mechanisms already discussed.

Land readjustment approaches regeneration by temporarily pooling land ownership; redesigning; investing in new infrastructure; redeveloping; and then transferring redeveloped land back to original owners, *pro-rata,* but minus an amount required to cover the costs of readjustment. It addresses the incentive problem by allocating a share in land value increment to all stakeholders, including original land owners, local government, developers and investors. As part of the project negotiation, a package of enhancements is agreed upon and, in effect, a price set. It is an ownership model for pricing and re-engineering accessibility.

A transit impact zone allows the land value enhancement arising from a new transit node or line to be partially returned to the agency that invested in the transit. This may be achieved through *eminent domain*: government appropriation of land around the transit node. Or it could be achieved by a law permitting selected application of a land value tax – a tax on land around a new transit node and levied at the time of the first subsequent land transaction, for example.

Neither mechanism is without problems in implementation, of course, but they are good illustrations of ways of creating markets for particular kinds of accessibility enhancements and this is the way we should be thinking.

A final world should be give to the idea of equity, since the report has purposely emphasised markets and efficiency. Most urban planners in the UK would claim to have a strong social mandate – championing underprivileged and poorer neighbourhoods; ensuring an adequate supply of low cost housing; an even distribution of green spaces in the city; and so on. Few would see their purpose to maximise aggregate land values in a city, or the flipside taken as the focus of this report: to maximise accessibility.

The two – efficiency and equity – are not mutually exclusive goals, however. The planner has a responsibility to ensure that a city has a sufficient quantity of key worker housing, good urban design and green infrastructure. Such resources are public goods and will tend to be undersupplied by property markets. This suggests the need to identify threshold stocks (a political decision); plan for them; and broker deals

and partnerships that ensure their supply. The arguments in the report show that in many cases this can be achieved with the help of markets. The planner's job becomes one of maximising accessibility (land values) subject to certain social constraints. And it should turn out that, at a system-wide level, the constrained maximisation solution is, in fact, of higher value to society as a whole (measured for example in terms of aggregate land values or an aggregate accessibility indicator) than the unconstrained (free-market) design.

I have talked about first and second best mechanisms for ensuring an optimal spatial configuration of a city. Market pricing of accessibility provides superior information about demand and leads to a better match of supply and demand. I have discussed the kinds of mechanism that can turn missing markets into markets. But many of the public goods that create a city's accessibility cannot easily be priced and urban planners, designers and managers have to make many decisions without price information. Statistical models that measure the independent effects of public goods on house prices (so-called hedonic model) capture from the housing market, useful information about the value of different accessibility enhancing factors. This is probably the best kind of second best information. The regularity in the relationship between land value and general geometric accessibility also points to another good second best approach. Systemic connectivity measures from network models like Space Syntax have proven to be powerful determinants of movement behaviour, land use patterns and special accessibility value (all interconnected concepts). Add connectivity value to the other public and private goods components of a hedonic price model and you probably come as near as you can get to capturing (via a surrogate market) the value of general and special accessibility. That, in turn, can provide a scientific foundation for designing and calibrating new institutions aimed at improving (and pricing) urban accessibility (like targeted land value tax).

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