A Political Economy of Access

Infrastructure, Networks, Cities, and Institutions

David M. Levinson • David A. King

1
Accessibility

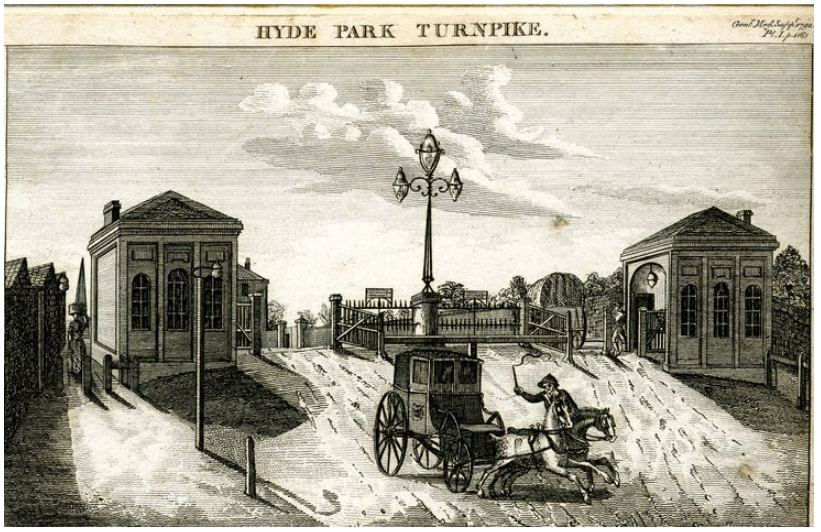

Figure 1.1: Eighteenth century print of the Hyde Park Turnpike toll gate, London.

According to the system of natural liberty, the sovereign[1] has only three duties to attend to ...

First, the duty of protecting the society from violence and invasion ...

secondly, the duty of protecting, as far as possible, every member of society from the injustice or oppression of every other member of it ... and,

thirdly, the duty of erecting and maintaining certain public works and certain public institutions, which it can never be for the interest of any individual, or small number of individuals, to erect and maintain; because the profit would never repay the expense to any individual or small number of individuals, though it may frequently do much more than repay it to a great society. – Adam Smith

[1] The 'sovereign' here means the political leader.

1.1 *The duty of the sovereign*

In his 1776 book *Wealth of Nations*, Adam Smith[2] puts his finger on a number of buttons. He identifies three "Duties of the Sovereign," shown in the opening quote, the most relevant of which is the third, concerning "erecting and maintaining certain public works."

[2] The quotes in this chapter are from (Smith 1776). See also Metschies (2001) for further discussion of Adam Smith's comments on transport.

ACCESS IS SOCIALLY PRODUCED. Public works like roads reduced travel time by reducing distances and by increasing speeds. This is the mobility half of the accessibility problem. In western countries transport networks are regulated or owned by the public sector, which has assumed the role of Smith's 'sovereign.' The other half of accessibility is what can be reached. This is the activity that takes place on land. In western countries, this is largely in the hands of the private sector.[3] A developer not only gains value for himself by developing, but also increases access for everyone else.

This chapter introduces access as efficiency[4] and access as equity[5] in sequence before turning to the motivation[6] for the book.

[3] Governments regulate land development and thus can influence access on this half as well.

[4] §1.2.

[5] §1.3.

[6] §1.4.

1.2 *Access as efficiency*

> Good roads, canals, and navigable rivers, by diminishing the expense of carriage, put the remote parts of the country more nearly upon a level with those in the neighbourhood of the town. They are upon that account the greatest of all improvements. They encourage the cultivation of the remote, which must always be the most extensive circle of the country. They are advantageous to the town, by breaking down the monopoly of the country in its neighbourhood. They are advantageous even to that part of the country. Though they introduce some rival commodities into the old market, they open many new markets to its produce. Monopoly, besides, is a great enemy to good management, which can never be universally established but in consequence of that free and universal competition which forces everybody to have recourse to it for the sake of self-defence. It is not more than fifty years ago that some of the counties in the neighbourhood of London petitioned the Parliament against the extension of the turnpike roads into the remoter counties. Those remoter counties, they pretended, from the cheapness of labour, would be able to sell their grass and corn cheaper in the London market than themselves, and would thereby reduce their rents, and ruin their cultivation. Their rents, however, have risen, and their cultivation has been improved since that time. – Adam Smith

Smith's quote, from Chapter 11 of *Wealth of Nations*, notes how transport (roads and canals in his day) created value. While his view was largely agrarian and shaped by seasonal shipments of commodities, the logic applies to contemporary metropolitan

regions and their daily flows of goods and labor. Transport creates value because it extends the market, and thus increases the division of labor, specialization, and economies of scale.

In cities, firms aim to exploit economies of agglomeration and improve productivity and output by locating near customers, workers, suppliers, and even competitors, while trying to reduce the combined costs of land and travel. Individuals and families aim to achieve proximity to their work, shops, and other activities and amenities while simultaneously obtaining more house and lot for the money. This tension between centralizing and decentralizing forces keeps the city from collapsing into a black hole or flying apart at the edges. However, the balance between these two forces changes over time as technology, demographics, socio-economics, and other preferences change. In recent decades, these changes have led to many US cities becoming larger in population, but larger still in area.[7]

[7] (Marshall 2007).

As firms choose locations, they select metropolitan regions to be near activities, things, organizations, and people they find important, and select locations within metropolitan areas for similar reasons, trading off benefits and costs of those locations. Residents are no different. Location choice is a set of trade-offs. Those trade-offs depend on the location pattern given by placement of other activities, and the transport networks used to reach them. Transport networks, often publicly provided, convey value to land by enabling access to key activities.

People are willing to pay more for locations with better locations where more activities can be easily reached.[8] Streets, highways, and transit systems, however, are not free. Further, the resources provided to support transport have diminished in real terms in the United States,[9] leading to a degradation in quality. This reduces their value as people will avoid traveling on bad roads or decrepit buses. However, capturing the property value created by access to destinations provided by transport networks, and using that captured value to invest in the operations, maintenance, and in some cases expansion of those networks is a win-win solution waiting to be reached. We think of this as a virtuous cycle: infrastructure creates access, access creates value, value can be captured, and captured value can fund infrastructure, an idea we elaborate in value capture.[10]

[8] (Iacono and Levinson 2017).

[9] (Pew Charitable Trusts 2014) (Figure 7).

[10] §16.

The Division of Labor is Limited by Accessibility

> As it is the power of exchanging that gives occasion to *the division of labour*, so the extent of this division *must always be limited by* the extent

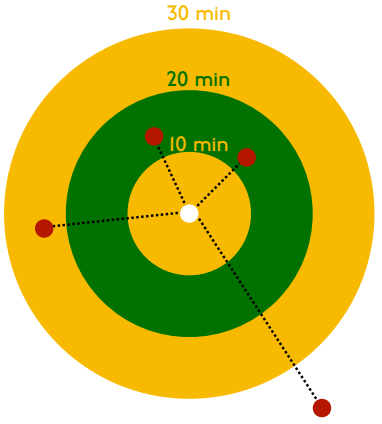

Figure 1.2: Cumulative opportunity accessibility. No jobs are available in less than 10 minutes, 2 jobs within 20 minutes, and 1 additional job within 30 minutes.

> of that power, or, in other words, by *the extent of the market*. When the market is very small, no person can have any encouragement to dedicate himself entirely to one employment, for want of the power to exchange all that surplus part of the produce of his own labour, which is over and above his own consumption, for such parts of the produce of other men's labour as he has occasion for. – Adam Smith

The bigger the market, the more specialized producers can be. And the bigness of the market depends on transport (how far you can reach) as well the intensity with which space is used (density of activity). In modern language, Smith observed that the size of the economy depends on accessibility.[11]

Accessibility measures the efficiency of the city in its primary role: enabling people to reach other people, places, and things. In short, *accessibility is the ease of reaching valued destinations*.[12] A place that is accessible is easily reached. A place that has high accessibility is a great jumping off point to go elsewhere quickly. The places that we value are varied, but typically include work, shop, school, entertainment, and recreation. Firms value access to suppliers, labor talent, and their end markets.

MOBILITY VERSUS ACCESSIBILITY. Those not steeped in the jargon (and some who are) often conflate mobility and accessibility. Mobility measures the ease of moving on the network, and is often captured by network speed or the travel time index (the ratio of actual (congested) travel time to the best possible, or freeflow time),[13] a standard way of defining congestion across networks. Yet mobility only addresses half the problem, movement on the network. It does not address where people are going. A simple example illustrates the problem with considering only mobility.

Compare Manhattan and Manitoba. In Manitoba there is a high network speed, there is virtually no congestion, and a travel time index of approximately 1. The population of Manitoba, an area of 649,950 km^2,[14] is almost 1.2 million people,[15] of which about three out of four live in metropolitan Winnipeg. In contrast consider the island of Manhattan, an area of 61.56 km^2,[16] (over 19,000 Manhattans could fit in Manitoba) and a resident (night-time) population of 1.6 million. Clearly the island is heavily congested, it takes a relatively long time to travel a given distance. The travel time index for New York City as a whole is 1.37, among the top five cities in the US. Manhattan alone would be higher still. This means it takes about 37% longer to travel with traffic than without, and of course the freeflow speeds are lower in Manhattan than Manitoba. But because the population and employment are so high, there are many more destinations one can reach in the same amount of time.

[11] The most commonly used accessibility measure (Hansen 1959) is given below.

$$A_i = \sum_{j=1}^{J} O_j f(C_{ij}) \tag{1.1}$$

To apply this in practice, the function of costs needs to be specified. For simplicity we present the cumulative opportunities formulation. The idea is illustrated in Figure 1.2.

$$f(C_{ij}) = \begin{cases} 1 & \text{if } C_{ij} < t \\ 0 & \text{if } C_{ij} \geq t \end{cases} \tag{1.2}$$

where: A_i is access at point i, O_j are the opportunities at point j, C_{ij} is the cost of travel between i and j, and f is a function that transforms costs.

[12] The concept has been well-described in the literature, and there are numerous definitions (Handy and Niemeier 1997; Kwan and Weber 2003; Geurs and Van Wee 2004; Scott and Horner 2008; Ottensmann and Lindsey 2008).

[13] Travel time index (TTI) is given by:
$TTI = \frac{t_c}{t_f}$
where:
t_c is the congested travel time and
t_f is the freeflow travel time.

[14] 250,950 mi^2.

[15] (Health Information Management Branch 2008).

[16] 33.77 mi^2.

In a half-hour drive from the center of Manhattan, one can reach millions of jobs.

From the densest part of Manitoba, the center of Winnipeg, one could reach about 400,000 jobs. Manhattan is roughly 10 times as accessible as Winnipeg despite speeds that are at best half as fast. Compared to a random point in Manitoba, it is thousands of times more accessible. This value is reflected in land prices.[17] The difference in rent is not as great as the difference in accessibility, but that is due to the cost of the structure itself (as opposed to the land) which is largely fixed (though still may be higher in New York than the Prairie Provinces).

[17] As of 2010, monthly rents in Midtown Manhattan were just under $\$645/m^2$ ($\$60/ft^2$). In Winnipeg rents were about $\$150/m^2$ ($\$14/ft^2$). The rent in Winnipeg is in Canadian dollars, the exchange rate varies.

The transport problem is often posed as a mobility problem, for instance: How can we move quickly on networks? Concerns about congestion are often brought to the fore.[18] Hyperbolic words like 'gridlock'[19] are often thrown around in the media, though literal gridlock, as shown in Figure 1.3 is uncommon.

[18] The Urban Mobility Indicators report is the most widely cited of these reports (Schrank and Lomax 2009).

[19] The term gridlock was popularized by transport engineer Sam Schwartz, who used it during a transit strike in 1980 to describe conditions. The earliest use of the term to describe traffic was the early 1970s.

A widely cited study finds that congestion in the Twin Cities region increased from 1995 to 2005, with annual delay per peak traveler rising from 31 to 43 $hours/year$.[20] In contrast, another study[21] finds the same Twin Cities region was more accessible in 2005 than 1995, more jobs could be reached in the same amount of time despite the rise in congestion.

[20] (Schrank and Lomax 2009).

[21] (Levinson et al. 2017).

How can we explain these two seemingly divergent outcomes? There are several possibilities. On the mobility side these relate to additional roadway capacity and more intense use of faster roads in 2005 and 1995. On the land use side, these relate to the relative location of jobs and housing. Starting on the mobility side, it is possible that average network speed can rise as does congestion. Table 1.1 illustrates this.

In this example, the average speed before was 28 km/h.[22] The speed drops on both links, yet, in the after case, the system average speed has risen to 30. This is because the share of travelers on each link has changed. This example illustrates what happens manyfold as more and more travelers (and more importantly, a greater share of travelers) switch to faster suburban highways from congested

[22] 17 mph. The units don't actually matter.

		Link 1	Link 2
Speed (km/h)	Before	55	25
	After	40	20
Flow (Share of traffic)	Before	10%	90%
	After	50%	50%

Table 1.1: Example: Two Facility System. Adapted from Levinson and Kumar (1994b).

urban arterials. While both roads got worse, the relatively faster route attracted more travelers.

So why would the share of travelers using each link change? The decentralization of employment, which grew in the suburban ring while being essentially static in the center city, is the driving force behind these seeming paradoxes of higher travel speeds despite higher congestion, and more importantly, greater accessibility despite rising congestion. Moreover, there were small changes in relative residential location – this period saw the number of people residing in downtown Minneapolis increase from approximately zero to about 30,000 – clearly more of the region's new residents moved into suburban locations. This convergence of accessibility (or flattening of the city) is illustrated by improved job/worker balance as shown in Figure 12.2, and indicates that locators (especially employers) respond to accessibility determined by network configuration and pre-existing land use (especially residential) to site their own organizations in a way to keep transport costs for their workers in check (and thus reduce the wage required to attract good employees).

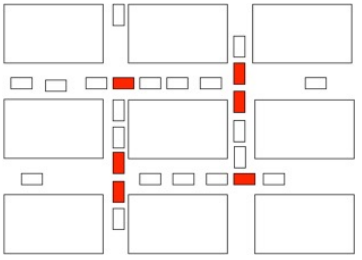

Figure 1.3: Stylized image of Gridlock.

MOBILITY COMPLEMENTS ACCESSIBILITY. Mobility-focused transport policies are not the enemy of accessibility-focused policies. Mobility improvements can complement accessibility. For governments, it is a matter of understanding the trade-offs between density and mobility, which affects overall accessibility. Figure 1.4 has a y-axis as density, and x-axis as mobility, where the Northeast corner would be high access: high density multiplied by high mobility.

This system behaves differently by mode. For transit networks, cities arrange themselves on a line from the southwest to the northeast (a positive feedback loop between supply and demand). For auto networks, cities arrange on a line from the southeast to the northwest (a negative feedback loop between congestion and demand). Using data one could place specific cities on the graph. One expects places like New York and Hong Kong in the northeast corner, most US cities in the southeast corner, small developing-world cities without widespread adoption of modern automobile or transit technology in the southwest corner. Poor, but dense cities without good transport networks lie in the upper northwest corner.

Accessibility is an economic good,[23] but it is not a good without costs such as congestion, and there are limits to how much people are willing to pay for access. It may also suffer from diminishing

[23] §A.

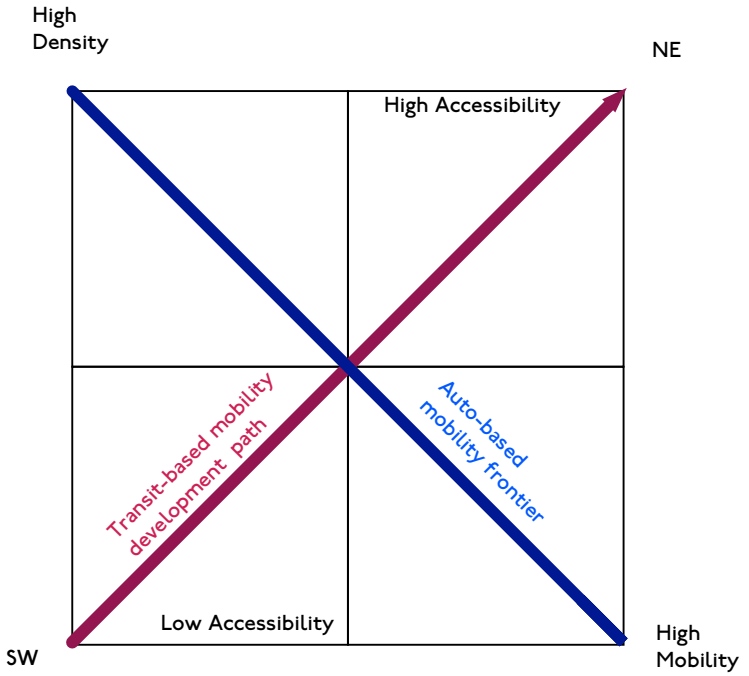

Figure 1.4: Density Mobility Tradeoff.

returns, where beyond a point each additional unit of accessibility is worth less and less.

1.3 *Access as equity*

If we agree that more access is generally better than less access, especially after accounting for all the benefits and all the costs associated with access, then we want our transport - land use systems to efficiently produce access. The more efficiently we produce access, the more access we can have per dollar spent. Of course, access per dollar is but one measure of efficiency. To maximize access provided per dollar, only the investments that carry very high access per dollar returns should be pursued. This would result in smaller networks than we have now. Hong Kong is built around this principle in many respects, where the transit owner and operator is also a real estate developer, so transit and land for development are constrained to ensure high densities and lots of ridership. From an efficiency perspective, this works well, and people travel from around the world to marvel at how well the Rail + Property model works. But Hong Kong is also consistently ranked as the least affordable city in the world.[24]

[24] (US Department of Housing and Urban Development 2018).

Equity is also an important objective. In an absolute sense, there is a trade-off between efficiency and equity. The most economically efficient investments from a social productivity sense do not necessarily benefit the least well-off, and certainly don't benefit everyone equally. For instance, it is clear that rich people have a higher economic value of time than poor people in the conventional ways of measuring such things, which depend on willingness to pay to save time. Investing public funds to reduce the travel time of wealthy people (which increases their accessibility) tends to pencil out[25] more than investing those funds for poor people. Departments of Transportation, with their political leadership, insist that value of time for all individuals making a particular kind of trip be considered equal in evaluations.[26] This is an assumption to support equity over efficiency. While we can argue that our measures of efficiency and productivity are broken, we do so primarily because we do not like the implications of the outcomes.

A system change that increases access for someone without worsening access for others in an absolute sense is a net improvement.[27] Paradoxically, however, this change may also worsen equity by some definitions, which considers the relative differences between groups. There are many different measures of equity, which makes even discussing equity in transport difficult.[28] Should we promote equality of opportunity (everybody has the same chance) or equality of outcome (everybody gets the same thing)?

Humans are social animals, and relative status is as important to many people as absolute wealth, at least above some minimum standard of living. We are on a hedonic treadmill.[29] While this drives progress as people innovate and compete to improve their own lot in life, relative status should not drive public policy. Someone always must be first and someone else is always last, and while people may be more absolutely equal, there is also always a difference in rank. So long as the least well-off gain access in absolute terms, we argue that we should think of it as an improvement.

[25] By *pencil out* we mean expected benefits from time savings exceed costs required for investment.

[26] (Rogoff 2014).

[27] Referred to as a 'Pareto improvement' in the economics literature.

[28] (Palmateer and Levinson 2017; Martens et al. 2012).

[29] The phrase 'hedonic treadmill' refers to the idea that people have a relatively stable level of happiness, and events can't effect this much. You need to keep walking just to stay in place, but even if you run, you don't get any farther.

1.4 *Why* A Political Economy of Access*?*

> Policy making takes place in a political and administrative system that is fragmented to the point of chaos. – Douglas Yates[30]

[30] (Yates 1977) p.34.

Developing a city of high accessibility is a massive coordination problem. So, at the simplest level, access is improved through coordinated transport and land use actions. In an unregulated, competitive, free market, prices act to perform that coordination

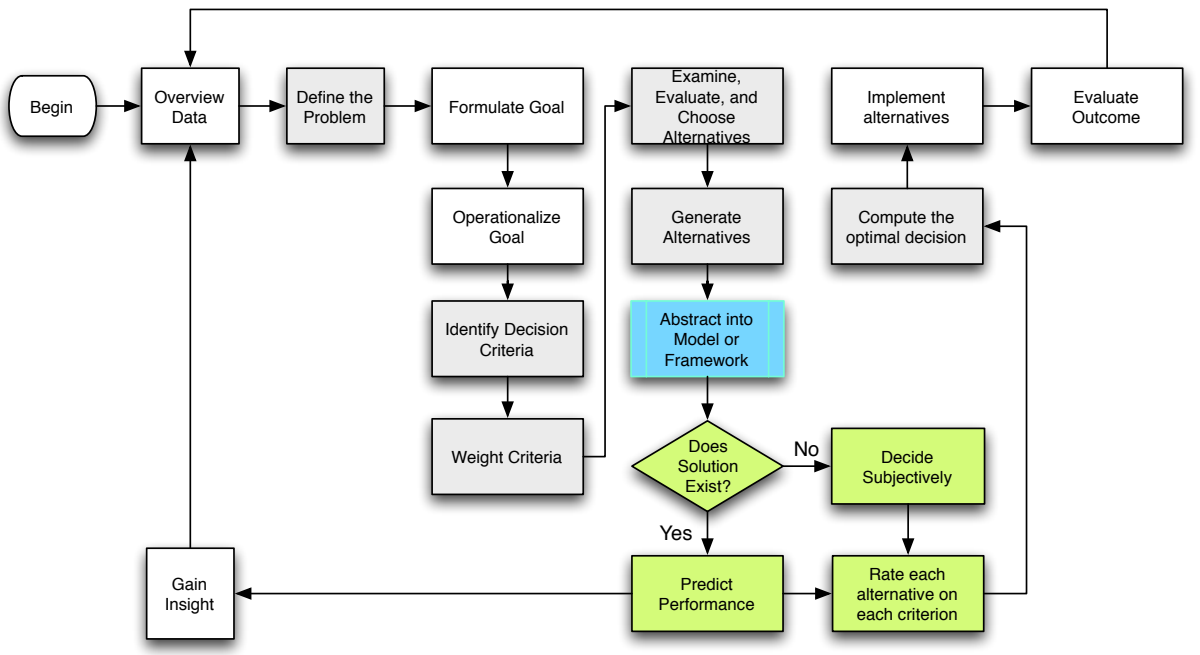

Figure 1.5: Rational planning and decision making model. This is not how decisions are actually made.

function. Cities are far from perfect free markets, as they have significant aspects of spatial monopoly and are highly regulated to control externalities. To the extent policies affect actions in the intended way, this means access improves where access promoting policies are adopted and access diminishing policies are not. But it is not so easy.

A common framework used to analyze planning is through the differences between the public sector and private markets. As a binary choice this distorts the mixed nature of urban systems. Transport and land use co-develop (or mutually decline) through the actions of public and private actors. At a basic level of analysis, public sector responses are due to some type of market failure (or market responses are due to government failure, depending on your perspective). In transport and land use, market failure often takes the form of negative externalities (congestion, emissions, noise, crashes, etc.) or inefficient supply of infrastructure.

There is no shortage of research that explores the relationships between transport and land use. These studies are nearly all about effects or outcomes, such as the effect of residential or employment density on transit ridership, does bike infrastructure increase the amount of cycling, does transit make us healthy (or short)?[31] Collectively, these studies are what happens if a certain set of

[31] (Ermagun and Levinson 2017).

interventions are made in certain types of places. We know far less about how to make things happen. The 'how' question is one of politics rather than transport expertise or need.

We see many scholars (and others) look at problems and propose intuitive sounding solutions, especially in the context of seemingly uncoordinated governance and institutions. For instance, a proffered solution to fragmented, city-by-city land use policy is state level planning – the assumption being that the outcomes under unified governance will be necessarily better than the status quo. This sounds reasonable, so to curb urban sprawl in the 1990s over a dozen states implemented statewide growth management regulations. The idea – following the theory stated above – was that local land use regulations lacked coordination to minimize environmental harms and other effects of sprawl, so state mandates would supersede and improve local decisions. These state efforts were successful politically in that they were adopted, but they had no effect on reducing the rate of suburban sprawl.[32] So the politics worked but the policy didn't – a familiar refrain.

[32] (Anthony 2004).

Today we regulate land use in a way that was unknown in Adam Smith's time. Smith was writing before the railroad and the industrial revolution, before zoning, the elevator, the high rise, the internal combustion engine, the automobile, the modern road, or even the United States. Of course, we also intensively use land far more than was common in all but the worst slums of 1776 (the largest city in the 13 colonies at the time of US independence was Philadelphia with 40,000 people). Our networks are far more comprehensive and faster than Smith could imagine, though in the US they have seen few improvements in speed for decades.

To understand how things are done, we need to look at how decisions are made. From a cursory glance at the state of the world, it is obvious that classical expectations of rational decision making, as shown in Figure 1.5, are not a reliable description of policy making. We can see the political economy of access in action through coalition building for investment. Within any region, developing a coalition in support of road projects is relatively straightforward. Roads are popular because roads are ubiquitous. Transit coalitions, by contrast, are much more difficult to assemble. Transit investment requires regional (or higher) coalitions to support the extremely high costs of construction, but since rail transit costs so much to provide, the total mileage built is small. Even with the dramatic increase in light rail transit (LRT) systems over the past three decades, there are still only about 1,500 *km* of total light rail track in the US, compared with approximately 9,000

km of track in Europe. In contrast, the City of Melbourne alone has 250 *km* of tram track, (which is a mix of what the US would call light rail and streetcar) but that serves under 5% of work trips per day in the region,[33] even relatively extensive transit networks are not as influential as they seem. To appeal to voters regionally, transit coalitions have to be built around benefits to drivers more than benefits to riders.[34] Thus, regional coalitions promote mobility improvements (faster travel speeds) rather than accessibility improvements.

[33] Overall transit share in Melbourne is higher, as it includes trains and bus.

[34] (Manville and Cummins 2015).

US streetcar systems,[35] which generally promote economic development and property values over mobility or accessibility, are another interesting coalition. Streetcar coalitions bring together transit advocates – some of whom will support any transit investment – real estate interests and local economic development proponents. These projects are, in nearly all cases, transport projects that are developed apart from the existing transit agencies. Portland, Cincinnati, Atlanta, Kansas City, and others developed streetcar systems managed by non-profit corporations. Though the regional transit agency may be contracted to operate the system in some cases, streetcar systems are designed with separate sources of revenue to support development and operations to achieve economic development goals rather than access.[36]

[35] §11.

[36] (King and Fischer 2016).

When the primary goal is to generate political support rather than improve accessibility, then any policy will do. This is roughly the way things are – the US has politically stable transport and land use policies. The problem is that these stable policies get our cities wrong, and many of us would like to see changes that improve cities for the better. If our goal is to improve access, and it is, the political coalitions needed to move forward politically are different than those that favor the *status quo*.

So have we learned anything since Adam Smith? In short, we have learned a lot, but we too often relearn[37] basic lessons rather than gain new knowledge.

[37] §14.3.

In post-nomadic societies, transport in the absence of development, and development in the absence of mobility are equally pointless. Transport connects people with their destinations. These things are all well known, yet we continue to struggle with actually building cities with these principles in mind. This gap between the normative (what we know we should do) and the positive (what we actually do) comprises our the deficit of knowledge about the *Political Economy of Access*. So when trying to understand the political economy of access, we need to combine these historically *siloed*[38] fields.

[38] *Stovepiped*, for our industrial, rather than agrarian, readers; *sandboxed* for our information age friends.