

Were Statutory Authorities Second-best?

Examining the benefits, costs, and alternatives to British Institutions in the eighteenth century

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Abstract

British institutions differed from those in Continental Europe and throughout the world in the eighteenth century, but there is disagreement about their contribution to economic development. Statutory authorities are one example of Britain's economic institutions. Parliament granted organizations monopoly rights to levy tolls and undertake infrastructure projects. This paper examines whether two types of statutory authorities, turnpike trusts and river navigations, were second-best policies by comparing the social benefits with the social costs. It shows that the social savings from lower transport costs exceeded the social costs from monopoly, exclusion, and legal expenditures. It also argues that the alternatives to statutory authorities were generally worse because they would not have produced the same level of infrastructure investment.

1. Introduction

By 1820 Britain had the highest per-capita income in the world (Madison 2003. p. 32, 59). Its industrial expansion from 1760 to 1830 propelled Britain's average income above its commercial rival, the Dutch Republic, and its military rival, France. In seeking to explain Britain's economic ascent scholars often point to institutional differences. The common law, with its emphasis on precedence and judicial independence, is often cited as an example of a British institution which helped promote growth (Glaeser and Shleifer 2002). Another is the strengthening of Parliamentary government following the Glorious Revolution of 1688-89. According to some accounts Parliamentary government contributed to growth by protecting against sovereign expropriation, by opening new markets through colonial expansion, and by sheltering emerging industries from foreign competition (North and Weingast 1989, Ormrod 2003, Griffiths, Hunt, and O'Brien 1991).

There is another line of research which stresses Parliament's ability to adapt property rights in directions which enhanced efficiency (see Bogart and Richardson 2008a, 2008b). The creation of statutory authorities through acts of Parliament is one prominent example. Statutory authorities were organizations that received monopoly rights to levy tolls and undertake infrastructure projects. Their treatment in the literature is intriguing because they are both lauded and reviled depending on the perspective. Some studies emphasize how statutory authorities added to growth by provided much needed infrastructure, like the construction or improvement of roads, bridges, rivers, canals, and eventually railways (see Albert 1972, Pawson 1977, Bogart 2005a). Others point to the frequent complaints about monopoly and excessive spending on the procurement of acts and the collection of tolls (Webb and Webb 1913, 1922). It is clear that statutory authorities were not 'first-best,' but were they the best policy available at the time?

Economists are beginning to recognize that seemingly inefficient institutions might be the most efficient among the set of available alternatives. This view is derived from the theory of second-best which states that a policy which eliminates a single distortion may not improve welfare if there are multiple distortions. Dani Rodrick (2008) has pushed this view further by emphasizing that there are multiple ways to remove a constraint on growth, some of which may be more politically feasible than others. Economic historians are also beginning to assess whether seemingly inefficient institutions might have been second-best. For example, Mauricio Drelichman (2008) has argued that selective enforcement of the Mesta's rights might have been the most efficient way of defining property rights to land in early modern Spain. This chapter follows a similar line of inquiry by comparing the social benefits of statutory authorities with their social costs and then assessing whether other institutional arrangements would have yielded a better outcome. The analysis focuses on two of the earliest types of statutory authorities: turnpike trusts and river navigations. Turnpike trusts were non-profit organizations that improved roads by levying tolls. They became ubiquitous in the eighteenth century and formed one of the largest toll road networks in history. River navigations were typically for-profit companies or corporations that improved rivers by levying tolls. They had authority over 34% of all navigable rivers in 1750 and 46% by 1800.

The chapter begins by reviewing the evidence on the social benefits of turnpike trusts and river navigations, including the first estimate of the social savings from river improvements in 1750 and 1820. It then shows that the social savings from turnpike trusts and river navigations were much larger than the social costs arising from monopoly, the collection of tolls, and expenditures on acts of Parliament. Lastly, it considers alternative institutions and argues that they were inferior to statutory authorities because they would have resulted in less investment.

The broader conclusion is that statutory authorities were an example of a ‘second-best’ institution. Statutory authorities typically replaced a highly decentralized system of infrastructure provision. Parishes and sewer commissions were ineffective in improving roads and rivers because of inter-jurisdictional spillovers and a legal structure which allowed vested interest to oppose projects. Decentralized infrastructure provision at the level of the county was more promising because it led to greater internalization of spillovers, but there were still legal and fiscal limitations which made it suboptimal. Centralized infrastructure provision would have been the best of all if Parliament had control over both expenditure and tax revenues. However, because Parliament did not control expenditure it was unwilling to authorize more taxes beyond that which was necessary for defense. This limitation points to one of the shortcomings of the reforms following the Glorious Revolution. Parliament was able to use its fiscal might to defeat its rivals on the battlefield but it was not powerful enough to command investments in infrastructure. Instead Parliament chose to delegate this task to statutory authorities which it could regulate and monitor more closely than spending by the crown.

2. Background

Before analyzing the social benefits and costs of turnpike trusts and river navigations it is necessary to provide some background on their development. In the seventeenth century, England had a road network that connected London with all major provincial cities, but many roads were too narrow and poorly maintained. The existing system for maintaining roads was based on two acts in 1555 and 1557, which made parishes responsible for maintaining roads within their jurisdiction.¹ It was believed that local inhabitants should be responsible for their

¹ For parish road provision see Webb and Webb (1913), Jackman (1916), Albert (1972), and Pawson (1977).

own road maintenance because they were the main users. This premise worked reasonably well until trade expanded beyond the parish and the benefits of improving roads began to accrue to merchants and farmers in other areas.

England was also well endowed with rivers, but many internal areas remained more than 15 miles from a navigable waterway (Willan 1964). Custom dictated that inhabitants near a river should be responsible for its maintenance, but many failed to remove debris and other impediments to navigation. Locals could petition to form a Commission of Sewers, which had rights to compel landowners to cleanse the river, and if necessary, levy a property tax to pay for maintenance expenses. Most Sewer Commissions suffered from the same problems as parishes. They had no authority to tax inhabitants other than those adjacent to the river, and they could not purchase land or divert the path of the river (Willan 1964).

There were a series of major changes in the provision of roads and rivers during the seventeenth century. Parliament and the King began to reduce the authority of parishes and Sewer Commissions by issuing patents or by passing acts giving individuals the right to levy tolls and undertake improvements on a specific road or river. The political conflicts of the seventeenth century cast great uncertainty over these reforms. Both the King and Parliament sought to control the supply of rights to improve roads and rivers and neither wanted to enforce the rights issued by the other (Bogart 2008b). The conflict was finally resolved by the Glorious Revolution of 1688. Thereafter acts authorizing the improvement of roads and rivers originated from private citizens and local governments who submitted petitions, or had a Member of Parliament introduce a bill on their behalf.

The acts usually named a group of individuals and gave them authority to levy tolls and improve either a specific road or river. In all cases the tolls were capped by a maximum

schedule which was defined in the act. Turnpike acts named a body of trustees who were typically local landowners, merchants, and industrialists. The trustees were not allowed to earn profits and instead they had to devote all the revenues to road improvements, salaries, legal expenses, interest payments, and debt payments. Trusts raised their capital by issuing bonds secured on the income of the tolls. River navigation acts gave authority to a single undertaker, a partnership, a company, or a municipal corporation. These entities were typically allowed to earn profits. They usually raised capital internally or by borrowing, but in some cases they also issued tradeable shares.

Turnpike trusts and river navigations differed in the duration of their authority. Most turnpike acts required that trustees renew their authority every 21 years. This meant that a turnpike trust created in 1700 would need 6 renewal acts by 1825. Renewal acts were used to adjust the tolls charged by the turnpike and if necessary expand their powers to nearby roads. Most river navigations were given permanent rights to levy tolls. Therefore they were not required to obtain a renewal act. Some did though to adjust their tolls or to get new powers.

There were many proposals to improve rivers in the early 1600s but nothing was done until the 1630s. Figure 1 shows the number of navigable river miles from 1600 to 1820. The greatest growth occurred from 1630 to 1750. In 1630 there were 898 miles of navigable river and in 1750 there were 1351 miles of navigable rivers. The vast majority of this increase came from river navigations.

There were some proposals to improve roads in the early 1600s, but little was done until the 1690s. Figure 1 shows the number of turnpike miles up to 1820. The diffusion process exhibits the familiar s-curve. Turnpike mileage increased slowly in the early 1700s, rapidly in the 1750s and 1760s, and more slowly afterwards. By 1820 the turnpike network was largely complete.

3. The Social Benefits of Statutory Authorities

3.1 Turnpike Trusts

Turnpike acts were passed to improve roads and lower transportation costs. How successful were they in meeting these goals? There is substantial evidence that turnpike trusts increased road expenditure. There was nearly a 6-fold increase in monetary expenditures on roads between 1730 and 1810 (Bogart, 2005). 54% of the growth in road expenditure was associated with turnpike trusts and 46% was associated with parishes who continued to maintain local roads. At the level of individual roads, the establishment of a turnpike led to more than a 10-fold increase in spending during the first five years compared to the preceding five years when parishes managed the road. Moreover, 62% of the initial road expenditures by turnpike trusts went to labor, materials, improvements, and land for road widening. The rest went to the construction of toll houses and toll gates, salaries, legal expenses, interest, and debt payments.

It is difficult to estimate total investment in roads because turnpike accounts did not distinguish between improvements and maintenance in the 1700s. Turnpike expenditures were higher in their first 5 years because they widened and resurfaced the road. If one assumes that 62% of the expenditures in the first 5 years represented investments, then the average investment per mile would be £310 in 1819 prices (Bogart 2005, p. 454). Given that there were 20,875 turnpike miles in 1820 this would imply a minimum total investment of £6.5 million, which is about 1.1% of the British net capital stock in 1820.²

Ron Harris (2000) estimates that turnpike trusts invested £16 million by 1810. Harris's estimates are based on Ginarlis and Pollard's (1988) estimates of 'quasi-investment.' The latter figures include all annual spending by turnpike trusts, much of which was designed to maintain

² I use Feinstein and Pollard's (1988, p. 427) estimate of £593 million for the value of British capital stock.

the existing road stock. I prefer to include only the initial expenditures because they added to the road stock. Moreover the stock of turnpike mortgage debt in 1820 was £4.5 million.

Considering that most turnpike trusts had only begun to repay their debts by 1820, the estimate of £6.5 million invested would seem more accurate than £16 million.

The quality of turnpike roads was usually better than parish roads. The Board of Agricultural report from Huntingdonshire in 1810 provides some evidence on quality.³ The survey describes the roads in each parish as very good, ok or good, and bad. Table 1 shows the distribution of categories for parishes with turnpikes and parishes without turnpikes. 43% of the parishes with turnpikes had very good roads as compared with 35% for parishes without turnpikes. At the other end of the spectrum, 17% of parishes with turnpikes had bad roads while 35% without turnpikes had bad roads. This data makes it clear that not all turnpike roads were good, but on average they were better than parish roads.

There is also substantial evidence that turnpike trusts lowered transport costs. Several papers in the literature quantify the contribution of turnpikes versus other technological and organizational changes (Pawson 1977, Gerhold 1996). The econometric evidence suggests that turnpike trusts contributed to a 20% decrease in freight charges, which is about half of the total decrease in freight charges between 1750 and 1820 (Bogart 2005b). The contribution of turnpikes to greater travel speeds has not been established with such precision, although it is clear that turnpikes did have an influence on the adoption of fly-machines, which increased the speed of passenger travel.

Turnpike trusts also contributed to higher property income. Econometric estimates imply that turnpike trusts increased property income in the parishes where they were located by a minimum of 20%. They also added to property income in neighboring parishes, but to a lesser

³ I would like to thank Robert Allen for providing the data on Huntingdonshire.

extent (Bogart 2008a). These findings provide one explanation as to why local landowners served as trustees even though they could not profit from the tolls.

The total contribution of turnpike trusts to national income can be estimated using the social savings methodology. Social savings estimates based on lower freight charges and travel times imply that turnpike trusts generated a savings of £2.9 million in 1820. Social savings estimates based on increased property income imply that turnpike trusts generated a savings of £5.4 million in 1815. These figures imply that national income would have been between 0.9% and 1.6% lower in the early nineteenth century without turnpike trusts. Dividing the social savings by the total investment yields an average social rate of return on turnpike road investment of at least 45%. The social benefits of turnpike trusts were large indeed.

3.2 The Social Benefits of River Navigations

The economic effects of river navigations are more difficult to establish because there are few official records on their operations. Most river navigations made their investments during the first 10 to 20 years after they were established by an act. Secondary sources provide information on total investment for certain navigation companies (Willan 1964, Wilson 1971; Bogart 2008). These can be supplemented with figures from the Journals of the House of Commons. Table 2 shows the total investment and the average investment per mile for various river navigations from the 1630s to the 1740s. The sample consists of river navigations covering 187 miles or nearly 40% of the total made navigable by 1750.

Total investment from 1600 to 1750 can be estimated by multiplying investment per mile across the sample by the number of miles made navigable. The price level was fairly stable over this period, so there is no need to correct for inflation. The estimate is that river navigations

made a total investment of £0.63 million by 1750. This represents approximately 0.5% of the net capital stock for Britain in 1750.

There is no survey which identifies the proportion of rivers which were in good condition. The qualitative evidence suggests that rivers often became navigable after acts were passed. Daniel Defoe (1724), for example, describes how parts of the river Trent were made navigable by the help of ‘art.’

The Trent is navigable by ships of good burthen as high as Gainsborough, which is near 40 miles from the Humber by the river. The barges without the help of locks or stops go as high as Nottingham, and farther by the help of art, to Burton upon Trent in Staffordshire. The stream is full, the channel deep and safe, and the tide flows up a great way between Gainsborough and Newark (from Letter 8, Part 1: The Trent Valley)

Contemporaries like Defoe also provide indications that navigations greatly enhanced commerce. For example, he spoke favorably on the effects of making the river Trent navigable.

[The River Trent navigation]...is a great support to, and increase of the trade of those counties which border upon it; especially for the cheese trade from Cheshire and Warwickshire, which have otherwise no navigation but about from West Chester to London; whereas by this river it is brought by water to Hull, and from thence to all the south and north coasts on the east side of Britain; 'tis calculated that there is about four thousand tons of Cheshire cheese only, brought down the Trent every year from those parts of England to Gainsborough and Hull; and especially in time of the late war, when the seas on the other side of England were too dangerous to bring it by long-sea (from Letter 8, Part 1: The Trent Valley)

River navigations enhanced trade the most when the only alternative was road transport. Secondary sources provide data on freight charges for rivers that became navigable. These can be combined with information from the journals of the House of Commons. Table 3 lists observations on freight charges per ton-mile in shillings on various rivers. The average freight charge was 0.36s per ton mile.

Freight charges on river navigations were higher than those on rivers which had been navigable since ancient times, like the Thames and the Severn. The average freight charge per ton mile on these and similar rivers was 0.12s. (Willan 1964, pp. 119-121). The main reason is that users had to pay tolls to navigation companies. The difference was also due to geographic factors. River navigations extended old navigable rivers into areas that were more difficult for boats to pass, which would have added to the costs of freight.

The sources often compare river freight charges with freight charges on nearby roads. They indicate that road freight charges per ton mile averaged 0.93s. This would imply that freight charges on river navigations were 39% of freight charges by road. Data from land carriage rates indicates that average freight charges were 1.22s per ton mile on roads before turnpike were established (Bogart 2005b, p. 505). This would imply that freight charges on river navigations were 30% of freight charges by road. The latter figure might over-state the price difference because road transport was cheaper near rivers due to competition. Also the terrain might have been favorable near rivers compared to other areas. Thus it is likely that freight charges on river navigations were at most 39% of road freight charges and perhaps a little less.

It is possible to make an estimate of the social savings from river navigations by estimating the ton miles shipped on improved rivers and multiplying it by the price difference between river and road transport costs. Ton miles can be estimated using information on average toll revenues per mile and the average toll per mile on river navigations.⁴ Table 4 shows the average toll income per mile for various rivers using data on the leases of firms who collected the tolls. Some of the observations come from 1750 while others come from the 1720s, 1730s, and 1740s. The evidence from Dun, Aire and Calder, and Great Ouse navigations shows that toll

⁴ Let total toll revenues be defined by $t*Q$, where t is the average toll per ton mile and Q is ton miles. Dividing toll revenues by t yields Q ton miles.

income grew during the 1740s. The average annual growth rate for these three rivers was 3.7% from 1740 to 1750. Extrapolating toll income from the early years to 1750 using this growth rate yields the estimates of average toll income per mile in 1750 in the last column of table 4. Total toll income in 1750 can be estimated by multiplying the number miles under the authority of river navigations by average toll income per mile across the sample (£90). The average toll income per mile should be scaled upwards because toll collectors bid below the total toll income in order to pay for the expenses of toll collection. Assuming 10% collection costs gives an estimate of total toll income at £47 thousand in 1750.

Table 5 shows the toll per mile charged by various river navigations. The toll data come from the maximums set in the act.⁵ The average across the sample was 0.15s per mile or £0.0075 per mile. Dividing the total toll income by the average toll per mile yields an estimate of 6.27 million ton miles shipped on river navigations in 1750. It is worth point out that this is likely to be an under-estimate because the toll levied by river navigations could be lower than the maximum set by the act.⁶

The last step is to multiply ton miles by the difference in freight charges on river navigations and roads. Table 6 reports the social savings based on different estimates of road freight charges. Row (5) uses the estimate from secondary sources which directly compared road and waterway freight charges. The social savings equal £179 thousand which is around 0.2% of G.D.P. in England and Wales in 1750. Row 6 uses the estimate of road freight charges from land carriage rates. The social savings here are £270 thousand or 0.3% of G.D.P. In either case, the social savings from river navigations were relatively small in 1750. The social return

⁵ Data on tolls schedules come from acts of Parliament. The acts are available in private collections. Those used here were obtained at the William Clark Library in Los Angeles and the University of Minnesota Law Library.

⁶ Recall that ton miles, Q , are estimated by dividing toll revenues $t*Q$ by t . If t is over-stated by the maximum schedule then estimated ton miles will be lower.

on river navigations was high however. Dividing the social saving by the total cost of investment yields an average social rate of return between 28 and 43%, which is certainly higher than most investments at the time.

The social savings from river navigations likely increased over the eighteenth century because river traffic grew relatively rapidly. It is possible to make a preliminary estimate of the social savings in 1820 using the toll income from the Aire and Calder, the Cam, and the Great Ouse river navigations in the early nineteenth century (see Wilson 1969, Summers 1973). Multiplying the toll income per mile across these three rivers by the number of miles navigable yields an estimate of total toll income in 1820. Dividing this figure by the average toll per ton mile on these three rivers yields an estimate of ton miles shipped in 1820. Row 9 in table 6 reports a lower road freight charge in 1820 because turnpike trusts and other transport innovations reduced road freight charges by 40% (Bogart 2005b). Lastly, multiplying ton-miles by the price difference in road and river navigation freight charges yields a rough estimate of the social savings in 1820. They equal £2.24 million or 0.7% of G.D.P. At the very least these calculations suggest that river navigations yielded more social benefits to the economy as the demand for river transport increased.

4. The Social Costs of Turnpike Trusts and River Navigations

The social savings from turnpike trusts and river navigations were sizable but they might have been diminished by the high tolls and the expenses associated with operating numerous authorities and toll gates. This section examines the social costs and gauges their magnitude. It estimates the size of monopoly profits and the opportunity cost of expenditures on toll collection and acts of parliament.

4.1 Monopoly

The sanctioning of monopoly powers would appear to be a significant social cost associated with river navigations. They were often located in areas where there was no nearby river or poor access to the sea. Road transport provided little effective competition for river navigations because it was 10 times as expensive as water transport in the 1600s and early 1700s. Parliament clearly recognized the potential for monopoly. They regulated river navigations by setting a maximum schedule in the act. The average maximum toll per ton mile was 0.15s (see table 5). River navigations could charge less than this, but they would only do so if the maximum exceeded the monopoly toll. The key issue is whether Parliament set the maximum toll low enough so that river navigations earned less than the monopoly profit.

The Aire and Calder navigation is one prominent example where it appears that parliamentary regulation did not preclude monopoly profits. An act in 1699 authorized making the river navigable from Leeds to Ferrybridge, where the river Aire was already navigable to the sea. The navigation was opened in 1704 and for the first 15 years the dividends were negligible, but between 1720 and 1775 the dividends ranged between 10 and 28%. The undertakers of the Aire and Calder were known locally as the 'fourth estate of the realm' because they were enriched by the navigation (Wilson 1971, p. 140).

Despite these descriptions, it is not obvious that the Aire and Calder navigation earned a super-normal rate of return. The initial profits were low which meant that undertakers earned less than the competitive rate of return during their initial years. The internal rate of return can be estimated by calculating the present value of the toll lease income from 1704 to 1772 and comparing this figure with the investment costs. The lease income provides a reasonable

approximation of the annual profit because toll collection costs were already deducted and the maintenance costs on the river were likely to be small. Figure 2 shows the time path for the lease income of the Aire and Calder Navigation using Wilson's (1971) data. Lease income was zero for the first four years and then it steadily rose during the next 70 years.

In the early 1700s the mayor of Leeds raised £26,700 from the merchant community to improve the river. No further improvements were made until the mid-1770s. The net present value of the profit stream up to 1772 was £31,825 in 1700 assuming an interest rate of 5%.⁷ By 1772 the Navigation was clearly earning a return above 5%. The magnitude of the return depends on the value of the lease income after 1772. If the toll income would have remained constant at its 1772 value of £8500 then the internal rate of return on the initial investment of £26,700 in 1700 would be 5.9%.⁸ If the revenues continued to grow at the same annual rate as they did between 1700 and 1772 (3.5%) then the overall rate of return would have been 6.2%. If the investments were spread evenly over the first 10 years and revenues grew at 3.5% then the rate of return would be 7%.⁹

The Aire and Calder navigation invested £70,000 in the river in the early 1770s adding to the earlier investment of £26,700 (Wilson 1971). The gross revenue in 1775 was £40,200 yielding an immediate return at least as large as 30%. From 1775 to 1826 the revenues on the

⁷ The present value assuming an interest rate of 5% is $\sum_{t=0}^{72} \frac{profit_t}{(1+.05)^t}$ where the profit stream is shown in Figure 2.

⁸ The internal rate of return can be identified by solving for the interest rate r such that the net present value is zero. The formula for the net present value is $\sum_{t=0}^{\infty} \frac{profit_t}{(1+r)^t} - I$. In this case the Investment is equal to £26,700.

⁹ When the investment cost is spread over 10 years, the formula for the net present value is

$$\sum_{t=0}^{\infty} \frac{profit_t}{(1+r)^t} - \sum_{t=0}^{10} \frac{I/10}{(1+r)^t}.$$

Aire and Calder grew at an average annual rate of 2.1% per year, whereas the rate inflation was around 0.8% over the same period.

These calculations suggest that the Aire and Calder earned considerable profits, but it appears that it was exceptional in this regard. Using the sample of river navigations in table 4 and dividing the average toll income per mile in 1750 by the average investment per mile by 1750 yields an average return in 1750 of 5.4% (103/1918). The same calculation for the Aire and Calder shows a return of 13.5%. The Aire and Calder was also exceptional in that it was located in the West Riding of Yorkshire, which was a growing industrial area. Between 1750 and 1800 the average growth of toll income on the Great Ouse in Bedfordshire was 1.1%. On the River Cam in Cambridgeshire toll incomes grew at an average rate of 1.6% between 1752 and 1813. By comparison, the average rate of inflation over the same period was approximately 1.2% and so in real terms toll revenues were either constant or they were increasing modestly on these two river navigations.

The average rate of return on river navigations can be estimated using a base year profit of £103 per mile in 1750 and an average investment per mile of £1918. The data from the Great Ouse indicates that profits grew at 1.3% per year before 1750 but were stagnant in real terms after 1750. The data from the river Dun suggests its real revenues grew by 2.2% in the 1740s. The data from the Cam suggests that real revenues grew by 0.4% from 1750 to 1813. The data from the Aire and Calder shows that real revenues grew by 3% per year from 1700 to 1750, 3.3% from 1750 to 1772, and 1.3% from 1775 to 1827. For the purposes of the rate of return calculation, I assume that annual real profits grew at average rate of 2.15% from 1700 to 1750 and 1.25% after 1750, and that investment costs are spread evenly from 1708 to 1717. These assumptions yield an average rate of return around 4.7%.

Based on this calculation, there is little evidence that the average river navigation earned a premium from their monopoly power. The average real yield on long-term British government debt from 1700 to 1750 was 4.94% and the average rate of return on charity assets was 4.6%.¹⁰ The implication is that the social costs from monopoly were minimal in most cases. One of the main reasons is that the toll schedules were reduced or they were kept constant so as not to increase with inflation. The maximum tolls on the Great Ouse were set by acts in 1665 and 1720 and they were not amended over this whole period. The average toll was 3s 6d per ton in the 1720s and remained so until the late nineteenth century (Summers 1973, p. 71). The 1699 act establishing the Aire and Calder set the tolls at 10 shillings per ton in the summer and 16 shillings per ton in the winter for all goods. The 1774 act which authorized new investments on the river set the maximum between 3 and 7 shillings per ton for most commodities (Priestly 1969). On woolen cloth, the most important export of the West Riding, the maximum toll was 7 shillings a ton. On the river Cam the tolls were set by an act in 1702 and were not altered until another act was passed in 1813.¹¹ In that year the tolls were adjusted upwards and the revenues increased by 44% (Summers 1971). This did not necessarily imply that profits increased by 44% because the 1813 act authorized new investments in ‘making the River Cam more navigable from Clayhithe Ferry to the Queen's Mill.’

Monopoly was less of concern in the case of turnpike trusts. Unlike river undertakers, turnpike trustees were not authorized to earn profits from the tolls. The acts stated that all revenues were to be devoted to road improvement, maintenance, salaries, interest, and the payment of debts. Trustees could be fined treble costs by county courts if they were caught

¹⁰ The average real yield on long-term government debt is the nominal yield minus the rate of inflation. For the nominal yield see Neal (1990) and for the rate of inflation see Clark (2005). For the return on Charity assets see Clark (1998).

¹¹ The 1813 River Cam act is 53 George III, c. ccxiv.

embezzling the revenues. Trustees might try to extract through the accumulation of balances. When the revenues exceeded the expenditures then the treasurer might deposit the surplus in a bank or lend the funds at interest (Albert 1972, p. 76). In 1821 the total net balance in treasurers hands was £229,000, but the total unpaid interest was £558,000.¹² Therefore some trusts had a surplus, but most were in deficit with no surplus to be extracted.

Competition between turnpike trusts is one reason why there were negligible surpluses. By 1821 there were 0.05 turnpike miles per square mile of land in England and Wales. This figure implies that the network was extremely dense and that users could shift to another turnpike if tolls were too high. The spatial structure of turnpike roads along the Great North Road provides an example of the choices available to road users. The Great North road was the main route from the northern counties to London. Near London it also served as a major route for farmers in the counties of Hertford, Cambridge, Bedford, and Huntingdon to ship their goods to London. Just outside of London, the Great North road split into two branches which ran parallel to one another for about 60 miles where they joined once again in the small city of Alconbury (see Albert, 1972 p. 32). Before 1820 12 different turnpike trusts managed the parallel roads between London and Alconbury. The distance between parallel trusts was as little as 5 miles and as much as 10 miles. Thus travelers clearly had a choice as to which turnpike roads they would take.

Parliament also kept the maximum tolls from increasing with the rate of inflation in the early nineteenth century. Data from all turnpike acts passed between 1695 to 1750 reveals that the average maximum toll on wagons with four horses was 0.93 shillings.¹³ A sample of acts from 1800 reveals that the average maximum toll on wagons with six horses was 1.86 in the

¹² All data on turnpike trusts in 1829 and 1821 comes from the Report from the Select Committee of the House of Lords appointed to examine the Turnpike returns. See British Parliamentary Papers, House of Lords 1834 Vol. X.

¹³ The sources for tolls are described in Bogart (2005b).

early nineteenth century. The 100% increase in the nominal toll is less than the 134% increase in living costs from the first half of the eighteenth century to 1800. Similar information on the toll for coaches with four horses shows that tolls increased in nominal terms by 98% from the early eighteenth century to 1800. Again this nominal increase is less than inflation.

In some cases Parliament also lowered the maximum toll when it was clear that revenues were more than sufficient. One such instance occurred in 1740 when the trustees for the Oxford to Stokenchurch turnpike applied for an act renewing their authority. The trustees petitioned that the term of their act needed to be extended to keep the road in repair. The MP reported from the committee that the debts had been paid off. An act was passed extending the term, but the tolls on coaches were reduced by 33%.¹⁴

4.2 Legal and Exclusion Costs

Nineteenth century reformers often pointed to the waste resulting from numerous toll gates and toll collectors. They also pointed to the high expenses associated with passing acts of parliament.¹⁵ These exclusion and legal expenditures were necessary for turnpike trusts and river navigations because they prevented evasion and they established or regulated their authority. This sub-section investigates whether these legal and exclusion costs were large in comparison to the social savings from turnpike trusts and river navigations.

Turnpike trusts were given the authority to levy tolls for 21 years in their original act. Once this term expired the trustees had to obtain a renewal act otherwise their authority would cease. Renewal acts were particularly controversial because they might do little more than

¹⁴ The original and the renewal act for the Oxford to Stokenchurch trust is 5 GII 2 and 13 GII 15 (see Bogart 2008b).

¹⁵ See the Report from the Select Committee of the House of Lords (1833) for reformers views.

authorize the turnpike trust to continue doing what it was previously doing. However, some may have added value by altering the tolls or by adding more miles to the authority of the trust.

Acts were costly in that they required the time and expertise of solicitors, clerks, and MPs. The cost of passing an initial act was around £500 in the early nineteenth century. Renewal acts were usually around £300.¹⁶ One way of gauging the magnitude of legal expenditures is to compare the opportunity cost with the social savings from turnpike trusts in 1821. Acts were obtained throughout the eighteenth century. Therefore it is appropriate to calculate the cumulative spending on acts in each year up to 1821 and to calculate the cumulative return if that money was invested in government bonds. The opportunity cost calculation makes use of data on the number of turnpike acts and those establishing new trusts in each year (see Albert 1972 and Bogart and Richardson 2008b). Multiplying all original acts by £500 and all renewal acts by £300 gives total legal expenditures in each year. Since the first permanent turnpike trust was created in 1692, the opportunity cost of legal expenditures is calculated beginning in 1692. In this first year £300 was spent on an act. If that money was invested in government bonds and earned the real annual yield it would have a future value of £51,000 in 1821.¹⁷ A similar calculation is done for the legal expenses in each year and summed across all years.¹⁸

Figure 3 shows the opportunity cost of all legal expenditures from 1692 to 1821. By 1821 the cost reached £140 thousand. The lower bound estimate of social savings in 1821 is £2.65

¹⁶ Pawson (1977) gives data for the cost of passing various types of turnpike acts. £500 and 300 are somewhat high and should bias against the conclusion that exclusion costs were low.

¹⁷ The future value of expenditures in 1692 in any year t is given by the recursive equation $E_t = (1 + r_t)E_{t-1}$ where $E_0 = 300$ and r_t is the interest rate in year t .

¹⁸ Let FV_j be the future value of legal expenses expended in year j . The opportunity cost of all legal expenditures by 1821 is $\sum_{j=1692}^{1821} FV_j$.

million and the upper bound estimate is £5.3 million (Bogart 2005, 2008). Total legal costs equaled at most 5% of the social savings and thus were fairly trivial by comparison.

Exclusion costs were another expense associated with turnpike trusts. The costs of toll collection were largely determined by the number of toll gates. In the simple case of a single road connecting an agricultural hinterland with a city, it was possible for a single toll gate near the city to charge all road users. But if the road was managed by more than one turnpike trust, then each was likely to construct its own gate. The added spending on gates would be inefficient because all traffic ends in the city and should be charge once. This type of pattern was prevalent on the roads leading into London where different turnpike trusts managed individual segments of between 5 and 15 miles. This organizational structure was believed to be wasteful, which is why in 1822 Parliament passed an act merging the trusts in the vicinity of London (see Albert 1972).

Multiple gates could arise even if there was a single turnpike trust operating a main highway connecting two cities or a city with its agricultural hinterland. Suppose there were feeder roads or multiple destinations then the trust would want to charge users who enter or exit at different points. They might also construct ‘side-bars’ when road users tried to evade the tolls by entering the road just after the collection point. In these latter cases, exclusion costs could become so great that they outweighed the benefits of using tolls.

A survey from 1829 shows that England had 4478 toll gates, or one toll gate for every 4.5 miles of turnpike road (BPP HL 1834). Extrapolating to 1821 using the number of miles implies there were around 3600 toll gates or 3.5 gates per turnpike trust. The same survey shows that 4% of expenditures were devoted to the construction and repair of tolls gates and toll collectors’ houses. In 1821 that would amount to £41 thousand per year or £11 per gate. In the mid-eighteenth century, toll collectors were usually paid 6 shillings per week (Albert 1972, p. 34). In

the early nineteenth century this would be equivalent to 12 shillings per week or £31 per year. Assuming that each gate was managed by one toll collector implies an annual wage bill for toll collectors of £31 per gate. Adding repairs and wages gives the annual exclusion expenditure per gate of £42 (in 1821 prices).

The opportunity cost of exclusion expenditures can be compared with the social savings in the same manner as legal costs. Wages to toll collectors and repairs to toll gates were annual expenses which otherwise could be invested. It is assumed that every turnpike had 3.5 gates and that the annual cost for each trust was £147. Multiplying this figure by the number of trusts in each year gives an estimate of total exclusion expenditures throughout the economy. The annual interest rate is the same as before and is equal to the real yield on long-term British government debt. Figure 3 shows the opportunity cost of all exclusion expenditures from 1692 to 1821. By 1821 the costs were £756 thousand. This implies that the opportunity cost of exclusion expenditures equaled between 14 and 28% of the social savings in 1821. The opportunity cost of legal and exclusion expenditures together represented between 17 and 34% of the social savings. These social costs were clearly substantial, but importantly they did not outweigh the benefits from turnpike trusts.

5. Alternatives to Statutory Authorities

Could Britain have done better with a different institutional arrangement? Like most statutory authorities, turnpike trusts and river navigations assumed the authority of other organizations when they were created. Turnpike trusts assumed parishes' authority for road maintenance. River navigations assumed sewer commissions' authority for river maintenance. This section considers whether infrastructure provision through parishes or sewer commissions'

would have yielded higher social benefits and lower social costs. It also considers whether other institutional arrangements would have been more beneficial. One alternative was centralization where the king and Parliament borrowed to finance road and river improvements and then either levied tolls or used excise and land taxes to service the debt and pay for maintenance. The second was a decentralized system where the county financed road and river improvements by using county tax revenues.

5.1 Parishes instead of turnpike trusts?

Reliance on turnpike trusts meant that several hundred thousand pounds were lost every year because of toll collection costs and the expenses of passing acts. These costs could have been saved if parishes spent an equivalent amount on road improvements. However, both theory and evidence suggests that parishes would have spent far less than turnpike trusts and therefore the economy would have lost much of the social savings from road improvements.

Parishes had an incentive to under-invest in major roads because their residents comprised only a small fraction of the users. The high volume of through-traffic meant that their residents' marginal benefits from additional road spending were less than the marginal benefit enjoyed by all the users. To see this problem more clearly, consider the problem faced by the parish of Islington which was just to the north of London. Islington had two major thoroughfares running through its jurisdiction. These highways brought agricultural goods from counties like Hertfordshire as well as manufactured goods from northern counties like Yorkshire. By levying taxes to maintain these roads Islington was effectively subsidizing the road use of residents across several counties. Their citizens derived only a small benefit in proportion.

Even if parishes wanted to improve their roads they were limited in their ability to borrow for road investment. Parishes had no experience issuing bonds backed by tax revenues.

Lenders therefore would have been reticent to lend to parishes for road improvements. The problem would have been especially severe for smaller parishes which had a limited tax base.

The data show that parishes spent little before turnpike trusts, but it is not obvious that they would have continued to spend little if turnpike trusts were never established. Perhaps parishes would have responded to the growing demand for road investment in the eighteenth century. It is difficult to establish the counter-factual level of road spending, but there are estimates of how much parishes spent on roads for which a turnpike was proposed in Parliament but the act did not pass. The estimates suggest that parishes would have increased their spending to only £10 per mile (Bogart 2005, p. 459). If this approximates the counter-factual level of parish road spending, then road investments per mile would have been 83% lower if parishes continued to maintain turnpike roads. In other words only £1.0 million pounds would have been invested on roads rather than £6.5 million.

The social cost of lower investment in roads can be estimated using the average social rate of return on turnpike investment. Using the lower bound return of 45%, the social cost equals £2.5 million in 1820. This estimate is significant because it shows that that the social costs from legal and exclusion expenditures (£0.9 million) were much smaller than the social costs from lost investment had parishes continued to maintain turnpike roads.

5.2 Sewer Commissions instead of river navigations?

Sewer commissions were authorized by the Lord Chancellor at the request of local communities. According to the Law of Sewers formulated in the reign of Henry VIII, sewer commissions had the authority to levy taxes on property holders near the river, but they had no right to levy tolls, nor could they levy taxes to alter the river. Specifically they could not ‘make a new river or try inventions at the charge of the country’ (quoted in Willan 1964 p. 17). The

limited fiscal base from which Sewer commissions could finance improvements created some of the same problems faced by parishes. Anyone who used the river—including farmers, manufacturers, and mining interests—benefited from improved navigation, but sewer commissions could only tax the landowners near the river. Therefore, any time they proposed to levy a tax they were likely to face some resistance from these landowners who bore a disproportionate share of the cost.

The legal restrictions on altering the river created even more vexing problems because it allowed vested interests to challenge projects proposed by commissioners. Vested interests included the towns which feared that river navigation would divert trade from their city, landowners near cities who feared lower prices for their agricultural goods, land carriers who feared the loss of their jobs, and finally mill-owners who feared the loss of water to drive their waterwheels (Willan 1964). If any of these groups felt that river improvements would eliminate their rents they could appeal to the courts on the grounds that the sewer commissions acted outside their authority. If the courts responded favorably they could require the commission to levy taxes to pay damages or they could order that the project be halted.

The evidence suggests that sewer commissions were not successful in implementing river improvements. A commission of sewers was created in 1605 to improve navigation and drainage on the Great Ouse. The commission tried to make a new cut in the river between Ely and Littleport. They spent £1000 before dropping the project because there were protests that it was too expensive (Summers 1973, p. 41). In 1616 another Commission was formed to improve navigation on the Great Ouse. It too failed to implement any improvements. According to the commissioner, Richard Atkyns, its authority was disregarded by ‘self conceited, willful and overweening persons out of their own singularity and perverse dispositions (Quoted in Summers,

p. 41). These opportunistic individuals were undoubtedly the landowners who were concerned that improving the navigation would impede the drainage of land.

The role of vested interests can also be seen in the case of the river Dee. In 1607 a commission was created to improve navigation on the river. In 1608 it announced a plan to make a breach in the causey, near Chester, which impeded the flow of water along the river. The city of Chester opposed this project because the causey helped supply water to its mills. Chester appealed to the Privy Council, which requested that the Lord Chief Justice, the Lord Chief Justice of the Common Pleas, and the Lord Chief Baron hear the case. Chester argued that the Commission had no authority to alter the river. The judges ruled in their favor and ordered the commission to halt the project (Willan 1964, pp. 18-20).

In the absence of major reforms, it is highly unlikely that sewer Commissioners could have implemented the same amount of investment as river navigations. In light of the limitations faced by sewer commissions, the social costs of river navigations can be seen as the 'price' for improving rivers in England. The tolls charged by river navigations were an easy way to distribute the costs of investment among various users. The tolls were also used to compensate vested interests who opposed projects on the grounds that they would suffer damages. The acts appointed special commissions that would assess the damages caused by navigations. They also allowed landowners to appeal to juries which would make recommendations to the commission. This appeal system was used by groups who suffered damages from the improvement of the River Douglas and the River Weaver (Willan 1964, p. 49). Unlike the Sewer Commissions, the commissions named in river acts had legal authority granted by Parliament. Vested interests could not appeal to the Privy Council or other courts to challenge their decisions.

5.3 Were Centralization and Decentralization viable Alternatives?

Parishes and sewer commissions were not the only alternatives to statutory authorities. The king and Parliament might have borrowed to finance road and river improvements and then levied tolls or excise and land taxes to service the debt and pay for maintenance. Parliament developed a very effective fiscal system for fighting wars in the eighteenth century. It could have used its fiscal might to finance infrastructure. Counties might have also financed road and river improvements by levying local taxes like the county rate. Counties financed bridges throughout their counties. They could have done the same for rivers and highways.

Centralization made the through traffic problem irrelevant because all users throughout the country would share the costs through their payment of national taxes or tolls. Centralization might have also led to better engineering, fewer toll gates, and savings in operation costs. The potential gains can be seen in the operation of the Holyhead road. Unlike most turnpike trusts, the 109-mile route from London to Holyhead was operated by a commission appointed by Parliament which included 3 ministers. It received substantial sums from the House of Commons from 1815 to 1830 in addition to charging tolls. After its completion it was described as “an example of road making on perfect principles” (quoted in Webb and Webb 1913, p. 170). Toll income per mile was 19% lower on the Holyhead road compared to the average turnpike. The Holyhead road was also distinctive in that it had 36% fewer toll gates per mile than the average trust and its spending on salaries and legal expenses per mile was 22% lower than the average.¹⁹

Based on the example of the Holyhead road it appears that central government financing could have produced significant cost savings. However, it is unlikely that centralization would have yielded a more efficient outcome absent some major reforms to the political system. In the seventeenth century, before the Glorious Revolution, it was fiscally impossible for the King to

¹⁹ See the information on the Holyhead road in the Report from the Select Committee (BPP HL 1834 X).

finance road and river improvements. Central government revenues were around 3.6% of G.D.P. (O'Brien, 1988, p. 3) in 1680. By comparison, toll revenues from turnpikes and river navigations were around 0.5% of G.D.P. in the mid-eighteenth century. The Stuart monarchs also had great difficulties borrowing and when they did the interest rate was above 15% (Dickson 1967). The crown's debt was 1 million in 1688 (Fisk 1920, p. 93). By comparison total investment for road and river improvements was approximately £1.7 million in 1750. There was simply no way that the king could finance an expansive transport network using the seventeenth century fiscal system.

Many of the problems in the fiscal system were addressed by the Glorious Revolution and the reforms that followed. By the 1720s the central government could borrow at interest rates at or below 4% (Dickson 1967). Tax revenues expanded through land taxes and the addition of customs and excise duties. Central government borrowing expanded to 100% of G.D.P. in 1750, 130% in 1790, and 175% in 1820 (Clark, 2001, p. 436). Parliament might have used its robust fiscal system to finance some infrastructure but it seems unlikely that it would have financed a similar level of investment as statutory authorities. Henry Parnell, one of the nineteenth century reformers made exactly this claim:

It must be quite clear to anyone who has carefully examined this subject that nothing but leaving the management of the roads to those persons who live in their neighborhood, would ever have induced the people of England to pay, as they now do, arising from turnpike tolls to the amount of £1.2 million...and although Government, by employing scientific engineers, might have expended the produce of them with greater skill than country gentlemen; the hostility to pay them, if they had been wholly at the disposal of Government, would have no doubt prevented the making of useful roads so universally over the whole country as they have been made under the established system" (1833 p. 288-89).

Why was there a 'hostility' to pay taxes at the disposal of the central government? One theory is that Britain had a divided fiscal structure. Parliament controlled tax revenues by setting

rates and by staffing and monitoring the excise and customs offices. The King controlled expenditures including the army and the navy.²⁰ A theoretical model developed by Hoffman and Rosenthal (1997) provides insights on how divided fiscal structures in early modern Europe led to low taxes and low spending on public goods. Their model assumes that elites care about public goods because it increases G.D.P., while the king cares about their own personal consumption. Under a divided fiscal system, the elites authorize low taxes because they cannot ensure that the executive (i.e. the king) will use tax revenues to pay for public goods instead of personal consumption. The low taxes imply that the executive spends little on anything, including public goods. When warfare is incorporated into their model, the results are largely the same. Faced with the threat of lost property, the elites authorize more taxes for defense but not enough to pay for public goods. The executive uses the additional revenues to pay for defense, offensive wars, and personal consumption. Public good spending remains low.

Their argument applies to infrastructure quite well. Parliament had the ability to levy high taxes to pay for roads and rivers, but they could not control how the King spent the revenues which they authorized. Therefore, in the absence of statutory authorities, the theory suggests that Parliament would have authorized few additional tax revenues to pay for roads and rivers and the king would have spent little on these public goods. It is difficult of course to say with certainty how much spending Parliament would have authorized in the absence of statutory authorities, but it is telling that there were no proposals to increase central government involvement in road and river financing during the eighteenth century. It was a political non-starter.

Decentralization at the level of the county was a more viable alternative than centralization. In his *Essay on Projects*, published in 1697, Daniel Defoe proposed a plan where counties would levy seven years of their 'usual' taxes to pay for road improvements in their

²⁰ See Binney (1958, p. 246-251) for a description of parliament's influence over revenues and expenditures.

county. This money would be supplemented by a fund which was to be created after all waste land adjacent to highways was expropriated and placed in a trust operated by the Bank of England. A similar proposal was put forth in a House of Lords bill in 1661. It proposed to give counties or municipal corporations first rights to improve rivers in their area.²¹ Neither this bill nor Defoe's plan was adopted, but it does give an indication that some contemporaries viewed county financing as a desirable alternative to statutory authorities.

County expenditure decisions were made by Justices of the Peace. JPs were appointed by the King but they were largely independent from the Crown's influence in the early eighteenth century as it became customary for all nobles and most members of the gentry to be appointed. JPs would gather four times a year in meetings known as Quarter Sessions. In Sessions they performed their judicial duties, made decisions about spending on bridges and jails, and issued indictments against parishes who failed to maintain their highways. With respect to highways, JPs could go further by levying a county tax to pay for road improvements in a specific parish. County highway subsidies were uncommon, but not unknown. In 1713 the township of Holbeck in Leeds petitioned for a 'gratuity' on the grounds that they had already levied substantial property taxes to pay for road improvements over the preceding years. The JPs in the West Riding of Yorkshire granted their request and paid the substantial sum of £30 to the township. Their generosity was exceptional because over the next 100 years there was only one other case where JPs in the West Riding offered a gratuity to a parish. Instead they actively levied fines on parishes for failing to maintain their highways.²²

The reluctance of JPs to pay for highways or for rivers is not surprising because they knew that localities would turn to statutory authorities. Would JPs have offered more gratuities

²¹ A draft of the bill is in the Parliamentary Archives, HL/PO/JO/10/1/311.

²² The activities of JPs in the West Riding can be found in the records of Quarter Sessions. The Family History Library in Salt Lake City, Utah has these records on microfilm (see films #1657872-4, 1657913-5).

to parishes if Parliament stopped authorizing statutory authorities? The answer is mostly likely yes. Counties did not have a divided fiscal structure like the central government. JPs made both revenue and expenditure decisions. In terms of the Hoffman and Rosenthal framework, elites in the county should have been more willing to authorize county taxes for infrastructure because there was less of a concern that tax revenues would be diverted. Evidence from county bridge expenditures reveals that this was largely true. Individuals sometimes complained that JPs were authorizing expenditures for bridges that were used by a minority of individuals. These concerns were alleviated to some degree by an act in 1739 which required a grand jury or the judges of assize to first issue an indictment that the bridge was out of repair (Webb and Webb 1913). This provided some check on wasteful spending and gave county tax payers greater assurances.

What were the main benefits if counties expanded their role? First, infrastructure would have been well-planned because JPs had local information on which roads and rivers needed improvement. Second, county-level provision helped to mitigate the through traffic problem. Landowners who resided within the county contributed to the costs through the payment of property taxes. There would have been a closer match between the marginal social benefits of an infrastructure project and its marginal cost borne by the county.

What were the main disadvantages if counties expanded their role? First, counties did not have a debt funded by tax revenues. Therefore it would have been difficult to finance projects with large fixed costs by borrowing. Defoe's proposal that counties should levy seven years worth of taxes to pay for road improvements instead of borrowing provides an indication that this constraint was binding. Second, county-level financing would not have addressed the through traffic problem on major thoroughfares leading into London or on major rivers. These transport routes were used by residents from several counties and so here there would have been

a greater gap between the marginal social benefit and the marginal cost borne by the county. Third, counties could not tap into industrial or commercial income by levying property taxes. Tolls, by contrast, tapped into a large income pool because firms and merchants were extensive users of road and river transport.

Overall it is not obvious if county level provision would have been better. The safest conclusion is that British infrastructure would have been different. If counties were in charge the expense of maintaining local roads and rivers would have been lower because the tolls and legal expenses were not necessary for these routes. But major thoroughfares and major rivers would have suffered and expensive projects would have been forgone. In other words, Britain would have had a more regional transport system with few large-scale projects.

6. Conclusion

Statutory authorities were not the ‘first-best’ way of organizing and financing infrastructure investment. They created monopoly power, where none had existed before, and they led to significant spending on the procurement of acts and the collection of tolls. At the same time statutory authorities yielded much needed investments in infrastructure which benefited the economy as whole. This chapter analyzes the social benefits and social costs of two prominent types of statutory authorities: turnpike trusts and river navigations. It shows that river navigations and turnpike trusts did not earn significant monopoly profits on average and that the opportunity cost of spending on acts and toll collection was less than the social savings from turnpike trusts and river navigations.

This chapter also argues that turnpike trusts and river navigations were more efficient than other feasible institutional arrangement at the time. Divided fiscal authority meant implied

that centralization would not have yielded the same amount of investment. Legal and fiscal limitations implied that decentralization would not have been significantly better. Turnpike trusts and river navigations therefore were ‘second-best’ institutions.

More generally this chapter adds some evidence that British institutions contributed to economic growth by adapting property rights. This hypothesis has been discussed in other papers (see Bogart and Richardson 2008a, 2008b). Statutory authorities are one example of the way in which property rights were altered in a directly that enhanced efficiency. By giving trusts or companies secure monopoly rights to improve infrastructure, there were strong incentives to invest. Parliament also limited the losses from monopoly by regulating the fees charged by statutory authorities. The result was that users were given cheap and easy access to an extensive amount of social overhead capital. This is not to say there were no shortcomings, like the high opportunity cost of exclusion expenditures, but it is hard to imagine how Britain could have done better given its political and legal institutions in the eighteenth century.

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Tables

Table 1: Quality of roads in parishes with and without turnpike trusts: Huntingdonshire c1810

	# very good roads	# ok or good roads	# bad roads	total
Parishes w/ turnpikes	32	30	13	75
Parishes w/o turnpikes	28	24	28	80
	% very good roads	% ok or good roads	% bad roads	total
Parishes w/ turnpikes	43	40	17	100
Parishes w/o turnpikes	35	30	35	100

Source: Parkinson (1811).

Table 2: Investment by River Navigations, 1600-1750

River	Time period	Amount Invested (£)	Miles	Investment per mile (£)
Avon	1640s	30000	42	714
Kennet	1720s	44603	20	2230
Weaver	1720s	18000	20	900
Douglas	1720s	6000	17.5	343
Wey	1650s	15000	19.75	759
Salwerpe	1660s	6000	5	1200
Beck	1720s	1400	1	1400
Dun	1730s	24750	18	1375
aire and calder	1720s	26700	25	1068
Dee	1740s	56461	8	7058
Exe	1690s	21000	4	5250
great ouse	1630s	10000	14	714
Average		21660	16	1918
Total Across Sample		259914	194	1340

Sources: For the Avon, Kennet, Weaver, Douglass, Beck, and Dun rivers see Willan (1964, pp. 66-72). For the Wey and Salwerpe rivers see Bogart (2008). For the Aire and Calder see Wilson (1971, p. 138). For the Great Ouse see Summers (1973, p. 50). For the Dee see the Journals of the House of Commons, 5.3.1743, and for the Exe see the Journals of the Commons, 15.2.1699.

Table 3: Freight charges on rivers that became navigable

River Navigation	time period	freight charge per ton mile (in Shillings)
Wey	1650s	0.267
Idle	1720s	0.667
Maldon-Chelmsford	1730s	0.215
Calder	1740s	0.45
Douglas	1730s	0.286
Avon	1730s	0.5
Weaver	1730s	0.331
Great Ouse	1660s	0.192
Average		0.3635

Sources: For the Wey, Idle, Maldon-Chelmsford, Calder, and Douglas see Willan (1964, pp. 121-128). For the Great Ouse see Summers (1973, p. 70). For the Avon see Journals of the House of Commons, 31.3.1734 and for the Weaver see Journals of the House of Commons, 13.2.1733.

Table 4: Toll Income per Mile on river navigations (net of collections costs)

River	time period	annual toll income (in £)	Miles	estimated toll income, 1750 (in £)	estimated toll income per mile, 1750 (in £)
aire and calder	1750	4400	25	4400	176
Kennet	1720s	667	20	1312	66
Beverly beck	1730s	99	0.75	130	173
Tone	1720s	386	11	813	74
Yorkshire ouse	1732	600	18	1104	61
Weaver and Dane	1730s	1674	20	2271	114
Dun	1740	1500	18	193	83
Wear	1732	1200	11	2208	221
Great Ouse	1750	1784	23	1784	77
Cam	1750	430	7	430	61
Lark	1742	332	14	435	31
Dee	1740	556	8	780	98
Average		1136	15	1322	103
Total across Sample		13628	175.75	15860	90

Sources: For the Aire and Calder, Kennet, Beverley Beck, Tone, Yorkshire Ouse, Weaver and Dane, and Dun rivers see Willan (1964, pp. 124-130) For the Great Ouse, Cam, and Lark see Summers (1973, pp. 150, 226-28). For the Wear and Dee see JHC, 6.2.1732 and 5.3.1743.

Table 5: Tolls per ton mile for river navigations

River	toll per ton mile (in shillings)
Idle	0.1
Stour	0.2
Kennet	0.2
Yorkshire Ouse	0.06
Weaver	0.08
Douglass	0.15
Idle	0.09
mersey and irwell	0.16
Dun	0.13
derwent yorkshire	0.21
aire and calder	0.33
Great Ouse	0.12
Average	0.15

Sources: For the Derwent, Stour, and Aire and Calder rivers see Willan (1964, p. 117). For the Great Ouse see Summers (1973, p. 71). For the other rivers, the tolls come from the maximum schedules published in acts, which are available at the Parliamentary Archives.

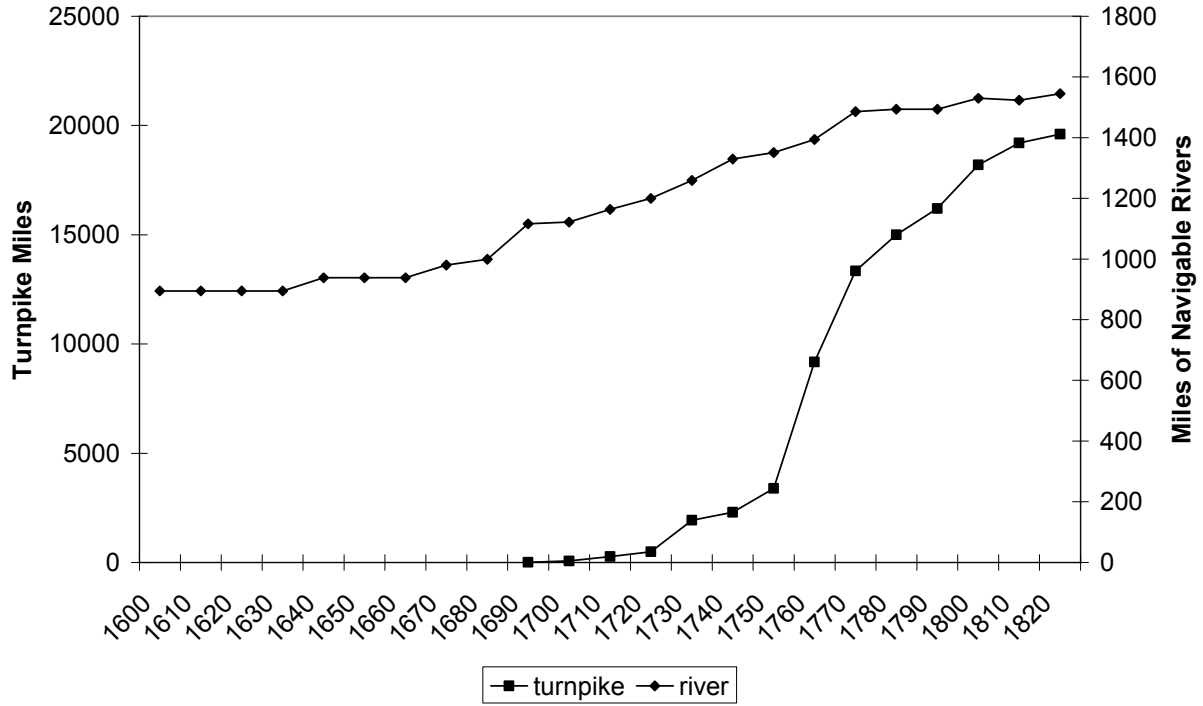
Table 6: Social Savings Estimates for River Navigations, 1750 and 1820

	1750	% of G.D.P.
(1) estimated ton miles	6270000	
(2) freight charge river navigations ton-mile	0.018	
(3) freight charge roads ton-mile estimate 1	0.0465	
(4) freight charge roads ton-mile estimate 2	0.061	
(5) social savings estimate 1 (3-2)*1	178695	0.2
(6) social savings estimate 2 (4-2)*1	269610	0.3
	1820	
(7) estimated ton miles	120446030	
(8) freight charge river navigations ton-mile	0.018	
(9) freight charge roads ton-mile estimate 1	0.0366	
(10) social savings (3-2)*1	2240296	0.7

Sources: see text

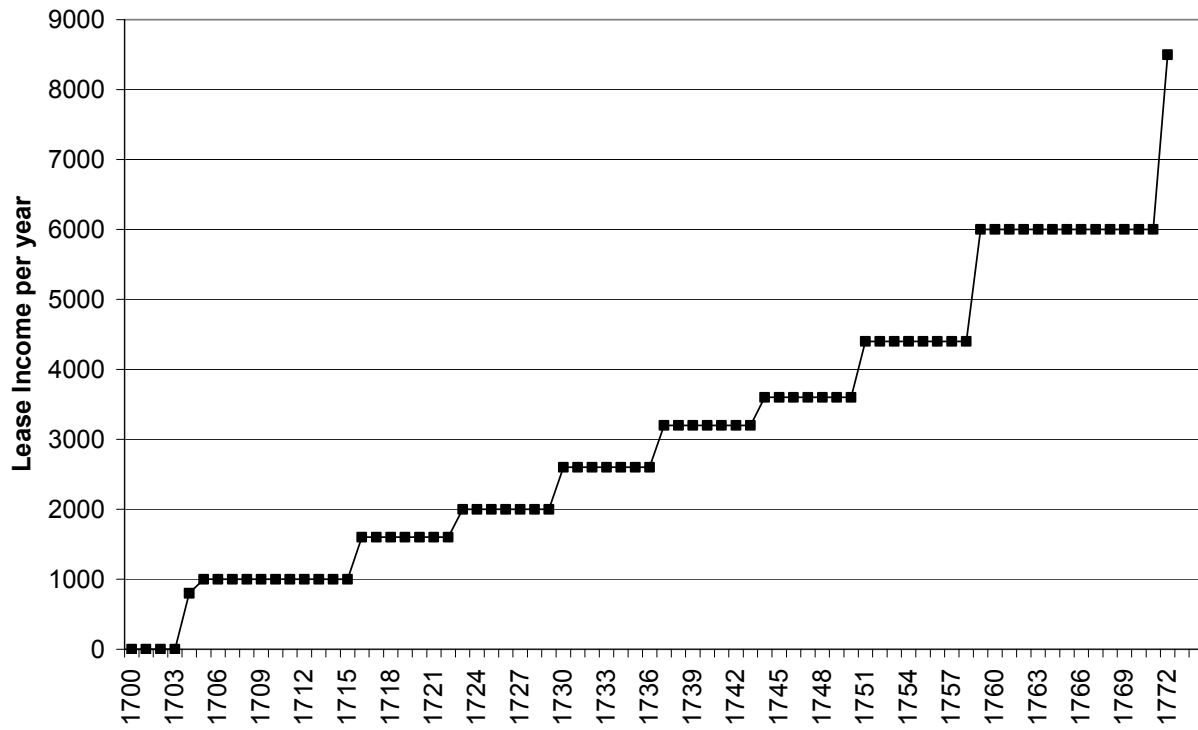
Figures

Figure 1: Miles of Turnpike Roads and Navigable Rivers in England and Wales, 1600-1820



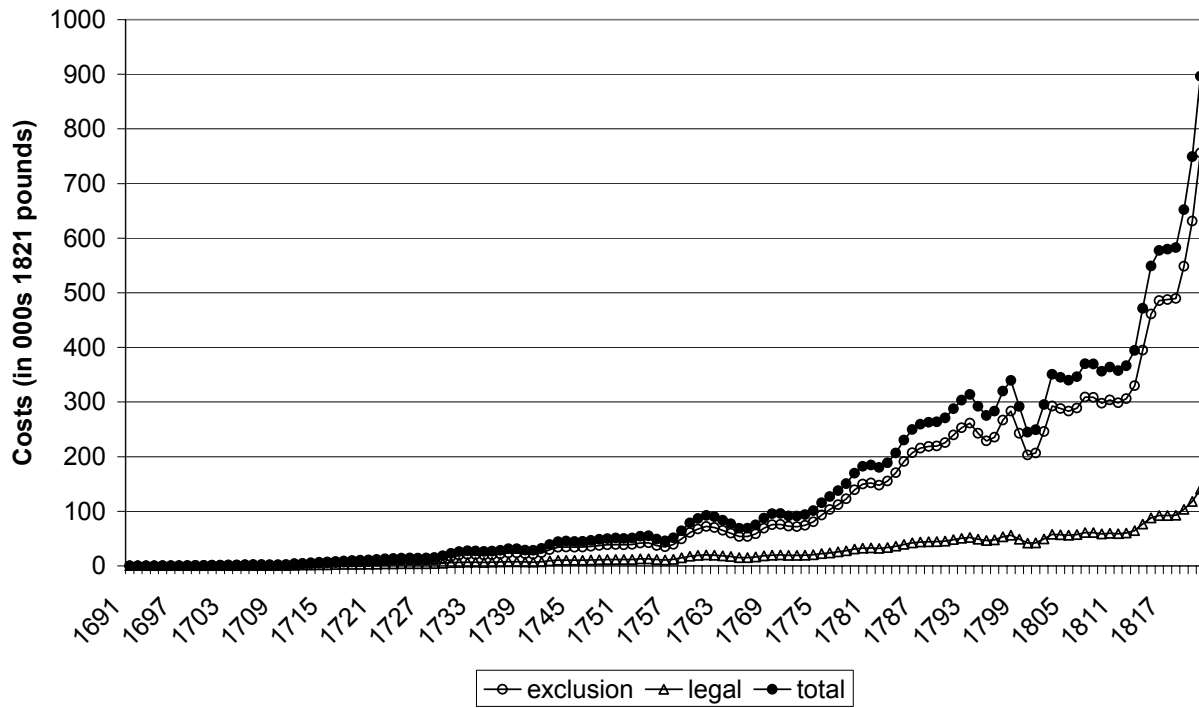
Sources: For Turnpike miles see Pawson (1977). For miles of navigable rivers see Shead (2007).

Figure 2: Lease Income on Aire and Calder Navigation, 1700-1772



Source: Wilson (1971, p. 141).

Figure 3: The Opportunity Cost of Legal and Exclusion Expenditures for Turnpike Trusts in England and Wales



Sources: see text.