Highway Leasing and Club Theory

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Introduction

In recent years financially stressed jurisdictions have attempted to solve their fiscal shortfalls by leasing highways to private companies. The private company pays an upfront fee or promises a regular stream of cash payments in return for operating and collecting tolls from highway users during a fixed term.

In a front page article on August 26, The Wall Street Journal described the efforts Pennsylvania was going through to lease the United States’ oldest, major toll road, the Pennsylvania Turnpike.2 Leasing highways to private parties benefit state and locality finances with a lump sum or a stream of cash that can then be turned to pay for other programs. Other government entities considering highway or other infrastructure leases include Florida, Chicago, and New York State.

Mancur Olson is his classic work, The Logic of Collective Action, provides a basis for understanding why providing resources for road construction and maintenance has always been so problematic. Olson argued that large groups have trouble mobilizing for a collective action that would benefit the whole group because each individual realizes that their solitary action would be meaningless unless there is significant action by many others. Olson declares that large group action generally requires some element of

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coercion. The logic of collective action has been a problem for road construction and maintenance since earliest times. Until a coercive force like a king or emperor became involved, systematic road building languished.

Once civilization has constructed a highway system, another economic model is useful in describing how government and the highway system interact. Club Theory, which originated from a seminal article by James Buchanan in 1965, has been applied to highways. In an article on intergeneration clubs, Todd Sandler showed that when governments provide highways, governments tend to favor the current generation by charging current users less than full cost and providing less upkeep. Sandler termed this tendency: intergenerational myopia.” The highway facilities are thus over-used and deteriorate more rapidly, leaving a worn and torn up infrastructure for future generations.

Sandler obtains a different result if an inter-generational club is privately owned. In this case, if the club members’ ownership is represented by securities that can be sold, and the club charges fees adequate to cover current expenses. The facility is not over-used and worn down. This implies that a private highway would not have infrastructure repair and funding issues associated with government ownership and operation. But what about the current set of highway lease proposals?

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This paper analyzes highway leases using a club theory approach. The paper seeks to answer the question whether leased highways would continue to have the problems of government-provided highways regarding maintenance and funding or might more resemble a privately owned and operated highway. The paper finds that highway leases, while ameliorating intergenerational myopia, do not eliminate it entirely.

**History of Highway Construction, Financing and Maintenance**

In his book, *The Logic of Collective Action*, Mancur Olson identified a fundamental problem with group action. For groups to be successful, the members must see that their individual actions will have significance and lead to benefits. If the groups are too large so that an individual member’s action will have no effect, group action will not be successful unless there is some form of coercion.\(^6\)

For primitive societies, roads provide such a problem. Many members of a primitive society would benefit from a road system, but any individual’s action would have no effect. It required an aristocratic or military elite within an emerging empire or kingdom to coerce the subjects into road construction and maintenance. However, even with coercion, road construction and maintenance proved difficult. Early funding could be problematic, even for the Romans.

The ancient civilizations of China, Persia and India were great road builders, but the Romans have the strongest legacy in the West. Rome possessed a military and

commercial elite that realized the benefits of a road system for trade and defense. At the Roman Empire’s peak, Rome had 80,000 km compared to 40,000 km for China.

Rome’s first arterial road was the Via Latina, constructed in 334 BC to link Rome with Calvi, a recently acquired colony. This colony grew in significance so that Rome began construction of the more famous Via Appia (Appian Way) in 312 BC. Poet Publius Statius called it the “Queen of Roads” in 70 AD. However, its construction emptied the public treasury.

The Roman system linked the far reaches of the empire and circled the Mediterranean and covered Western Europe. The Roman army had responsibility for road building and maintenance, but road crews were usually made up of convicts and slaves. At the empire’s zenith, Augustus tried to make road funding the responsibility of the local inhabitants, but this was not popular. Imperial funds continued to be needed. Toward the end of the empire, construction ceased and maintenance became solely the responsibility of local citizens. This was proved unsatisfactory as the theory of collective action would predict. The repeated support struggles of the ancient world’s finest road system testifies to the strength of Olson’s thesis on collective action: If individuals within a large group feel their individual action will have no impact, a large group will have difficulty achieving beneficial actions.

**Medieval Roads: Rise and Fall of the Corvée**

Early medieval localities viewed roads as a means for invasion so they obstructed or blockaded old Roman roads at local and regional boundaries. Feudal lords
also realized that roads could mean freedom for their serfs so controlling road access was important for controlling subject populations. Charlemagne understood roads’ significance in empire building. He had an imperial vision so he constructed roads and put them under a central authority (771-814 AD). He also instituted a system for his subjects’ obligations to work on road maintenance, which would evolve into the dreaded corvée, abolished by the French Revolution in 1791.

Providing the resources for road maintenance was a problem that medieval France and England tried to solve through use of the corvée. The corvée subjected vassals to military or other physical duty. It entailed maintaining the roads and bridges of the feudal lord. The corvée is a clear example of coercion on members of a large group to achieve benefits for the group or the elite at the top of the group.

As feudal obligations ceased to fulfill the maintenance requirements, renaissance European societies experimented with other means to resource road work, especially maintenance. France added a salt tax in 1591 to generate revenues for road upkeep. In 1555 the English Parliament passed a highway act that required the various parishes to maintain roads with individual parishioners obligated to provide four days of service annually. In 1654 Parliament allowed parishes to hire road surveyors to supervise the work.

In the early industrial period, funding roads remained problematic. France repealed the corvée in 1791 and replaced it with taxes and tolls. Virginia tried a lottery in
1790. New York still had a variation of the corvée, a law requiring free males to provide between 1 and 30 days annually for roadwork, depending on need and capability. But New York roads were still poor and there were not enough settlers in rural areas to provide adequate labor. Acquiring resources for adequate road construction and maintenance brought many to support a private approach, the turnpike corporation, funded by tolls. This meant providing a small group of entrepreneurs with means to develop and maintain roads that would benefit the larger society.

**Tolls and Turnpikes**

Roadway tolls have an ancient lineage. India had roadway tolls in 320 BC. Eleventh century Europe was quite familiar with tolls, and tollgates are noted in the Domesday Book in 1085. The authorities found it easiest to enforce toll collection on bridges. London Bridge began collecting tolls in 1286, and generated enough of a surplus to fund its own maintenance plus the construction of Tower, Southwark, and Blackfriars bridges. In 1274 Edward I granted toll authority on a road heading north out of London, but the measure did not lead to widespread toll collecting grants.

The English turnpike era began in 1706 when Parliament passed the first of several turnpike acts. These acts granted turnpike trustees powers to borrow money to improve the roadway and to impose tolls to collect revenue. The private toll road became known as a turnpike. The name derives from military defensive obstructions known as turnpikes, which were long poles with sharp metal tips attached to vertical poles. These long poles with metal spike ends resembled the pike weapon.
However, turnpike tolls were not popular. Riots against turnpikes led George II in 1734 to impose the death penalty for turnpike gate destruction. This had minimal deterrent impact. For example, in 1753 Yorkshire and Bristol rioters wrecked about a dozen turnpike gates. English turnpike expansion peaked in the second half of the 18th century. Between 1751 and 1771 Parliament passed almost 900 separate turnpike acts. England had 40,000 km of turnpikes by the early 19th century. The largest turnpike was the 300 km Bristol Turnpike Trust, and the average English turnpike was about 40 km.

The turnpike era came later to America and was also driven by the need to acquire adequate funding. But economic development also played a large role. A corvée-based system did not work in rural American areas with sparse settlement: there was not enough labor to apply to road maintenance. Improvement sponsors believed that a turnpike corporation provided the means to organize resources necessary for construction and road maintenance.

Competition for trade flows also drove turnpike construction. For example New York sought to draw traffic into the Hudson Valley and away from Pennsylvania or Massachusetts. But Pennsylvania got the jump: The first US turnpike was the Lancaster Turnpike, which the Pennsylvania legislature chartered in 1792 with a $300,000 capitalization. This turnpike was 100 km long when it was completed in 1794. The Virginia legislature funded a second turnpike, the Little River Turnpike, in 1785; but it was not completed until 1802. However, this turnpike was exceptional in its being a public venture. American turnpikes were generally organized as private concerns.
While English turnpikes were organized as non-profit trusts, financed by bonds, Americans created for-profit turnpike companies, funded by an early version of stock, local subscriptions. The turnpike company had several advantages over the previous methods of road construction or maintenance. It could reach beyond a single local town and acquire resources from all the towns it planned to connect. Instead of relying on corvée labor obligations, the company could hire contractors for specific jobs. An important job was the toll-keeper who, besides collecting tolls, provided some local security and local community representation.

Turnpike companies were an organizational breakthrough. When a company completed a certain mileage, like 10 miles (about 17 km), its charter enabled it to construct a tollgate and start collecting tolls. By the 1830s American turnpikes reached their zenith. Pennsylvania had 80 companies with 4,000 aggregate km while New York had 278 companies and 7,000 km. In 1811 the US federal government began constructing the National Road, which began in Cumberland, Maryland and reached Wheeling (now West Virginia) in 1818. It reached Zanesville, Ohio in 1833, but the government began receiving reports of corruption among the road’s construction contractors. Furthermore, President Andrew Jackson vetoed the Maysville Road project in 1830, bringing to an end any federal road schemes until the 20th century.

After Jackson’s Maysville veto, the National Road had limited support. It reached Vandalia, Illinois in 1841 and was terminated as a federal project. By this time the states
also had lost enthusiasm for turnpike or road projects. New technology, in the form of
first canals and then railroads, began dominating transportation.

The turnpike decline can be traced to several factors. They did not make any
money for their investors. They were caught between the difficulty of collecting tolls and
the emergence of lower cost technologies: canals and railroads. In the 1830s turnpike
ton-mile rates were 10 cents while canal rates were 2-3 cents, and those customers who
did pay turnpike tolls complained when particular turnpikes were not well maintained.
This could lead to state intervention and suspension of tolls. Victorian England moved to
eliminate tolls and road barriers because they restricted freedom of movement. Roads
declined until another, new invention, the bicycle, precipitated the “Good Roads”
movement.

“Good Roads” and the Rise of the Automobile

The bicycle became extremely popular in the 1880s. US manufacturers produced
more than one million bicycles annually by 1890. However, the US road system outside
of cities and towns constrained bicycling, and poor roads made bicycling dangerous.
Cyclists and manufacturers came together to create the Good Roads Movement. The
movement lobbied at all government levels to gain passable roads.

An early success arrived when the Cleveland administration established the Office
of Road Inquiry in 1893. This is the predecessor agency to the Federal Highway
Administration. The new agency became the focal point and leader of the Good Roads
Movement. In the 1890s it built short road segments to show local engineers proper road
building techniques. The Good Roads Movement acquired support at the state level as well. Massachusetts and New Jersey created state highway agencies in the early 1890s. New York began a state role in highway financing in 1898. However, funding highway improvements was still problematic.

The widespread use of the internal combustion engine provided both increased road demand and a funding source. Governments imposed fuel taxes and registration fees to gather funds for highway construction and improvements. This was a step toward economically efficient road pricing because these fees were user fees. And the fuel tax was tied to actual use. The US federal government provided aid from general revenues through a series of acts. In 1912 the federal government provided rural road funds to facilitate postal delivery. A second act, the Federal Highway Act of 1916, provided more general highway aid but was stalled by World War I. The Federal Highway Act of 1921 unleashed a highway construction boom. This legislation restricted funds to a federal highway system linked at state lines and required roadways to be at least 5.5 meters wide. This system was seven percent of total public roads.

**Autostrada, Autobahn and Interstates**

Highway carriers in developed countries have a good infrastructure available to them. The foundations for this infrastructure were laid in the inter-war period. The fascist dictators built the precursors of the modern super highway. Mussolini developed Piero Puricelli’s plan for a new Italian highway system. The first autostrada was a 50 km route from Milan to Varese and Lake Como, which opened in 1924-25. It had concrete pavement and a design speed of 60 km/hour. The German autobahn began before Hitler
with 20 km segment built between Cologne and Bonn in 1929-32 by the Rhineland province. The Nazis took over all autobahn construction in 1933. Fritz Todt led construction, which completed 1,000 km by 1936 and 4,000 km by 1942.

America and Britain came later to the building of super highway systems. The first British motorway came in 1958 with completion of the 13 km Preston Bypass. US built parkways, for automobiles only, in the first half of the twentieth century, mostly through the efforts of local governments. The 10 km Long Island Motor Parkway opened in 1908. New York City and Westchester County built the 27 km Bronx River Parkway between 1916 and 1923. Another New York area parkway, the Merritt Parkway, opened in 1939. America’s first super highway was the 270 km Pennsylvania Turnpike, which opened in 1940. It was built on an abandoned rail line with federal support. It was federal intervention that brought America’s modern super highway system.

President Eisenhower galvanized the country behind the need for an interstate system, which now bears his name. In 1956 Congress passed two acts that authorized and funded the interstate highway system. Congress created a trust fund, maintained by fuel taxes, to provide financing. The system grew to 70,000 km by 1990 and provides road systems historic contributions to commerce and defense.7

We are now more than fifty years past the inception of the Eisenhower Interstate System. The interstate system is creaking along. Todd Sandler in a perceptive 1982 article explained why this is so using club theory.

**The Theory of Club Goods**

In his seminal 1965 article, James Buchanan first posed the concept of a club good. The club good exists between the two extremes of private goods and public goods. With private goods, consumption of a unit of output removes that unit from anyone else’s consumption. This also means there are discrete decisions concerning the production and provision of private goods. Food is an example of a private good. When one eats a hamburger, it is no longer available for others to consume. And each day McDonalds has to decide how many hamburgers to produce and what price to charge.

On the other hand a purely public good is not used up when consumed. It is impossible or hugely inefficient to prevent people from enjoying the benefits of a public good. Furthermore, when the public good is produced all members can enjoy its benefits. Broadcast radio or national defense are usually cited as examples of public goods.

Buchanan identified goods that fell between the two extremes of private and public goods as club goods. These were goods that provided benefits for a group larger than an individual or family. An example might be a neighborhood swimming pool. In many neighborhoods a swimming pool would provide excessive benefits and costs for a

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single homeowner so neighborhood associations have pooled their resources to provide the pool collectively. Provided the pool is not crowded, any individual’s enjoyment of the pool does not foreclose nor impair another’s enjoyment.

With club goods like swimming pools, the collective group must resolve questions concerning membership size and congestion. The size and diversity of the membership affects the size, type and even number of pools that the collective group provides. Congestion can detract from any member’s enjoyment of the pool. In response the collective group can limit membership and prevent non-members from using the pool. The collective can also impose membership fees to raise revenue and limit membership.

Buchanan’s swimming pool is thus an example of an impure public good. It falls between purely private and purely public goods. The pool provides benefits beyond a single household but is also subject to congestion or crowding.

**Highway Funding and Intergenerational Clubs**

Todd Sandler has extended Buchanan’s club framework to add an intergenerational component and depreciation. Sandler’s additions mean that the club good’s useful life extends beyond one generation’s lifetime and usage can cause wear and tear on the club facilities. Depreciation is an intergenerational factor because the current generation’s usage can affect club good’s condition for use by future generations.

Highways can usefully be examined as an intergenerational club good. The history of highway construction and maintenance exhibits highways as providing benefits
that extend beyond an individual or family. In the highway case, a driver’s license is the club membership card.

Assuming that all consumption goods can be collapsed into two general categories: club goods and private goods, Sandler posits the following utility functions for members and non-members:

\( W = W (u^1, u^2, \ldots, u^n) \) 
\( u^n = u^n (x^n, c^n, D^n, y^n) \) 
\( \hat{W} = \hat{W} (\hat{u}^1, \hat{u}^2, \ldots, \hat{u}^n) \) 
\( \hat{u}^n = \hat{u}^n (0, 0, 0, \gamma^n) \) 
\( c^n = c^n (k^n) \) 
\( D^n = D^n (k^1, k^2, \ldots, k^n; m^1, m^2, \ldots, m^n) \)

Equation (1) is the multi-period utility function for a club member; \( u^1 \) is the member’s utility in period 1. Equation (2) shows that a club member’s utility in any period depends on their consumption of the club good \( x \), the private good \( y \), congestion \( c \), and depreciation \( D \). Member’s utility increases with consumption of each good \( \frac{\partial u^n}{\partial x} > 0 \) and \( \frac{\partial u^n}{\partial y} > 0 \) and decreases with increases of congestion or crowding \( \frac{\partial u^n}{\partial c^n} < 0 \) and \( \frac{\partial u^n}{\partial D^n} < 0 \).

Equation (3) presents the multi-period utility function for the non-member; \( \hat{u}^1 \) is the non-member’s utility in period 1. Equation (4) shows that the non-member’s utility depends only on the consumption of the private good. Their utility increases with such

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consumption ($\partial u^n / \partial y^n > 0$). Their not being members of the club means they do not consume the club good nor are affected by crowding nor depreciation.

In equation (5) $k$ represents the average usage of the club good in a given period ($k^n = \sum x^n / X$, where $X$ is the initial provision of the club good). Increasing $k$ represents increasing congestion ($\partial c^n / \partial k^n > 0$). Equation (6) shows that depreciation is a function of club usage in each time period and any offsetting maintenance. Depreciation increases with use ($\partial D^n / \partial x^n > 0$) but decreases with maintenance ($\partial D^n / \partial m^n < 0$).

The optimal pricing scheme would set marginal price equal to marginal cost. In this case the fee should include a congestion component and a depreciation component (fee = $\partial u^n / \partial x^n = \partial c^n / \partial x^n + \partial D^n / \partial x^n$). But how likely is this to be achieved in the highway arena?

Sandler observes that governments have a tendency to favor the current generation, who also happen to be current voters, over future generations, who are not currently voters. Sandler terms this tendency: “intergenerational myopia.” The government is myopic regarding the needs of future generations, who are not current voters. When governments own and manage highways, governments tend to charge fees that do not include full depreciation costs. Full maintenance provides benefits to future generations that are not shared by the current generation who could be perfectly satisfied with a somewhat depreciated asset because the asset’s depreciation will not impact the current generation’s usage.
A further complication with highway management and financing involves congestion. With a few exceptions, the U. S. highway system does not have congestion tolls. The technology to permit congestion pricing without adding to congestion is a relatively recent phenomena. U. S. drivers are used to “paying” for congestion with time rather than money.

Because usage fees do not account for depreciation nor for congestion \( (\text{fee} < \frac{\partial c}{\partial x^a} + \frac{\partial D}{\partial x^a}) \), it is reasonable to conclude that future generations receive a rundown highway system when the government owns and manages the highways as Sandler does. But what if a private firm owns and operates the highway system?

If a private firm owns and operates the club, it will seek to maximize profits from club use, in this case use of the highway. The private firm will obtain capital by issuing equity stocks or bonds. This capital will transfer across generations. If the private firm tries to favor the current generation like the government, such favoritism will be negatively reflected in the firm’s securities’ prices, i.e., its stock price should fall. Such favoritism should be much more transparent than the arcane collateral backing derivative securities. The potholes will tell you if the road is being maintained. A private firm owning and operating a highway will thus have an incentive to maintain the highway and maintain its stock price.
The Recent Trend Toward Private Highway Leasing

With the collapse of the Pennsylvania Turnpike lease,¹⁰ it is a propitious moment to consider whether leasing instead of privatizing highways will avoid the maintenance issues that Sandler identifies. Pennsylvania Governor Edward Rendell proposed leasing the turnpike for 75 years in return for $12.8 billion. Rendell like many other political leaders had sought leases of infrastructure as a means to offload maintenance costs to private operators. “Since 2005, eight states have enacted legislation enabling officials to sell or lease highway or transit infrastructure, bringing the total to 25 states, according to the U.S. Department of Transportation. [Australia’s Macquarie Infrastructure Croup and Cintra (a Spanish toll-road operator] recently acquired long-term leases for the Indiana Toll Road and the Chicago Skyway….”¹¹

As credit markets loosen and the economy recovers, there will, no doubt, be renewed interest in highway leases. In the long run, Sandler’s intergenerational club thesis argues that political processes tend to favor current voters and provide too little current maintenance spending if the highways are publicly owned versus privately owned. The question is whether a lease can provide an outcome similar to private ownership.

Time horizons are critical. As long as the leasing firm can recoup its maintenance expenses, it will incur the maintenance expense and charge accordingly. The leasing firm does not gain favor from voters by charging lower fees. A problem occurs when any

maintenance the leasing firm might do, would provide benefits outside of the lease term. At that point the firm has incentive to scrimp on maintenance. The leasing firm might also charge fees that are too low because its marginal costs no longer include maintenance (fee= \frac{\partial u^n}{\partial x^n} = \frac{\partial c^n}{\partial x^n} < \frac{\partial c^n}{\partial x^n} + \frac{\partial D^n}{\partial x^n}).

A lease with a 75 year term may provide adequate incentives for the leasing firm to provide a good highway for the current generation and the next one or two, but what about the generation that inherits year 76? The leasing approach may have reduced the intergenerational myopia or really pushed it into the future, but it has not eliminated it.

**Highways as Intergenerational Clubs**

Highways are neither purely private nor purely public goods. Olson’s theory of collective action applies well throughout highway history and identifies why highway construction and especially maintenance have been so problematic. Buchanan’s theory of club goods provides a useful context for analyzing current highway funding issues, particularly when Sandler’s notion on intergenerational clubs is applied.

The many recent proposals to lease highways to private firms offer an opportunity to apply intergenerational club theory with a new wrinkle. Unfortunately, while simple leasing proposals may ameliorate the problems Sandler identified, they will not eliminate them. The leasing firm will most likely scrimp on maintenance as it approaches the end of its term.