

Regulation As a Barrier to Market Provision and to Innovation: The Case of Toll Roads and Steam Carriages in England

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Abstract

The turnpike system of toll roads in England peaked around 1830, with 1,116 turnpike trusts operating 22,000 miles of roads. It declined thereafter; the last turnpike trust shut down in 1895. William Albert, author of *The Turnpike Road System in England, 1663–1840*, contends that private enterprise dominated the turnpike system. Since English roads today are largely publicly provided and tax financed, the implication appears to be that the market failed to provide sufficient roads and the government stepped in to alleviate the “public good” problem. Parliament heavily regulated the turnpike system, however, setting tolls to benefit organized special interests, not allowing turnpike trusts to pay trustees or retain profits, and preventing efficiency-enhancing mergers. The turnpike system’s failure does not imply market failure; excessive regulation prevented development of an effective private enterprise system of roads.

Turnpike regulation also reinforced monopolistic “market failure.” When entrepreneurs attempted to introduce steam carriages several decades before the advent of the internal-combustion automobile, Parliament imposed high tolls and access limitations in response to demands of railroads and horse-drawn transport providers. Steam carriages would have competed with railroads if not for these regulations. As new routes were built, railroads quickly eliminated horse-drawn competition and enjoyed a long period with little competitive threat. Furthermore, several decades of potential innovations in steam-powered road transportation either did not occur or could not be implemented in Great Britain.

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I. Introduction

William Albert (1972, p. 3), in his widely cited and recently reprinted book, *The Turnpike Road System in England, 1663–1840*, states, “In England the various transport sectors developed gradually and were controlled almost entirely by private enterprise.” Since English roads today are largely publicly provided and financed

through taxes, the implication appears to be that the market failed to provide sufficient roads, and the government stepped in to alleviate the “public good” problem. This implication is not warranted. While private organizations in England were often heavily involved in road provision, including turnpike trusts, the implication that the country’s road system, or more specifically, the turnpike system, was a private-enterprise arrangement is very misleading. Parliament heavily regulated the turnpike system. It set tolls through the political process to benefit organized special interests, it did not allow trustees to be paid, it required any excess of revenues over costs to be invested in road improvements (i.e., profit taking was illegal), and it often prevented efficiency-enhancing mergers. The turnpike system’s ultimate failure does not imply market failure; excessive regulation imposed by the British Parliament prevented development of an effective private enterprise system of roads.

The point that regulation reflects the demands of special interest groups and can cause “market failure” is neither new nor unique (see, e.g., Tullock 1967; Stigler 1971).¹ Many industrial organization and public choice economists now recognize that regulations can and often do create monopoly power by preventing entry, setting prices, and limiting competition in other ways. Turnpike regulations certainly were manipulated by Parliament to meet the demands of special interest groups such as railroads to reinforce monopolistic “market failure.” For instance, by setting tolls and access rights, Parliament prevented adoption of innovations in horseless methods of road transportation, which would have posed serious competitive challenges to railroads. When entrepreneurs attempted to introduce steam carriages several decades before the advent of the internal-combustion automobile, high tolls and access limits that reflected the combined political power of railroads and the providers of horse-drawn transport, including producers of inputs into such transportation, undermined the potential profitability of the steam-carriage market.² These carriages would have been serious

¹ See Benson (2002, 2005) for reviews of much of the literature.

² The point that regulation can stifle innovation also is not new. For example, see Grabowski and Vernon (1977); Grabowski, Vernon, and Thomas (1978); Hauptman and Roberts (1987); Thomas (1990); Lyon (1995); Bellas (1998); Prieger (2002); Popp (2003); Vernon (2003, 2005); Lange and Bellas (2005); Vernon, Golec, and Hughen (2006); Golec and Vernon (2010); and Bargerion, Lehn, and Zutter (2010). Others argue that regulation can stimulate innovation, however. See, e.g., Porter (1991); Porter and van der Linde (1995); and Ashford and Hall (2011). Indeed, either result is possible. For instance, if a producer is not able to achieve

competitors for alternative transportation modes, but Parliament did not allow them to compete. Since Parliament gave railroads monopoly rights over routes, and railroads quickly eliminated horse-drawn competition as new routes were established, railroads enjoyed a long period without significant competition. Furthermore, the additional innovations in horseless road transportation that would have been discovered and adopted in England over the next several decades were lost.

Regulation of turnpike trusts also created an institutional environment that inevitably led to what might appear to be a public-goods market failure.³ A potential market certainly “failed” to provide adequate roads, ultimately leading to government provision, but as with regulation-generated monopoly power, this failure was not due to market-created incentives; it was due to regulations that did not allow a market to create incentives.

Section 2 examines the development of the highly regulated turnpike system. Section 3 continues with a discussion of why regulations imposed by Parliament led to the turnpike system’s decline. Section 4 explains the impact of regulations on a specific example of innovation, steam carriages, and the resulting market power for railroads. Section 5 follows with an examination of the regulatory factors that led to the demise of the turnpike system, and section 6 concludes.

II. England’s Turnpike System

The use of tolls had a long history in England before the turnpike era, but kings claimed for themselves the exclusive right to charge tolls (with one exception, discussed in the following paragraph). Anyone else who wanted to do so was required to get royal permission. Tolls collected from travelers who used various important bridges and roads were a significant source of royal revenues (Jackman 1966, p. 11). These revenues were not earmarked

compliance with existing products and processes, regulation may result in compliance innovation. Alternatively, entrepreneurs may pursue innovations intended to circumvent the regulations (Kirzner 1985, pp. 141–45; Benson 2002, 2004, 2005), by discovering opportunities to exploit uncontrolled margins and/or avoid the full negative consequences of the regulations. The evolving market process is likely to be along a different path than in a true free market, however, resulting in “wholly superfluous” discoveries (Kirzner 1985, p. 144; see Benson [2002, 2005] for examples).

³ The result actually is better described as a free access common pool rather than a public good (Benson 2014).

for road maintenance, however; they went into the general treasury. Local officials such as sheriffs who collected tolls also were granted rights to retain a portion for their own purposes, but those purposes rarely included road maintenance. These officials also resisted any granting of toll-collecting rights to others in fear of losing this revenue source, although kings, and later Parliament, had the power to do so. In fact, there is evidence that some burgesses (merchants who formed local governments in market towns) petitioned for and were granted the right to collect tolls as early as 1154 (Jackman 1966, pp. 9–11).

There was one situation under which a private citizen could collect tolls without royal permission: landowners could charge for passage through private land as long as an easement had not already been established. As transportation demands increased and roads deteriorated, enterprising landowners began to establish new “private roads” that allowed travelers to avoid the “ill-repaired public highways” (Pawson 1977, pp. 73–74) and that charged tolls for access. The potential impact of this option was severely limited, however, both by the fragmentation of land ownership and, perhaps more importantly, by the fact that easements for many feasible routes already existed.

Roads in Anglo-Saxon England were largely established and maintained by local “hundreds” (Webb and Webb 1913, pp. 6–7; Jackman 1966, pp. 4, 33), which can be characterized as voluntary associations or clubs (Benson 2014). These roads passed over private land, so easements were recognized for members of the hundreds, and individual landowners maintained the roads for everyone to use. Occasionally, long-distance travelers also used these roads. The Normans claimed that all land, including roads, belonged to the king, however, and the royal court freely traveled over many of them. The Normans also undermined incentives that supported the hundreds (Benson 2014), but the church and merchants stepped in to provide and maintain many existing roads that had been created by the hundreds (Jackman 1966, pp. 8, 15–16, 30–32; Gregory 1932, pp. 97–98; Pawson 1977, p. 68; Benson 2006, 2014). The monasteries often took leadership, drawing on local parishes for assistance.

Henry VIII dissolved the monasteries in 1536–39, however, divided their properties, and transferred them to “a class of rapacious landlords who would be slow to recognize any claim upon their rents for the maintenance of roads. . . . The inevitable result would be a rapid decadence of many highways which had hitherto been in

common use” (Jackman 1966, p. 29; also see Gregory 1932, p. 96; and Parkes 1925, p. 7). Local parishes continued to maintain roads in many areas, particularly for local travel (probably 80 to 85 percent of the actual roads in Great Britain), but the elimination of the monasteries was apparently quite significant with regard to the roads heavily used for long-distance travel by people dealing with or part of the royal court, as well as merchants, officials of the Church of England, and pilgrims. These roads began to deteriorate (possibly 15 to 20 percent of the roads).

Indeed, Jackman (1966, pp. 30–31) contends that seizure of the monasteries was the primary factor leading to passage of the “Statute for Mending of Highways” in 1555, mandating that parishes establish a very specific institutional arrangement for maintenance of all roads, and parishioners were required to provide specific amounts of labor and other inputs to road maintenance without compensation.⁴ Parishes generally did not provide adequate maintenance for heavily traveled roads despite the 1555 mandates, so a long series of additional statutes attempted to create sufficient negative incentives (e.g., fines) to induce parishioners to do their mandated road-maintenance duties. Ultimately, none worked, and the system of fines evolved into commutations to be collected from individual parishioners, relieving their obligations to perform the statutorily mandated duties. These collections allowed local justices of the peace (JPs) to hire laborers to work on roads (Pawson 1977, p. 71; Webb and Webb 1913, pp. 20–21). Commutations were supplemented with a general highway tax from the mid-seventeenth century onward. However, an even more important source of funds was generated through criminal law, as fines were levied by the royal courts through presentment or indictment of parishes as a whole for the nonrepair of its highways (Webb and Webb 1913, pp. 51–61).⁵

⁴ Note in this context that the parishes were ecclesiastical at this time. In fact, this is one of the earliest actions by Parliament that would ultimately lead to a formal distinction between “secular” or “civil” parishes and ecclesiastical parishes. The movement toward separation of civil and ecclesiastical parishes was reinforced with the 1601 enactment of the “poor law” and then the 1662 amendment to the poor law that enabled the creation of a form of parish that only had civil purposes; indeed, civil parishes are sometimes referred to as poor-law parishes.

⁵ The failure of the mandated parish system to maintain major long-distance arteries left Parliament with few options. A long series of regulations was passed defining “unreasonable” uses of the roads and establishing weight limits, limits on the number of horses, and so on (Pawson 1977, pp. 74–75). JPs were expected to enforce these laws, but they were reluctant to do so, in part because they were

Members of several parishes recognized that private toll roads suggested an alternative way to finance road maintenance, and the early market-town toll roads provided clear precedent for granting the right to limit road access and charge tolls. Given the ongoing failure of the parish system of road maintenance, Parliament needed an alternative, so when parishioners began petitioning for the right to establish toll roads,⁶ the response was positive. A long series of parliamentary acts was passed beginning in 1663, each enabling the establishment of a local ad hoc body known as a “turnpike trust.” These were not parliamentary innovations, however, as the initiative was always at the local level (Albert 1972, p. 12). Parishioners had to petition Parliament for each segment of road over which they wanted to establish tolls.⁷

After about 1700, the turnpike-establishment process became fairly standardized. A group of local landowners and/or merchants would accumulate the funds to pursue a turnpike act from Parliament that would enable the establishment of a specific toll road and would carry the cost of the trust through its start-up period (Moyes 1978, p. 406). Each turnpike act established a turnpike trust and granted it an exclusive right to operate a road (generally for twenty-one years) and to charge tolls for use of the road, but trustees did not have anything close to complete private rights to those roads. They were responsible for erecting gates to collect tolls, for appointing collectors and a surveyor to supervise repairs, and for appointing a clerk and treasurer to administer the trust, but the trustees were required to do so without personal compensation through wages or profits. Any revenues above maintenance and operating costs plus debt service

expected to do so without compensation. A more important option was to loosen the central government’s control over and claim to tolls. This was done by parliamentary creation of turnpike trusts, as explained in the rest of the paragraph. The trusts were made up of private citizens, but as made clear in the next paragraph, they were not “private enterprises” in a market sense.

⁶ The incentives for parishioners to create turnpike trusts are not discussed in detail here, but they do not involve profit seeking. They reflect the mandates imposed on parishes to maintain roads. Parishioners could avoid active participation in mandated maintenance by forming a turnpike trust. The portion of parishioners who actively participated as trustees varied due to numerous factors. In some cases, a small group of businessmen and/or landowners might do so perhaps in order to enhance their standing in local communities. In other cases, trustees numbered in the hundreds. For instance, Hearfield (2012) discusses one example of a trust that included almost 200 parishioners as trustees.

⁷ For more extensive discussions of turnpike trusts, see Pawson (1977), Webb and Webb (1913), and Albert (1972).

(discussed in the next paragraph) had to be spent by the turnpike trust to improve the road named in the act. The parliamentary act often specified in detail the tolls to be charged for various types of traffic. Parliament also exempted various groups from paying tolls, as explained in section 3.

Trustees were also allowed to borrow funds by mortgaging the future stream of tolls. After 1714, the official maximum interest rate that private capital, including trusts, could offer was 5 percent, but in 1727, Parliament set the interest rate on government stock at 4 percent, and in 1757, it was down to 3 percent. Thus, lenders expected to get a better return by investing in a turnpike than by lending to the government, and these turnpike trust loans “seemed a safe investment, too—the road would always be there, and people had to pay to use it, and traffic levels were rising all the time” (Hearfield 2012). As a result, new trusts were able to obtain long-term mortgages to cover start-up costs, and many trusts were able to take out additional mortgage debts over time.⁸

Turnpikes were usually existing highways, although new roads were also built, particularly after 1740, and more importantly, the extent of “usable” roads for heavy traffic expanded significantly (Webb and Webb 1913, p. 144). Trusts employed paid surveyors, some of whom developed significant expertise in road maintenance, and there is considerable evidence of experimentation and innovation in construction and maintenance by some of these specialists, particularly after 1750.⁹ Webb and Webb (1913, p. 144) note, for instance, that

⁸ The use of long-term mortgages may be surprising since many speculative ventures begin by starting a company and selling shares. Turnpike trustees may have wanted to do this, too, but they were not allowed to. At the time, it was widely believed that the ability to create companies by selling shares had led to the 1720 South Sea Bubble and the ensuing financial meltdown. The Bubble Act that followed prevented the formation of joint-stock companies without a specific royal charter, and the trusts were not given such charters. As a result, the turnpike trusts had few options other than taking out long-term loans secured against expected toll income. In fact, parishes themselves were not allowed to borrow, so in the absence of a trust, their road costs had to come from parishioner contributions or current revenues. Parishioners had to form turnpike trusts to access borrowed funds.

⁹ For instance, John Loudon McAdam, an engineer and a trustee of the Ayrshire Turnpike beginning in 1783, became very involved with day-to-day road construction activities and began developing improved construction methods. He accepted a surveyor position with the Bristol Corporation in 1804, became commissioner of paving in 1806, and was elected surveyor general to the Bristol Turnpike Trust in 1816. After this, McAdam was responsible for 149 miles of

between 1750 and 1770, when the number of Turnpike Trusts was actually trebled, the contemporary self-complacency over the new roads rises to dithyrambic heights, “There never was a more astonishing revolution accomplished in the internal system of any country,” declares an able and quite trustworthy writer in 1767, “than has been with the compass of a few years in that of England. The carriage of grain, coals, merchandise, etc., is in general conducted with little more than half the number of horses with which it formerly was. Journeys of business are performed, with more than double expedition. . . . *Everything wears the face of dispatch* . . . and the hinge which has guided all these movements and upon which they turn is the reformation which has been made in our public roads [the turnpikes].

By 1770, trusts controlled almost 16,000 miles of turnpikes (Moyes 1978, p. 407). The period of rapid expansion in turnpikes (1740–1830) also involved a dramatic increase in heavy long-distance traffic due to the Industrial Revolution.

The correspondence between the timing of the turnpike era and the beginnings of the Industrial Revolution is more than accidental. As Webb and Webb (1913, pp. 143–44) explain,

With the coming of the Industrial Revolution, with a rapidly increasing population, with manufactures ready to leap from the ground, with unprecedented opportunities for home and foreign trade, improvement of communication between different parts of the kingdom became, from the standpoint

turnpikes. He resurfaced all of the roads under his jurisdiction using methods he developed. His methods involved layers of crushed stone, and stone size was a key factor. The lower 200 millimeters of road thickness required stones no larger than 75 millimeters across, while stones in the upper 50-millimeter layer were to be no larger than 20 millimeters across (they had to be much smaller than the 100 millimeter width of iron carriage tires) (Lay 1992, p. 75). Road traffic caused the small broken stones to merge into a level, solid surface that could withstand weather and traffic (McAdam 1816, p. 41). The road surface also was raised above the surrounding ground and was slightly convex so rainwater could quickly drain off (McAdam 1816, p. 38). McAdam’s new construction method became known as “McAdamisation,” and it rapidly spread, not only in England but around the world. Modern road construction still reflects McAdam’s influence.

of material property, the most urgent requirement. . . . barring a few lengths of canal in the making, and a few miles of navigable river estuaries, it was, throughout the eighteenth century, on the King's Highway alone that depended the manufacturer and the wholesale dealer, the hawker and the shopkeeper, the farmer, the postal contractor, the lawyer, the government official, the traveler, the miner, the craftsman and the farm servant, for the transport of themselves, and the distribution of their products and their purchases, their services and their ideas. . . . And all contemporary evidence indicates that, what with the surface-making and embanking, widening and straightening, levelling and bridging, the mileage of usable roads was, by the eighteenth-century Turnpike trusts, very greatly extended.

Indeed, the tremendous increase in economic activity that began during the mid-to-late 1700s could not have occurred without the simultaneous improvements in transportation. Furthermore, the development of the British railroad system did not really begin until the 1820s, when the turnpike system was nearing its peak (Pawson 1977, fig. 3, p. 8), and well after the beginnings of the Industrial Revolution.

While the early period of the Industrial Revolution was supported by turnpike road (and water) transport, rather than by the railroad system that often seems to get credit (Pawson 1977, p. 338), aspects of the Industrial Revolution also helped lead to the turnpike system's demise, as competing modes of transportation, primarily the developing railroads, and shippers, including manufacturers who wanted to reduce their own transport costs (part of which were the tolls they had to pay), manipulated the political process. Thus, turnpike activity peaked in about 1830, when 1,116 turnpike trusts operated 22,000 miles of roads (Roth 1996, p. 176), and declined thereafter.¹⁰

¹⁰ The British experience with toll roads has an American counterpart. The first toll road company in the United States was chartered by Pennsylvania in 1792 to provide a highway between Philadelphia and Lancaster (Gunderson 1989, p. 196). Turnpike companies established more than 10,000 miles of roads in the eastern United States between 1792 and 1845, and as Gunderson (1989, p. 192) notes, "Relative to the economy at the time, this effort exceeded the post-World War II interstate highway system that present day Americans assume had to be primarily planned and financed by the federal government." Also see Wright (2014) for

III. Regulations, Incentives, and the Turnpike System's Inevitable Decline

The turnpike system's growth declined and ultimately ended due to at least three political economy factors. First, the regulated structure and characteristics of the trusts created significant principal-agent problems. The trustees could not legally retain profits or even be paid, so their other income-generating activities (e.g., farms, businesses) commanded most of their attention. The trustees generally were not interested in the road's day-to-day operation.¹¹ Toll gates were farmed out, and while trustees were supposed to monitor the gatekeepers and surveyors, their incentives to do so were weak, given their opportunity costs. As a result, corruption by officials through whom revenues passed (e.g., theft of tolls, bribery of gatekeepers, theft of maintenance supplies, or bribery of surveyors to influence their purchasing decisions), was rampant, "and only a small part of the money collected for the upkeep of the road was in fact used for that purpose" (Hindley 1971, p. 63). Over time, many small trusts were not able to meet their mortgage payments because of their inefficient management systems.

Second, the political limitations on trusts also led to significant complaints by shippers and travelers. While they probably did not want to pay tolls at all, that apparently was not the most significant cost imposed by the turnpike system. A serious complaint was that there were too many toll booths, requiring too many stops, thereby slowing transportation services unnecessarily. Gregory (1932, p. 193) suggests, in fact, that this was the most important complaint against the turnpikes, contending: "Road users declared that they would rather pay twice the amount if they could be saved the annoyance of the delay."

This problem resulted from the fact that most of the turnpike trusts controlled only short sections of roadway within a parish, so travelers had to pay new tolls each time they left one trust's road and entered another (Webb and Webb 1913, p. 177). While consolidation of trusts was often desirable, the trusts operated at the prerogative of Parliament, and any formal consolidation required parliamentary approval. Some efforts were made by trustees to obtain approval to

details on the dominant role of private organizations (mainly corporations) in all forms of transportation development during the pre-Civil War period.

¹¹ This was not always the case, of course, as suggested by the discussion of John McAdam in note 9.

combine small trusts into larger organizations, particularly after the reason for doing so was articulated by John Loudon McAdam beginning around 1810,¹² but Parliament did not respond with necessary enabling legislation that might have led to widespread consolidation, choosing instead to deal with such proposals individually and quite slowly (Webb and Webb 1913, pp. 177–80). The vast majority of the small trusts remained independent until their bankruptcy and demise because of the cost of influencing Parliament and political resistance to consolidation (e.g., by local trust employees such as toll collectors who did not want to lose jobs, and by competitive transportation modes that did not want competition from more efficient turnpikes, as explained in section 4 below).

Third, there was significant political opposition to the trusts themselves. Opposition came from those involved in competitive transportation modes such as the river and canal barges and railroads (see the discussion in section 4). It also came from the trade centers that already had effective transportation connections and feared competition from other centers if their road connections were improved. Some landowners and farmers feared that better roads would make it easier for their low-wage laborers to be attracted away, and farmers who supplied local markets feared that improved roads would bring in competition from distant suppliers. Further opposition came from heavy road users who did not want to pay tolls for access even though they wanted the roads to be maintained. Therefore, to gain sufficient support for passage, turnpike acts always reflected significant political compromise, including long lists of toll exemptions for powerful individuals and groups (Albert 1972, pp. 12, 24–29). Agricultural interests and, in some areas, industrial groups were particularly effective at obtaining exemptions (Jackman 1966, pp. 260–61). Often, those with exemptions were some of the heaviest users of the roads who also caused more damage because of heavy loads and/or large numbers of horses for pulling or hauling (pack animals were used as well as wagons). Exemptions also grew over time (individual Trust Acts were annually renewed, making revisions including changes in tolls relatively easy) as various groups gained more political influence, seriously reducing trust revenues (Jackman 1966, p. 261).

¹² See note 9. McAdam testified before parliamentary inquiries in 1810, 1819, and 1823 (Lay 1992, pp. 74–77) and wrote two treatises (1816, 1819) explaining his innovations.

Since politics, rather than economic considerations, determined the tolls that could be set, “there was no invariable relation, and no necessary connection, between the amount that it cost to keep a particular mile of road in repair, and the amount that could be collected in tolls” (Webb and Webb 1913, p. 216). Indeed, just as some road users who did considerable damage to roads were exempted, prohibitively high tolls were established for some types of transportation that did little damage, if that transportation option threatened the market for other politically influential road users or other transport modes, such as railroads.

IV. Regulations to Limit Competition Stifled Innovation

The inefficient allocation of transport services resulting from the political manipulation of tolls can be seen by examining parliamentary treatment of the steam-powered carriages that began to appear on the roads of the United Kingdom in the early 1800s (Fletcher 1891).¹³ Fletcher (1891) provides a detailed discussion of the development of and technological advances in steam-powered road vehicles, including information about both the successful and unsuccessful entrepreneurs and inventors involved. A few highlights follow.

The first steam-powered, self-propelled vehicle large enough to transport people and cargo was produced by a French innovator, Nicolas-Joseph Cugnot. He demonstrated his *fardier à vapeur* (“steam dray”), an experimental steam-driven artillery tractor, in 1770 and 1771. Cugnot’s vehicle proved to be impractical, however, because the boiler was too small. It could only run the vehicle for about 15 to 20 minutes at approximately 2.25 mph before stopping for a similar

¹³ The fact that automobiles appeared this early may be surprising, given the frequent claims that they first appeared in the late 1880s. For instance, the Daimler Corporation website reports, “On January 29, 1886, [Karl Friedrich] Benz applied for a patent for his ‘vehicle powered by a gas engine.’ The patent—number 37435—may be regarded as the birth certificate of the automobile. In July 1886 the newspapers reported on the first public outing of the three-wheeled Benz Patent Motor Car, model no. 1” (“The birth of the automobile: Benz Patent Motor Car, the first automobile [1885–1886]”). Similarly, the *Ask History* website answers the question, “Who built the first automobile?” (December 11, 2012) by stating, “Although ideal for trains, early steam engines added so much weight that they proved inefficient for vehicles traveling on regular roads rather than on rails. . . . As a result, some observers argue that the first true automobile was gasoline-powered. They point to . . . two inventors: Karl Friedrich Benz and Gottlieb Daimler . . . [who] filed their patents on the same day.” Such claims ignore the much earlier development of technologically and economically successful steam-powered automobiles, particularly in England.

length of time to allow steam to build up again. Further developments did not occur in France, but engineers and inventors in Great Britain, and to a lesser degree, in the United States, actively advanced the potential for steam carriages over the next several decades.

Numerous attempts to create practical steam-powered vehicles were made during the late 1770s, but a great deal of technological advancement was needed before practical success could be achieved. A power plant capable of giving steady rotating motion for a long period was required along with improvements in suspension, braking, steering, tires, and vibration-resistant bodywork, among other things. Incremental innovations in these areas occurred, so when Richard Trevithick developed the use of high-pressure steam around 1800, mobile steam engines became practical. His engine was the first to have the piston moved by steam at high pressure.

In 1801, Trevithick constructed an experimental steam-driven vehicle equipped with a firebox enclosed within the boiler, with one vertical cylinder, the motion of the single piston being transmitted directly to the driving wheels by means of connecting rods. It could reach a speed of 9 mph on the flat. Trevithick soon built the “London steam carriage” that ran successfully in 1803.¹⁴ The first half of the nineteenth century saw great progress in steam vehicle design, and steam carriage services were operating in England in the 1830s, principally by Walter Hancock and associates of Sir Goldsworthy Gurney. These sophisticated, steam-powered road vehicles had both commercial and technical success (Gurney 1831, p. 12; Dance 1831, p. 45). The steam carriages could sustain high speeds relative to horse-drawn carriages (24 mph over four miles, and an average of 12 mph over longer distances) and commercial steam carriages could carry more passengers (up to 14 in 1831) than horse-drawn commercial stagecoaches (see figure 1 for an example). Estimates of relative operating costs suggest that steam carriages could run at about one-half to one-third of the cost of horse-drawn stagecoaches (Gurney 1831, p. 18), and in the absence of discriminatory tolls, per

¹⁴ Almost simultaneously in 1803, Oliver Evans, who obtained the first patent on a steam carriage in 1789, reportedly built a self-propelled, steam-powered, flat-bottomed dredger in the United States that he modified to be self-propelled on both land and water. Evans claimed that this was the first amphibious vehicle, and the first steam-powered road vehicle to run in the United States, although no designs for the machine survive, and the only accounts of its achievements are from Evans.

passenger fares were about one-half those of stagecoaches (Gurney 1831, p. 12; Dance 1831, p. 45). These vehicles were also much safer, as they were much less likely to overturn, and steam engines did not “run away with” passengers the way horses could (Gurney 1831, p. 20). Thus, steam carriages were developed for both commercial (figure 1) and personal (figure 2) use.

Figure 1. The London and Birmingham Steam Coach



Source: Dr. Church's London & Birmingham Motor Car Built at Birmingham. 1833. Engraved by Josiah Allen, Birmingham. Beamish Museum, People's Collection.

Steam carriages threatened railroads as well as horse-drawn transport. Railroads generally were granted monopolies over particular routes (Dagleish 1980, p. 117), allowing them to charge relatively high prices for passenger services. The steam carriages could compete in terms of speed, however, and they were not limited by the need for rail lines. They should have been attractive alternatives to rail travel, but in response to political demands from railroad and horse-carriage related interests, Parliament did not allow their competitive threat to develop. Parliamentary-mandated tolls for steam carriages were set at least six times higher than those on horse-drawn stagecoaches (Gurney 1831, p. 22). Furthermore, Parliament

prohibited steam carriages in a large number of turnpike acts (Dance 1831, p. 48).

Figure 2. 1860 Rickett Steam Carriage



Source: “Steam Powered Cars of the 1800s.” *Louder and Funnier* (blog), September 22, 2008.

Parliament imposed very high tolls and prohibitions even though “highway engineers were unanimous that injury to the road surface from the action of horses’ feet exceeded that caused by the wheels of traffic by a factor of three” (Dalglish 1980, p. 119). Steam carriages had innovative braking systems that did not lock and drag, as well as one driving wheel with the potential of engaging a second to prevent slippage, both of which damaged roads less than horse-drawn carriages did. Furthermore, the wheels on horse-drawn vehicles were narrow to reduce the effort required of the horses, and these narrow wheels caused considerable rutting. Steam carriages, on the other hand, had wide wheels for greater traction, as figures 1 and 2 show. These wide wheels did virtually no damage to road surfaces, according to engineers such as Thomas Telford, a leading engineer and road builder who cofounded the Institute of Civil Engineers and was its first president. Telford testified before a parliamentary select committee convened in 1831 for the purpose of considering the exorbitant tolls on steam carriages and the potential future use of mechanical (steam and petroleum powered) vehicles (Dalglish 1980, pp. 118–19).

In light of steam carriages' safety, cost advantages, speed, capacity, and reduced road damage, the 1831 parliamentary select committee recommended dramatically reducing their tolls (Select Committee on Steam Carriages 1831; Gurney 1831). If this reduction had occurred, there is "little doubt that a network of good toll roads would have soon been built to take the new vehicles" and that a substantial part of the United Kingdom's railway system would not have been built (Dalglish 1980, p. 128). However, as Dalglish (1980, p. 125) notes, "We can well imagine what happened. The many interests—corn merchants, harness makers, horse-copers, railway promoters, iron masters hoping to make rails, and those who were simply against change—would unite against steam carriages. It was only necessary for parliament to do nothing for them to be killed off, and nothing is what it did."¹⁵

The steam carriage entrepreneurs did not all give up. For instance, at least one group including Thomas Telford initiated an effort to run steam-carriage services on its own improved road between London and Birmingham, with intentions of extending service beyond this route (Dalglish 1980, pp. 125–28). This group organized the "Steam Company," surveyed the route, and gained support from innkeepers and canal operators who hoped to compete with railroads by connecting with the steam carriages. The railway serving the route objected strongly, but the group apparently was relying on Telford's prestige to carry them through parliamentary approval. Telford died in September 1834, however, and the project was abandoned.

Yet another initiative by advocates for steam-powered road travel was the formation of the Institute of Locomotion for Steam Transport and Agriculture in order to pursue applications of steam power for transportation, agriculture, and other economic purposes through both economic and political means (Gordon 1833, p. 1). Their political efforts to alleviate the restrictions on steam carriages clearly continued after the 1831 Select Committee report. The report of the Select Committee on Mr. Goldsworthy Gurney's Case (1834) indicates that Gurney was an active advocate and promoter of steam carriage transportation, for instance, but the political influence of the railroad industry, the horse-drawn transportation industry, and the producers of inputs for these industries was too strong. As a result,

¹⁵ Dance (1831, p. 46) also notes that in addition to those groups listed by Dalglish (1980, p. 125), coach proprietors, coachmen, and postboys actively opposed lowering tolls for steam carriages.

extensive use of mechanical vehicles on Britain's roads was delayed for some sixty years.

Efforts to develop steam-powered transportation in England continued (Fletcher 1891), but political limitations also continued to be imposed, even as tolls were eliminated (the decline in the use of tolls is discussed in section 5). The Locomotives on Highways Act of 1865, for instance, required that all self-propelled vehicles on public highways in country areas be limited to a maximum speed of 4 mph (2 mph in towns) and that they be preceded by a man on foot carrying a red flag or lantern. Fletcher (1891, pp. 279–88) provides details on other political actions that prevented extensive use of steam carriages in England. Indeed, he laments that “all the high-speed engines of recent times have been built for service in foreign countries—our foolish and meddlesome laws prohibiting sensible speeds in this country—hence Russia, Greece, Turkey, India, Ceylon, France, New Zealand and Germany are all ahead of Great Britain in this matter” (Fletcher 1891, p. 257).

England was far ahead of the rest of the world in the development and improvement of road vehicles using steam power at the beginning of the nineteenth century, and their advantages continued for some time as they exported steam-powered cars to the places listed by Fletcher, but the political resistance to horseless transport on England's roads undermined these advantages over time, leading to a shift in innovative activity to other countries. The political situation was quite different in France, for instance, where the use of steam vehicles on ordinary roads was officially authorized in 1861. Considerable technological advances followed throughout the 1870s into the '80s. What some consider as the first “real” automobile was produced by Frenchman Amédée Bollée in 1873, for instance.

Nonetheless, steam vehicles were rare in France, as continental engineers were much more focused on developing internal-combustion engines. In fact, by the late 1870s, virtually all experimentation with road transportation in Europe was occurring in Germany and Austria where innovators focused on internal combustion technology. Austrian engineer Siegfried Marcus created the first gasoline powered car when he powered a handcart with a gasoline engine in 1870 (Setright 2004). He continued to improve gasoline engine design, and after 1883 his designs were used for all engines manufactured in the late 1800s. German engineers were also focusing on gasoline-powered automobiles. The most prominent

were Karl Benz and Gottlieb Daimler. By 1888, Benz cars were in full-scale production in Germany. Soon afterward, car manufacturers sprang up around Europe and the United States, including Peugeot in France and Oldsmobile, Cadillac, and Ford in the United States.

Internal combustion did not immediately displace steam in the United States, where innovations in steam-driven cars continued, even as steam declined in England. Many roads in the United States differed from the turnpikes in England, however, so different types of cars were required. The first carriage-sized automobile that could be used on wagon roads in the United States was steam powered. It was developed in 1871 by Dr. J. W. Carhart, several decades after England's steam carriages appeared on its superior roads. Another American, George B. Selden, filed for a patent for a steam carriage on May 8, 1879. His application included not only the engine, but its use in a four-wheeled car, which also was an attractive feature on North American roads. The early 1900s saw around 125 different manufacturers producing steam cars in the United States. They remained very competitive with internal combustion cars until Henry Ford's development of mass production methods.

Consider the Stanley Motor Carriage Company, for instance. The "Stanley Steamer" looked similar to most other cars of the day, but it had an important advantage due to its simplistic automation. Stanley's early steam engine boasted thirteen moving parts with the count for the entire car at thirty-seven. Internal-combustion engines and transmissions had hundreds of moving parts to break, wear out, or come apart. The Stanley Steamer was lightweight, quiet, and perhaps the most powerful vehicles of its time; it was definitely the fastest. Once lit, the car automatically generated steam to meet demand with little additional attention required except perhaps watching the water level. The driver had only to set the throttle to a comfortable speed and move the tiller for steering. Steam engines also are the only engines (or motors) that generate maximum power from rest. The simple movement of a lever precisely controlled their power. With their finicky ignition systems, balky carburetors, and gear-grinding transmissions, the "internal explosion engines," as Stanley called them, were no match for the simplicity, reliability, and power of steam. The smell of raw gasoline, partially burned hydrocarbons, along with the internal-combustion cars' thrashing, banging, and clattering, further tarnished the early image of the gasoline-powered automobile. In contrast, while there was a discernable hiss from a

Stanley burner, the dominant sound was from the tires rolling over the road.

The steam car was quite popular in America, especially with the rich, and Stanley Steamers became the premier steam cars to own. In fact, Stanley Steamers were the most popular cars in the United States from 1900 to 1904. They also set numerous land-speed records in January 1906, reaching 127.6 mph on January 26. About 11,000 Stanley Steamers were sold over roughly twenty-five years, with peak production of 750 in 1907. Eighty-six major models were produced with six different body styles. The company consciously chose not to compete with Ford, however, and in 1914 twice as many Model Ts were produced in a day than the annual output of Stanley Steamers. Model Ts also sold at about 25 percent of a Steamer's price because Ford's assembly line production reduced per-vehicle production costs dramatically. Stanley did not adopt a similar process in order to compete, however, and production of Stanley Steamers ended in 1924.

England was the world leader in steam-powered innovation at the beginning of the nineteenth century, when it also dominated the development of horseless road transportation. There is no way of knowing what kinds of steam-powered transportation innovations might have been discovered if steam carriage use had been allowed to continue in Great Britain, and British entrepreneurs and inventors, with their clear technological lead in steam-powered road transport, would have continued to have stronger incentives to find new ways to provide competitive road-transportation services. By the end of the nineteenth century, the technological leaders and innovators in horseless road transportation were in Germany and the United States, and significant numbers of innovations in steam-powered automobiles were only occurring the United States. England was not competitive in the rapidly growing automobile industry.

V. The End of the Turnpike Era

The success of the railroad- and horse-carriage interests allied against steam carriages also led to the demise of the turnpike trusts, because the highways were not competitive with the developing railroads without steam-powered road transport. With the development of the short lines between Stockton and Darlington in 1825 and then between Liverpool and Manchester in 1830, for instance, passenger traffic from stagecoaches, post chaises, and private horse-drawn carriages on the turnpike between these points

declined dramatically. Turnpikes had come to depend on such passenger traffic for revenues, in part because so many other forms of traffic had toll exemptions or limitations. Ironically for the horse-drawn passenger service and its supporters who joined the railroads to prevent the development of the steam carriage industry, the advantage going to the railroads quickly led to the decline of the stage-coach industry and the industries producing inputs to horse-drawn transportation as well.

Without the steam carriage as a more effective competitor for the railroads, “the transfer of this business was instantaneous and complete. Every coach had to be taken off the road the moment the railway was open to the towns along its route” (Webb and Webb 1913, p. 215). The last stagecoach between London and Birmingham went out of business in 1839, for instance, with other routes from London ending their runs over the next few years (e.g., to Bristol in 1843, Plymouth in 1847, and Bedford in 1848). Thus, turnpike toll revenues fell by one third between 1837 and 1850 as railroads spread through the country. More and more trusts were unable to maintain their financial solvency, forcing defaults on debt payments. Creditors for many of the defaulting trusts took immediate possession of all revenues to cover interest on mortgages, leaving no funds for maintenance.

Rather than recognizing the underlying incentive problems and lifting the imposed constraints that created them (e.g., allowing trusts to retain profits and charge market-determined tolls, including those for steam carriages, and lowering the costs of mergers and competition for ownership), Parliament began to empower the trusts to draw on “statute labor” for maintenance (the labor that the parishioners were mandated to provide under the 1555 highway statute). Initially, the trusts were required to pay wages fixed by Parliament, but later, a portion of the labor was required to be supplied without payment (Hindley 1971, p. 62). Some trusts were even given parliamentary authority to appropriate materials without payment.¹⁶

Nonetheless, chronic insolvency spread, and the burden of maintenance for more and more turnpikes shifted back to local

¹⁶ Furthermore, under the law, the parishes had never lost the liability for road maintenance, and while they were supposedly able to recover any money they spent from the turnpikes’ revenues, the trusts that failed in their road maintenance were generally so far in debt that parishes had little chance of repayment.

parishes.¹⁷ This led to resistance and even violence. The most significant case of violent resistance was the “conclusive popular rebellion known as the Rebecca Riots” in South Wales during 1842–43 (Webb and Webb 1913, p. 217). These riots led to a royal commission being formed to inquire about the grievances in South Wales, and finally to the dismissal of all turnpike trustees throughout the area and the merger of all trusts into “county road boards” that took over the roads, their debts, and the tolls of the former trusts. The central government appointed a general superintendent of county roads in South Wales, putting the area’s roads “under what was virtually Government control.” The central government also loaned £218,000 to counties so they could pay off creditors, and it consolidated debts at low interest rates (Webb and Webb 1913, pp. 219–20). These county organizations were able to substantially reduce the number of toll gates as well as the level of tolls that had led to the revolts. Furthermore, they operated efficiently enough to pay off the accumulated debts over the next 30 years, suggesting that if Parliament had responded earlier to the need for consolidation and allowed mergers, the riots and subsequent government control might have been avoided. In fact, if consolidation of a similar

sort could have been done with the English Turnpike Trusts in 1844, they might have been spared the long-drawn-out agony of the ensuing half-century. But every attempt at legislation was defeated. . . . So far as the government was concerned, under the timid and unresourceful advice of the Home Office, and the refusal of successive Cabinets to trouble themselves about the subject, the Turnpike Trusts were allowed to go on just as before, annually getting their expiring terms renewed by Parliament, as a matter of course, falling, most of them, progressively further and further behind their task, and many of them, deeper and deeper into insolvency (Webb and Webb 1913, p. 220).

A select commission of the House of Commons was formed in 1864 to consider how to end all tolls. The ‘commission’s report concluded that the tolls were “unequal in pressure, costly in collection, inconvenient to the public, injurious as causing a serious

¹⁷ The same incentives were at work in the parishes that existed at the beginning of the turnpike era, so this simply led to resistance.

impediment to intercourse and traffic” (quoted in Webb and Webb 1913, p. 221), all of which arose because of the politically created constraints on the trusts, of course. However, the commission concluded that the trusts should be abolished, and that the roads should be turned over to a government authority, as in South Wales. Again, Parliament did not respond to these recommendations by establishing a general policy. Instead, a gradual abolition of more and more tolls began.¹⁸ Most trusts were renewed each year, although from 1864 onward, twenty to thirty trusts were dissolved annually, with the roads turned over to a local parish or a highway district. Dissolution accelerated, however, and in 1871, all tolls were ended in the London area. The number of trusts was down to 854 in 1871, 588 in 1875, 184 in 1881, seventy-one in 1883, fifteen in 1887, and two in 1890 (Webb and Webb 1913). The last trust ended operations in November 1895.

The increasing rate of dissolution of turnpike trusts rapidly placed thousands of miles of roads back into the care of the parishes, leading to increased local resistance. To mitigate some of the local opposition, the central government began giving grants in aid in 1876 to help pay for maintenance. Then, in 1878, the Highway and Locomotive Act ordered the counties to contribute half of the annual cost of maintaining the former turnpike roads. The Local Government Act of 1888 granted more aid from the central treasury to the counties for road maintenance, but required the counties to take over full maintenance obligations from the parishes for all of the “main” roads. County governments were becoming the local road authority, and the parishes were finally formally relieved of their road maintenance liability in 1895. “Thus at length the British road system was placed under control of elected public authorities each representing larger areas,” Gregory writes (1932, p. 196). Funding shifted from tolls to county taxes (or in places, borough or other local government taxes¹⁹), along with subsidies from the central government, and government expenditures on roads increased

¹⁸ The Highway Act of 1862 actually started the process of creating highway boards throughout the rest of the United Kingdom to which the turnpikes could be entrusted.

¹⁹ The Local Government Act of 1858 authorized any parish to become an “urban sanitary district,” and these districts could not be included in any larger highway district (Gregory 1932, p. 195). Parishes whose local officials wanted to maintain control of their roads used this process to do so, and as a consequence, a number of small districts avoided political consolidation.

rapidly. The average government expenditure per mile of county roads rose from £43 in 1890 to £69 in 1902, for instance, while expenditures on urban roads increased from £49 to £207 over the same period (Gregory 1932, p. 196).

Free access to roads encouraged new types of road users and new sources of political pressure on Parliament. By the end of the nineteenth century, many highways had more bicycle traffic than horse-drawn traffic, and virtually every country home had a bicycle. As Webb and Webb (1913, pp. 240–41) report, “What the bicyclist did for the roads, between 1888 and 1900, was to . . . accustom us all to the idea of our highways being used by other than local residents. It was the bicyclist who brought the road . . . into popular use for pleasure riding.” In addition, while excessive tolls had kept the steam carriage off the roads, the end of tolls and the development of light internal combustion engines led to the introduction of the first petroleum-driven motor cars in England in about 1894. The bicycles and internal combustion automobiles alarmed horses and pedestrians, and raised dust due to their speed (roads were largely still surfaced with crushed stones or gravel at this time): “the turning loose on our roads of tens of thousands of heavy vehicles, often travelling at the speed of an express train, amounted to a real aggression on the safety and comfort of all the other users of the roads” (Webb and Webb 1913, p. 214).

Accidents increased dramatically, generally at the cost of those who did not enjoy the benefits of the new transportation methods (pedestrians, users of horses), and road damage significantly increased maintenance costs. Pounding of the road surfaces when dry created an unanticipated problem of “waviness” (Gregory 1932, p. 257). The use of “armored tires” with iron studs on automobiles to prevent side slipping further damaged road services, and ruts were created during rainy weather. Those who wanted to use the roads for traditional horse-drawn traffic protested loudly, but with no tolls to manipulate, raising barriers to road use by bicycles and automobiles proved to be difficult. Efforts to prevent their use were successfully resisted by the growing political influence of motor vehicle owners, although several actions were taken to limit their access. The Motor Car Act of 1903 required new vehicles to be registered and licensed with “conspicuous identification numbers back and front,” for instance, and drivers were also required to be licensed. The costs of automobiles were also increased due to requirements of lights and alarms that could be sounded, and speed limits were established.

These limitations were clearly not sufficient, and the use of motor cars expanded, with their accompanying externalities. The cost of road maintenance and improvement due to these “new users” rose rapidly during the first decade of the twentieth century, and the central government was continually pressed to provide relief to the local taxpayers. A national gasoline tax was established in 1909 along with increased licensing fees paid to the central government. These new road revenues were administered by a new road board with the power to subsidize local road authorities, not for general maintenance, but for specific types of road improvements and new roads. The new road users demanded a very different type of road than horse-drawn transport required, after all, and as the political power of motor vehicle owners increased, pressure increased on Parliament to provide roads suitable to such traffic.

The Road Transport Board was created in 1918 to coordinate all roadwork during the First World War, and it continued after the war as a department of the Ministry of Transportation. Its role was the centralized supervision of road development, but it also was given the power to allocate grants from the central government’s road fund (Gregory 1932, p. 248).

VI. Conclusions

This paper has focused on parliamentary regulation of toll roads, but similar analysis appears to apply to numerous other so-called public goods, including policing (Benson 1994, 1998; Benson and Meehan 2014) and higher education (Bennett 2014). As with England’s toll roads, the underproduction of private providers and/or the limited level of private innovations occur because of excessive regulation that prevents efficient provision and allocation of the good.²⁰ Government moves in to deal with the alleged market failure, so the alleged public good will be supplied. Costs rise, and taxes are raised. The good then is made available “free of charge” or

²⁰ It should be noted that tolls are not a necessary characteristic of private roads. Thousands of private residential developments have private roads. They may be owned and maintained by a developer or by a homeowners or road-owners association. Access may be limited in various ways so that community members largely internalize the benefits of the roads, much as with the hundreds in Anglo-Saxon England. Public streets can even be privatized, as they have been in many St. Louis neighborhoods (Newman 1980; Beito 2002). Commercial developments also can include private roads that allow customers to access their establishments. Shopping malls offer private parking lots accessed on private roads, as well as indoor private “roads” so consumers can walk from store to store.

at inefficiently low prices, even though the hidden “price” (taxes) paid by the public is, on average, higher than it would have been if a market had been allowed to develop and entrepreneurs had been allowed to function. How many potentially efficient markets have been destroyed by regulations and replaced by inefficient government production? Careful historical analysis of the actual reasons for limited private and growing government provision of goods and services may reveal that there are few true public goods, if any (Goldin 1977; Benson 1994).

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