Did the Glorious Revolution Contribute to the Transport Revolution?

Evidence from Investment in Roads and Rivers

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Abstract

Transport infrastructure investment increased substantially in Britain between the seventeenth and eighteenth century. This paper argues that the Glorious Revolution of 1688-89 contributed to transportation investment by reducing uncertainty about the security of improvement rights. It shows that road and river investment was low in the 1600s when several undertakers had their rights violated by major political changes or decrees from the King. It also shows that investment permanently increased after the Glorious Revolution when there was a lower likelihood that undertakers had their rights voided by acts. Together the evidence suggests that the political and institutional changes following Glorious Revolution made rights to improve infrastructure more secure and that promoters and investors responded to greater security by proposing and financing more projects.

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I.

In the seventeenth century Britain experienced a series of political revolutions. Kings James I and Charles I fought with Parliament over religion and the control of government policy. Their political conflict became a military conflict during the Civil Wars of the 1640s. The monarchy was abolished in 1649 and for a brief period—known as the Interregnum—the House of Commons had substantial authority. The monarchy was restored in 1660 with the return of King Charles II. The Restoration marked an initial attempt at a political settlement, but it was not successful. A lasting settlement was only reached after the Glorious Revolution of 1688-89 which ended James II's reign and established William and Mary as the new monarchs. Following 1689 Parliament met regularly and came to control key aspects of policy.

Many scholars have emphasized the economic implications of Britain's political revolutions. In one of the most well-known works, North and Weingast argue that the Glorious Revolution increased the security of property rights and reduced rent-seeking.[2] The North and Weingast thesis has stimulated much debate and research, but relatively few works have investigated the connection with infrastructure investment.[3] This paper addresses this issue by studying the link between transport investment, political changes, and the protection of property rights.

Investments in transport infrastructure were a key driver of the transport revolution. They were undertaken by individuals and local governments who approached Parliament and requested acts establishing companies or trusts with monopoly rights to undertake projects. The

[2] North and Weingast, 'Constitutions and Commitment', p. 803. See Ekelund and Tollison, *Politicized Economies*, p. 81, for a related argument.
[3] See Clark, 'Political Foundations', Wells and Wills, 'Revolution and Restoration', Quinn, 'The Glorious Revolution', Sussman and Yafeh,' Institutional Reforms', Stasavage, *Public Debt*, and 'Partisan Politics', Mokyr and Nye, 'Distributional Coalitions.'

vast majority of these statutory authorities went on to improve or build rivers, roads, bridges, canals, harbors, and railways to the great benefit of users and investors.[4] By the eighteenth century Parliament was the primary regulator of statutory authorities. Through acts it approved entry, set maximum fees for users, and sanctioned any changes in the formal rights granted to undertakers. However, the early history of river and road improvement shows that Parliament was not always the main regulator. In the early 1600s road and river promoters turned to James I and Charles I for patents nearly as often as they approached Parliament requesting acts. Regulatory authority over road and river improvement shifted to the Commons after the Civil War. Following the Restoration most rights were initiated through acts of parliament, but Charles II exercised significant influence and even revived the use of patents. Parliament's control over regulation was not solidified until after the Glorious Revolution.

The changing regulatory authority between the Crown and Parliament had the potential to greatly influence investment. Promoters and financiers might have been reluctant to invest in roads and rivers because they were uncertain whether their property rights would be protected or enforced following a shift in power. Similarly, promoters and financiers might have been reluctant to invest if they thought the Crown or Parliament might renege on privileges which it granted because of pressures from interest groups. Regulatory uncertainty is a general problem in private infrastructure investment. Once an infrastructure project is begun the investment is said to be 'sunk', meaning it cannot be recovered. Undertakers thus face significant losses if the regulatory authority tries to expropriate their investments, lower fees, or redistribute profits.

[4] For the literature on the effects of transport see Willan, *River Navigation*, Albert, *Turnpike Road System*, Pawson, *Transport and Economy*, Gerhold, 'Productivity Change', Bogart, 'Turnpike Trusts', Leunig, Time is Money'.

Theory makes strong predictions that undertakers will forego or delay investment under conditions where there is significant risk or uncertainty.[5]

This paper argues that the political settlement following the Glorious Revolution contributed to transport investment by reducing uncertainty about the security of improvement rights. First, it uses case studies to show that undertakers faced significant risk and uncertainty in the political and regulatory environment of the 1600s. Second, it uses regression analysis and structural breaks tests to show that the early 1690s marked a permanent increase in the level of road and river investment even after accounting for changes in interest rates, the growth of coastal trade, and the frequency of bad economic shocks. Third, it shows that the likelihood that an undertaker suffered a violation of their rights by a political settlement, royal decree, or act was lower after 1689.

Overall the evidence suggests that the Glorious Revolution was conductive for infrastructure investment in part because it eliminated the long-standing conflict between the Crown and Parliament. In the 1600s several undertakers had their rights voided unexpectedly following major political changes like the Civil War and the Restoration. These risks were mitigated once the political conflicts ended. The evidence also suggests how changes in regulatory authority influenced how disputes between undertakers and local groups were resolved. In the 1600s disaffected property-owners or users could appeal to the Crown for compensation or lower fees. This system created significant uncertainty because the Crown could essentially make any ruling that it liked, either in favor of undertakers or against them. After 1689 Parliament was called upon to resolve these disputes. In the 1690s and 1700s several bills were proposed to alter

[5] For the literature on investment and regulatory uncertainty see Levy and Spiller, 'Institutional Foundations', Newbury, *Privatization, Restructuring and Regulation*, and Pindyck, 'Irreversibility'.

undertakers' rights. Most of these bills were unsuccessful because they failed to get through committees in the Commons or they were vetoed by the Lords.

The findings in this paper give a new perspective on the North and Weingast thesis by providing evidence that the Glorious Revolution made rights to improve infrastructure more secure. It also provides evidence that there was an added 'demand' response in which promoters and investors responded to greater security by proposing and financing more transport projects. Together the findings yield the unexpected conclusion that the Glorious Revolution contributed to the investments underlying the transport revolution.

The findings also suggest the impact of the Glorious Revolution may have been even broader. In the eighteenth century there was a substantial increase in acts changing various types of property rights arrangements, including acts to create river navigation authorities and turnpike trusts.[6] One driving force was the increased length, periodicity, and predictability of legislative sessions after 1689 as well as the introduction of procedural changes in Parliament.[7] This paper suggests that greater security may have also contributed to this broader phenomenon. By making the rights vested in acts more secure the Glorious Revolution effectively raised the demand for acts among individuals and local communities.

The paper is organized as follows. Section II provides more background on regulatory authority during the 1600s. Section III illustrates the risks facing undertakers in the 1600s. Section IV uses a new series to show that road and river investment increased after the Glorious Revolution. Section V shows that undertakers were less likely to suffer a violation of their rights after 1689. Section VI concludes by discussing broader issues.

[6] See Langford, *Public Life,* Innes, 'The Local Acts', Bogart and Richardson, 'Adaptable Property Rights'.
[7] Hoppit, 'Patterns of Parliamentary Legislation' and Hoppit and Innes,' Introduction'

II.

A number of scholars have documented the Crown and Parliament's influence over economic policy in the seventeenth century, but less is known about their relative influence over the regulation of transport improvement authorities.[8] Willan, Albert, and other transport historians have documented the early history of navigation authorities and turnpike trusts which repaired rivers and highways throughout Britain. This section builds on their work and provides an overview of regulatory authority from the early 1600s to the early 1700s. It uses entries in the Calendar of State Papers, Domestic Series, from James I to George I to identify patents as well as proposals for royal privileges relating to roads and rivers.[9] It also draws on the Journals of the House of Commons and Lords, acts, drafts of bills, and petitions to the Lords to illustrate the role of Parliament.

In 1600 most tidal rivers were under the authority of a Commission of Sewers. Commissioners were appointed by the Lord Chancellor. They had rights to compel landowners to cleanse the river and to levy a property tax to pay for maintenance expenses, but they had no authority to tax inhabitants other than those who were adjacent to the river, and they could not purchase land or divert the path of the river.[10] At the same time road maintenance was the responsibility of parishes. These local governments could claim labor and materials from their

[8] See Sharpe, *The Personal Rule,* and Ekelund and Tollison, *Politicized Economies,* for studies on the role of the Crown or Parliament in economic affairs.
[9] The paper uses the electronic version of the Calendar of State Papers available through British History Online. The Bankes Papers in the Bodleian Library were also consulted but they did not identify any patents or grants relating to rivers that were absent in the Calendar of Sate Papers. Barrat, 'The Bankes Papers', p. 315, also points out that many of the proposals for patents in the Bankes papers are discussed in the Calendar of State Papers.
[10] Willan, *River Navigation, p. 16.*

citizens without compensation, but they could not levy property taxes or tolls and had no legal capacity to purchase land for new roads.[11]

In the early 1600s individuals began turning to Parliament to address these limitations. The aim of these 'undertakers' was to extend the navigation of tidal rivers through dredging, diverting, and making new cuts. They also wanted to repair and widen the main roads leading into London. The first proposals were made through bills submitted to the House of Commons or the House of Lords. Bills were reviewed by committees and then voted upon by the House of Commons or Lords. Passed Bills were sent to the other House and later to the Crown for final approval. Transport improvement bills generally dealt with individual projects. They gave an undertaker authority to levy tolls or special taxes and established a body of commissioners that would resolve disputes between undertakers and property owners regarding the purchase of land or damages suffered. The rights vested in river navigation acts were typically permanent and passed to heirs or assignees. Turnpike acts usually gave trustees authority for 21 years, but most obtained acts renewing their authority.

The Crown began to play a greater role in the 1610s and early 1620s. In 1617 James I awarded a patent to Jason Gason with broad powers over any river improvement in England.[12] Gason does not appear to have used his patent to exclude others from engaging in river improvements, although there is one case where he profited from his right.[13] Starting in 1619 James I began awarding patents for specific projects. In that year the Crown awarded a patent to

[11] Albert, *Turnpike Road System*, p. 16.
[12] See Woodcroft, *Titles of Patents of Inventions*, pp. 1-2, for a description of Gason's patent.
[13] Chrimes et. al., *Biographical Dictionary*, p. 647, states that Gason transferred his rights to improve the Great Ouse to Arnold Spencer.

the Mayor and Alderman of Bath for the improvement of the river Avon.[14] In the 1610s James I also began authorizing payments to individuals for improving specific highways.[15]

The process by which individuals petitioned and obtained patents or grants of privilege shared some similarities with acts. Individuals usually approached the king or his advisors in the Pricy Council and described a particular project.[16] It was also the case that the powers vested in patents were similar to acts. They gave undertakers authority to levy tolls and established commissioners to mediate disputes with property-owners. However, the main difference was that the Privy Council was the final court of appeal in disputes over river improvement patents. In the case of acts, commissioners' decisions were enforceable in common law courts, but appeals could still be made to Parliament.

The growing use of patents by the Crown aroused controversy in the 1620s. In 1623 Parliament passed the famous Statute of Monopolies, which made it illegal for the Crown to issue patents except for inventions. Around the same time numerous bills were introduced in Parliament for river improvement. Panel A in Table 1 lists all river improvement bills from January 1621 to March 1629. Many dealt with important rivers like the Thames, the Medway, and the Yorkshire Ouse. In 1620s there was also a bill to introduce tolls on a section of the North Road leading to London.[17]

Parliament's ability to pass road and river improvement bills was restricted because James I did not frequently call Parliament into session. Charles I carried this policy further during the era

[14] Willan, *River Navigation*, p. 25.
[15] For example James I ordered a payment of 20 pounds to John Hare for repairing the highways between Highgate and Barnet. See Green, *Calendar of State Papers Domestic: James I, 1603-1610*, pp. 590-605, April 27, 1610.
[16] For example, in 1633 someone made a proposal to the Privy Council to create a navigable river between the Thames and Severn . See Bruce, *Calendar of State Papers Domestic: Charles I, 1633-4*, pp. 41-61, May 1, 1633'.
[17] Emmison, 'The Earliest Turnpike Bill', p. 108-132.

of 'personal rule' from 1629 to 1640. Charles I was able to avoid the restrictions in the Statute of Monopolies and issued numerous patents or other privileges to river promoters in exchange for annual payments. Panel B in Table 1 shows that many rivers were proposed to be made navigable through royal grants in the 1630s. Notice that Parliamentary bills are absent during this decade.

Following the Civil War, the House of Commons gained complete authority over road and river improvement and several proposals were submitted to the Commons. In this period, there was the first act explicitly authorizing the use of tolls to improve a river. It gave James Pitson and others rights to charge no more than 4 pence for a load of goods and no more than 12 pence per passenger on the river Wey.[18]

The Commons had authority over road and river improvements for most of the 1650s, but there was a brief period in which promoters turned to Oliver Cromwell—the Lord Protector. Between 1654 and 1656 at least two proposals were made to Cromwell to improve rivers.[19] In 1657 the Lord Protector also granted a charter to undertake improvements on the Yorkshire Ouse.[20] The expansion of Cromwell's regulatory influence coincided with an enlargement of his political power. In 1653, Cromwell dissolved the Parliament that had sat since 1649 and established a new constitution in which government was by "a single person and a Parliament."[21]

There were another series of changes in regulatory authority following the Restoration in 1660. In the first year after the Restoration there were two attempts to obtain rights to improve

[18] Firth and Rait, *Acts and Ordinances of the Interregnum, 1642-1660* , pp. 514-17.
[19] See Green, *Calendar of State Papers Domestic: Interregnum, 1655-6*, pp. 88-154, January 1656. There is also evidence of a third proposal in 1655 although it is not recorded in the Calendar of State Papers. Jim Shead, 'Waterways Information,' states that Andrew Yarranton offered to seek letters patent from the Lord Protector to make the river Salwerpe navigable.
[20] *H. of C. Journals,* VII (1651-1660), pp. 575-578, 26 June 1657. Priestly, *Historical Account,* p. 491.
[21] Quoted in Seel and Smith, *Crown and Parliaments*, pp. 62-67.

rivers, but one went through the Crown directly and the other went through Parliament.[22] Matters became more unclear in February of 1662 when the Lords passed a bill that would have effectively enhanced the authority of the Crown.[23] It allowed any municipal corporation, hundred, or county to improve a river in its area without authorization from Parliament. Furthermore, if any municipal corporation, hundred, or county did not improve the river, then any private person could get rights from the Lord Chancellor to improve the river. In April 1662 the Commons received the bill from the Lords.[24] It was read twice but did not proceed further when the session ended in May 1662.[25]

In the same session that the preceding bill failed, the Lords, Commons, and the Crown approved two bills authorizing improvements on the Stower and Salwerpe rivers and the Wye and Lugg rivers.[26] Several other bills were introduced for rivers and roads in the parliamentary sessions from February 1663 to August 1665 and no proposals were made to Charles II for patents or royal grants. Thus in this two-year period there was a reemergence of the 'Crown-in-Parliament' system of granting improvement rights. As one part of this arrangement it appears that Charles II had significant influence over which undertakers received rights. For example, Sir William Sandys was named as the undertaker for the Wye and Lugg. Sandys received a patent from Charles I in the 1630s and was a prominent royalist who helped raise funding for the Restoration.[27] In another example, Henry Hastings was granted rights to make the Bristowe

[22] In November of 1660 a proposal was made to the Privy Council to improve the river Dee. See Green, *Calendar of State Papers Domestic: Charles II, 1660-1*, pp. 372-400, November 1660. In May of 1661 a bill was introduced in the Lords to improve the Stower and Salwerpe. See *H. of L. Journals,* XI (*1660-1666)*, pp. 249-251, 11 May 1661.
[23] A draft of the bill is in the Parliamentary Archives, HL/PO/JO/10/1/311.
[24] *H. of C. Journals,* VIII (1660-1667), pp. 400-401, 9 April 1662.
[25] The last mention in the Journals is April 28 1662. See *H. of C. Journals,* VIII (1660-1667), pp. 414-415.
[26] See Private Act, 14 Charles II, c. 14 and Private Act, 14 Charles II, c. 15.
[27] Chrimes *et. al.*, *Biographical Dictionary*, p. 592.

Causey navigable in 1664.[28] Henry Hastings was a supporter of Charles I during the Civil War. After the Restoration, he was appointed lord lieutenant of Leicestershire by Charles II.[29]

Charles II played a more direct role in river improvement after the mid-1660s. Panel A of table 2 shows the bills for river improvement introduced in Parliament between the session beginning in September 1665 and the session beginning in May of 1685. Panel B in table 2 shows proposals for river improvement made to Charles II over the same period. More bills were introduced in Parliament, but clearly some promoters were turning to Charles II, especially at times when Parliament was not in session.[30] In 1684 Charles II also reinstated John Mallet's patent for the river Tone, making it the first patent awarded since the late 1630s.[31]

The Crown's role in granting privileges was greatly limited after the Glorious Revolution. Only one river improvement proposal was made directly to the Crown during the reigns of William and Mary, Queen Anne, and George I, compared to more than one-hundred bills introduced in Parliament.[32] The Crown still retained the right to reject parliamentary bills, but it was not common.[33]

There were also changes in how local disputes relating to property were resolved. Improvement acts after 1689 continued to appoint commissioners to resolve disputes, but they also gave landowners or undertakers the right to request that a jury investigate the facts. Juries were impaneled in the same manner as for criminal trials. They had the power to make

[28] Private Act, 16 & 17 Charles II, c. 6.
[29] Martyn Bennett, 'Hastings, Henry, Baron Loughborough'.
[30] For instance, Parliament was not in session when the Earl of Bath and others proposed improvements on the Dee in April of 1669. See Green, *Calendar of State Papers, Domestic: Charles II, 1668-9*, pp. 258-305, April 1669.
[31] Green, *Calendar of State Papers Domestic: Charles II, 1684-5*, pp. 109-132, August 1684'.
[32] For the only proposal to the Crown, see Hardy, *Calendar of State Papers Domestic: William and Mar*y, 1693, pp. 243-297, August 1693.
[33] Hoppit, *Failed Legislation*, p. 25, points out that the Crown rarely vetoed any bills from the Commons before 1708.

recommendations to commissioners and they were also consulted by parliamentary committees who were considering bills to formally alter undertakers' rights.[34]

III.

This section draws on primary and secondary sources to show that several undertakers had their rights voided or diminished following major political changes or because of decrees made by the Crown. It illustrates that there was significant risk and uncertainty associated with the political and regulatory environment of the 1600s.

In the act establishing the Restoration settlement, there was a provision that all 'orders and ordinances of both or either house of parliament….to which the royal assent was not expressly had or given…are and so shall be taken to be null and void'.[35] This provision was not designed to revoke the rights of river undertakers specifically, but it had the effect of voiding the rights of undertakers for the Yorkshire Ouse and the Wey because they received their authority from charters or acts in the 1650s. The case of the river Wey is revealing because the undertakers were unable to get their rights reinstated even though they invested £15,000 and made the river navigable to the Thames. In 1662, one of the undertakers for the Wey, James Pitson, tried to get an act reinstating their rights but the bill failed in Parliament.[36] In 1664, Charles II named a new conservator, John Ratcliffe, who was to have rights over the Wey for 30 years.[37] In 1664, Ratcliffe attempted to get an act of Parliament to strengthen his claim, but the bill failed to be

[34] The Journals of the House of Commons provide several examples where juries gave testimony or made petitions. For one example see *H. of C. Journals,* XXIV (1743), 5 April.
[35] Quoted in Holmes, *the Making of a Great Power*, p. 28.
[36] Details on the petition are available in the Parliamentary Archives, HL/PO/JO/10/1/317.
[37] The details of this case are reported in a petition in the Parliamentary archives, HL/PO/JO/10/1/319. It appears that Charles II ignored the interests of the earlier undertakers in part because they used materials from his father's confiscated estate during the Interregnum.

passed. In 1666 a law suit was filed in the Court of the Exchequer over the possession of the river, but the Lord Chief Baron did not rule on the case for several years.[38] The authority over the River Wey was partially resolved by an act in 1670 which named Sir Adam Browne and others as trustees for the river. The act allowed individuals to submit a claim to the Court of the Exchequer for part of the profits from the river.[39] Numerous claims were submitted and how the Court resolved the matter is unclear.[40] Regardless it is fairly evident that the original undertakers suffered some losses as a result of their rights being nullified by the Restoration settlement.

There is a second example in which undertakers' rights were voided following the Civil War and the Restoration. In 1636 William Sandys was awarded a patent for the River Avon and invested more than £40,000.[41] In 1641 Sandys was expelled from Parliament because he was a supporter of the Crown. Sandys' rights in the river Avon passed to William Say, who was one of his creditors and a member of the House of Commons.[42] William Say's property was attained after the Restoration and his rights in the river Avon passed to James Duke of York, the brother of Charles II.[43] Shortly afterwards Sandys petitioned to the Crown to restore his rights in the River Avon. In his petition Sandys argued that Say unlawfully took control of the river by "receiving thousands more than he paid." Sandys pleaded to Charles II to "prevail with the Duke of York not to be the only severe one, and to suspend the delivery of any grant to Lord

[38] Green, *Calendar of State Papers Domestic: Charles II, 1668-9*, pp. 563-599, November 1669.
[39] Private Act, 22 & 23 Charles II, c. 26.
[40] Willan, *River Navigation*, p. 70.
[41] Green, *Calendar of State Papers Domestic: Charles II, 1661-2*, pp. 610-632, Undated 1662.
[42] Crimes *et. al.*, *Biographical Dictionary of Civil Engineers in Great Britain and Ireland*, p. 592.
[43] Green, *Calendar of State Papers Domestic: Charles II, 1661-2*, pp. 610-632, Undated 1662.

Windsor."[44] Despite Sandys plea, Lord Windsor was granted rights to the River Avon as one of the last provisions of an act in 1662.[45]

Summers' work on the Great Ouse describes a third example where undertakers' rights were voided following the Civil War and the Restoration.[46] In 1638 Arnold Spencer was granted a patent for the Great Ouse between Bedford and St. Neots. Spencer died in 1655 in the midst of financial difficulties and control over the navigation passed to his creditors. In 1665 an act was passed giving Sir Humphrey Bennet and others rights to collect tolls and improve the Great Ouse near Bedford. Bennet did not make the river navigable, but the provisions of the act would later be enacted to the detriment of Arnold Spencer's heirs. In 1674 Samuel Jemmatt purchased rights to the river by paying £1200 to Spencer's creditors. Jemmatt acted as a trustee for his two sons who were married to the granddaughters of Arnold Spencer. The navigation was then leased to Henry Ashley Sr., who then lobbied the commissioners of the 1665 act to name him as the undertaker. In 1687 the commissioners granted Ashley formal rights to the river, ending Jemmatt's claim.

Undertakers faced other political risks besides expropriation. Willan and Albert have documented the negative externalities associated with road and river improvements, including damages to land, mills, or trade.[47] These losses created a legitimate demand for compensation payments from undertakers, but they also provided opportunities for local groups to extract rents. The commissioners named in acts or patents were supposed to resolve these disputes, but their decisions were often unsatisfactory to one side. For example, undertakers often complained that

[44] *Ibid*.
[45] The re-establishment of formal rights can be found in the final provision of the 1662 act to improve the Stower and Salwerpe, 14 Charles II, c. 14.
[46] Summers, *The Great Ouse*, p. 53.
[47] Willan, *River Navigation*, and Albert, 'Opposition'.

landowners' demands for compensation were excessive or that their maximum fees were being set too low. In cases involving patents appeals could be made to the King or the Privy Council for redress. Groups could also turn to Parliament or the House of Commons if there was a similar conflict over an act.

There are several documented cases in the 1600s where the King or the Privy Council had to resolve local conflicts involving patents. A brief review of three cases shows that they had the ultimate authority to make a decision. This system bred uncertainty because the Crown could essentially make any ruling, either for or against undertakers. Summers describes one case where there was a dispute over the tolls between John Jackson, the patentee, and nearby inhabitants along the Great Ouse.[48] Local Justices of the Peace set the maximum toll on goods at 1 pence per ton in the early 1620s. The President of the Privy Council subsequently raised them to 1.5 pence per ton. In 1625 users appealed to Justices who ironically raised the tolls to 3 pence per ton. A final appeal was made to the Privy Council which then ruled that the tolls be reduced to 2.5 pence per ton. In span of five years the tolls were first raised by 50% and then lowered by 17%.

Willan describes a second case where Henry Lambe was granted a patent to make the river Lark navigable from Bury St. Edmonds to the River Ouse.[49] The work had begun when Lambe faced resistance from local mill-owners who claimed they were being adversely affected by the project. In 1636, Charles I appointed a commission to investigate. The commission came back with two recommendations. First, Lambe should pay £40 per acre for the purchase of meadow land and £2 per acre per annum as rent for tow paths. Second, the commission recommended

[48] Summers, *the Great Ouse*, pp. 48-49.
[49] Willan, *River Navigation*, pp.27-28.

that no tolls should be levied on the river between the town of Mildenhall and the river Ouse, which represented over half of the route originally granted to Lambe. In 1638, Charles I agreed with the commissioners recommendations and decreed that the river should be toll free from Mildenhall to the Ouse. It is not known whether Charles I upheld the compensation to landowners, but if he did it would have represented a very generous price for land.[50]

The third example comes from a drainage project. It provides a clear example of how Charles I could behave opportunistically towards undertakers. Wells documents how the Earl of Bedford was given the right to drain the Fens by a royal charter in 1637.[51] In return the Earl was granted 95,000 acres of drained land, 12,000 of which was allotted to the Crown. The project was initiated when locals brought complaints before commissioners in 1639. The commissioners determined that the Earl had violated the provisions of the charter. To make matters worse, the Earl was becoming closely allied with the parliamentary opposition to the Crown. Charles I seized upon the findings of the commissioners and revoked the Earl's charter. Charles then claimed rights to 57,000 acres of drained land and imposed a heavy tax on the Earl's lands.

IV.

In the 1600s undertakers faced both risk and uncertainty: there was not only a chance that their rights would be violated, but the likelihood of a violation could change significantly because of political events. This section uses a theoretical framework to generate some predictions about the patterns of investment in an environment where there is risk and

[50] Clark, 'Land Rental Values, shows that rents per acre in the 1820s in Suffolk were £1.07 per acre. This implies that a rent per acre of £2 or a purchase price of £40 per acre was very generous for this area in the 1630s.
[51] Wells, *The History of the Drainage*, pp. 105-127.

uncertainty. It also uses a new data series to show that proposed and completed investment in roads and rivers was low in the 1600s before increasing permanently after the Glorious Revolution. The new data series is based on all proposed projects between 1607 and 1749 identified by entries in the Journals of the Commons, the Journals of the Lords, and the Calendar of State Papers, Domestic series. Parliamentary records and other sources identify the miles of road or river affected by each proposed project and whether they resulted in improved river navigation or repaired roads. Lastly the investments per mile for a sample of river navigation authorities and turnpike trusts are used to estimate proposed and completed investment. The appendix provides details.

The theory of investment under uncertainty shows that when undertakers are uncertain about the risks they face then investments might be delayed or forgone. To see why consider an example where an undertaker expects to earn a profit on an investment as long as their property rights are protected, but if not they expect to suffer a significant loss. Suppose that in the current year the undertaker believes their rights will be protected with probability q and with probability $1-q$ their rights will be violated. Suppose also that next year they expect to learn more—say because there has been a shift in political power. As long as the new information significantly changes the probability that property rights will be protected, it will be better for the undertaker to delay and wait until next year to make the decision to invest. This 'option-value' can be considerable because the undertaker cannot reverse the investment once it has been initiated and they would suffer a loss if their property rights are not protected.[52]

The theory yields predictions about the patterns of road and river investment. First, it suggests that investment should have been low in the 1600s if there was a high chance that

[52] See Pindyck, 'Irreversibility' for a general discussion of the option value of waiting to invest.

improvement rights would be violated. Second, it suggests that investment should have increased substantially following a major political event, like the Glorious Revolution, if it reduced uncertainty about the security of rights. The data allow for a further distinction to be made between proposed and completed investments. The available evidence on promoters suggests that some financed the project with their own savings and in other cases outside investors provided crucial financing.[53] The theory suggests that if the promoter has to make a significant investment to get the project approved by Parliament or the Crown then little investment will proposed and completed when there is high risk and uncertainty. If outside investors are necessary to complete the project then completed investment should be low, but not necessarily proposed investment because a promoter might still initiate if their upfront costs are low. Therefore the strongest prediction is that completed investment should have been low in the 1600s when there was uncertainty about the security of rights and it should have increased following the Glorious revolution if it reduced uncertainty.

Figure 1 plots a four-year moving average of completed investment from 1607 to 1749 in constant 1750 prices. The series does not represent all road and river investments in Britain during this period, but given the difficulties of investing without authorization from the Crown or Parliament it likely represents the vast majority of investment. The patterns of completed investment in the 1600s are generally consistent with there being significant uncertainty. There were modest levels of completed investment in the 1630s, the 1660s, and early 1670s, but there were no completed investments in the 1640s, the late 1670s, and 1680s. Overall road and river investment was very low for most of the seventeenth century.

[53] Willan, *River Navigation*, p. 66.

Figure 2 plots a four-year moving average of proposed investment over the same period. Proposed investment was generally low before the 1690s, but there were some significant fluctuations particularly after the Restoration. The estimates imply that around £700 thousand in road and river investment was proposed in the 1660s, which is more than two times the £275 thousand proposed in the 1650s. However, the Restoration did not mark a significant change in completed investment. Only £90 thousand was completed in the 1660s out of the £750 thousand proposed.

The low completion rate of investment in the 1660s was due to several factors. First, a number of promoters received approval from Parliament but did not complete their project. Henry Hastings, for example, did not make the Bristowe Causey navigable to the Thames after getting rights through an act.[54] Similarly the undertakers who received rights to improve the Medway in Kent and Sussex failed to make the river navigable.[55] Second, there were a number of projects that failed to receive approval from Parliament and were proposed more than once after previous bills failed.[56] For instance there were three bills in the early 1660s proposing a canal between the Severn and Thames and none were successful. Willan describes this project as a 'theoretical scheme'.[57] It was distinctive from most others because it would have required a tremendous capital investment. If the three bills for the Severn and Thames canal are dropped from the series on account of their impracticality then proposed investment from 1660 to 1664 would fall by nearly 40 percent, making this period look less remarkable.

[54] Willan, *River Navigation*, p. 11.
[55] An investigation by a Parliamentary Committee in 1739 stated that "not any of the several powers given by the said Act, or any part thereof, had been carried into execution." See *H. of C. Journals*, XXIII (1739), 20 February.
[56] More than one parliamentary proposal was submitted for the Avon in Hampshire, for the canal connecting the Thames and Severn, and the Great Ouse in Bedfordshire. Two proposals were made to the Crown for improving the river Dee and one was made to Parliament. See the appendix, table 9, for more details.
[57] Willan, *River Navigation*, p. 10.

The late 1670s and 1680s are also an interesting period because proposed investment dropped significantly. Investment contracted so much in the 1680s that it reached a level comparable to the Civil Wars of the 1640s. This finding is significant because the conflicts between the Crown and Parliament intensified in the 1670s and 1680s. This period also marked a brief revival in the use of patents for river improvement.

The ten-years following the Glorious Revolution saw an increase in investment that was comparable to the ten-years following the Restoration. One major difference was that proposed investment did not decline as much in the late-1700s and 1710s as it did in the late-1670s and 1680s. Approximately £740 thousand was proposed from 1705 to 1719 compared with £80 thousand from 1674 to 1688. There was an even more striking change in completed investment after the Glorious Revolution. Approximately the same amount was completed in the fifteen years from 1695 to 1709 as in the previous 85 years from 1604 to 1688. It is true that completed investment fluctuated substantially from 1710 to 1749, but similar cycles occurred in the eighteenth and early nineteenth centuries.[58]

The river and road investments completed in the 1690s, 1700s, and 1710s were associated with projects of great economic importance. Many, like the Aire and Calder rivers in the industrial areas of Yorkshire, had been proposed much earlier in the 1600s, but were never approved or completed. There were also several new projects, like the extensions of navigation on the Thames river system and numerous repaired highways near London.[59]

[58] There were a series of booms in turnpike investment in the 1750s, 1760s, 1790s, 1810s, and 1820s. The well known canal boom occurred in the 1790s and was followed by the railway boom in the 1840s. See Pawson, *Transport and Economy* and Ward, *the Finance of Canal Building*, for more details.
[59] For more on the transport improvements after 1689 see Willan, *River Navigation*, and Albert, *Turnpike Road*.

The surge in proposed and completed investment in the 1690s and their sustained levels thereafter provides some evidence that the Glorious Revolution contributed to a higher level of investment. However, it is possible that the increase in investment was driven by other economic factors. For example, lower interest rates might have made it easier for promoters to finance investment. A higher growth rate of coastal trade might have increased the demand for infrastructure, particularly river improvements. A lower frequency of harvest failures could have changed domestic trade patterns altering the need for infrastructure in some regions. Foreign wars might have disrupted trade and lowered the return on investment. These alternative explanations can be evaluated using regression analysis and structural break tests. Suppose that investment in a given year depends on these economic conditions and investment in the previous year. The regression model is represented by equation (1):

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 x_{t-1} + \varepsilon_t \qquad (1)$$

where y_t is either proposed or completed investment in year *t*, ε_t is the error term, and x_t includes the real interest rate in *t,* the growth rate of coastal trade in *t*, an indicator for years when there was a foreign war, and an indicator for years when there was a significant harvest failure.[60] The constant term α measures the annual level of investment independent of these other factors. If the Glorious Revolution had no impact on the level of investment after accounting for interest rates, coastal trade, harvest failures, and foreign wars, then the parameter estimate for the constant term should be stable before and after 1689. However, if the Glorious Revolution did matter after accounting for these other factors, then the constant term should have been significantly different—and larger—after 1689. Table 3 reports results from a Chow test for a

[60] For descriptions of these variables and the sources see the appendix.

structural break in the constant term in 1689.[61] The F-statistics indicate a strong rejection of the null hypothesis of no structural break in 1689 for proposed and completed investment. They also show that the constant term is significantly larger after 1689.

The significance of the Glorious Revolution is further supported by unknown structural break tests. The Quandt-Andrews unknown structural break test allows the data to identify whether there is any structural break in the constant and if there is a single break which year is most likely to mark the break. In this procedure the Wald F-statistic for a structural break in the constant term is calculated for every year excluding 15% of the years at the beginning or end of the sample. If any of the Wald F-statistics for the intervening years exceeds the critical values then there is evidence that at least one structural break exists. The most likely break-date is the year in which the Wald F-statistic attains its maximum value.[62]

The results of the Quandt-Andrews tests are reported in table 4. The Maximum Wald F-statistics are highly significant, suggesting a rejection of the null hypothesis of no structural breaks in proposed and completed investment. They also identify 1692 as the mostly likely structural break in proposed investment and 1695 as the most likely structural break in completed investment. Therefore the data indicate that the years shortly after the Glorious Revolution marked a turning point in both proposed and completed investment even after accounting for changes in interest rates, the growth of coastal trade, or the frequency of bad economic shocks.

The conclusions are similar in other specifications. The break dates are still 1692 and 1695 if Newey-West standard errors are used to correct for auto-correlation. 1695 continues to be the most likely break if completed investments are spread over a four-year period rather than the

[61] A structural break in the constant exists if for some year the coefficient is different before and after. See Hansen, 'The New Econometrics' for a discussion of structural breaks tests.
[62] See Quandt, 'Tests' and Andrews, 'Tests for Parameter', for details on the Quandt-Andrews test statistic.

year the project was initiated. The year 1695 is again the mostly likely break in specifications where all the economic variables x_t are dropped and one where only completed river investment is included in y_t. If only proposed river investment is included in y_t the Wald F-statistics suggest there may be two structural breaks, one in 1662 and one in 1692. This makes sense because the data show a large surge in river proposals following the Restoration and the Glorious Revolution.

Overall the evidence strongly suggests that transport infrastructure investment was higher after the Glorious Revolution. Of course, there could be many factors which can explain this relationship. The following section provides evidence that investment increased in part because there was lower uncertainty about the security of improvement rights after 1689.

V.

The theory of investment under uncertainty suggests that undertakers should propose and finance more projects if they face a lower risk that their property rights will be violated. This section addresses whether undertakers faced lower risks after the Glorious Revolution when Parliament emerged as the main regulatory authority. To address this issue all acts relating to river improvements were studied to identify cases where undertakers had their rights violated by acts of Parliament.[63] The most serious violations occurred when the authority of undertakers or trustees was voided or when their maximum tolls were lowered without their approval. Other violations were also considered such as whether undertakers lost control of part of their road or river or they were forced to pay a subsidy to parishes. The analysis compares the likelihood that

[63] See the appendix for a discussion of the sources for public and private acts.

undertakers established between 1689 and 1749 experienced these types of violations by an act between 1689 and 1749 with the likelihood that undertakers established between 1606 and 1688 experienced the same types of violations by political settlements, royal decrees, and acts between 1606 and 1688. It also considers how the rights of undertakers established between 1606 and 1688 were treated after 1689.

Comparing the likelihood of a violation before and after 1689 is complicated because it is difficult in some cases to identify whether undertakers' rights were actually violated. Some undertakers may have lost their rights because they were negligent in carrying out their authority. Or—as in the case of most turnpike acts—there may have been provisions that Parliament would impose lower tolls on trustees once their debts were paid off. This type of measurement error will create a bias in the estimated likelihood of a violation, but it is only problematic if it creates a systematic bias in favor of greater security after 1689. It should also be pointed out that there is already likely to be a bias in favor greater security before 1689 because it is endogenous which undertakers propose projects and get approval. If property rights were less secure before 1689 then those undertakers whose rights were *relatively* more secure should have been more likely to propose projects and get approval. As a result, the observed likelihood of a violation for undertakers before 1689 may give an under-estimate of the likelihood of a violation for the population of undertakers in this period.

Tables 5 lists all instances where undertakers established between 1689 and 1749 had their rights violated by acts between 1689 and 1749. A table in the appendix describes these cases in detail. The likelihood at the bottom is estimated by the number of undertakers who had their rights violated by at least one act between 1689 and 1749 divided by the number of undertakers who received rights between 1689 and 1749. The estimates show that the likelihood was very

small. There was only a 6 percent likelihood that a river undertaker established after 1689 experienced at least one violation because of an act of Parliament.

Table 6 lists all instances where undertakers established between 1606 and 1688 had their rights violated by political settlements, royal decrees, or acts between 1606 and 1688. Most of these cases have already been discussed in section III.[64] The main result at the bottom of the table shows there was a 33 percent likelihood that a river undertaker experienced at least one violation before 1689. By these indicators it appears that the security of rights was much higher after the Glorious Revolution than before.

A similar finding holds for turnpike trusts although there is only one observation before 1689 to make a comparison. Table 7 lists all cases where trusts established between 1689 and 1719 had their rights violated by acts between 1689 and 1719. The results show there was a 18 percent likelihood that trusts established between 1689 and 1719 experienced at least one violation. The only turnpike authority before 1689 was along the Great North road. It was operated by Justices of the Peace in Hertfordshire, Cambridge, and Huntingdon. Albert provides evidence which suggests there was a violation of rights in this case, but it is not clear that it was linked with national politics.[65] Albert notes that toll gates were never put up in Cambridge and Huntingdon and they were abruptly pulled down in 1680 in Hertfordshire. This one example provides some evidence that rights to collect tolls on highways may not have been secure in the 1670s and 1680s.[66]

[64] The 1624 Thames act is described in the appendix.
[65] Albert, *Turnpike Road System*, p. 20.
[66] It is worth pointing out that in 1680, 1681, 1687, and 1688 Charles II and James II removed many of their political opponents from positions as Justices on the County Commissions of the Peace and replaced them with supporters. These politically motivated purges were perhaps significant because Justices were often named as undertakers for road improvement acts. See Glassey, *Politics and Appointment*, p. 262, for more details on the appointment of JPs.

The conclusion that undertakers faced lower risks after 1689 is unlikely to be overturned because of biases in the estimated likelihoods of violations. The difference in the likelihood that river undertakers experienced a violation of their rights is quite large—33 vs. 6 percent. Moreover, an analysis of the cases also suggests there is no obvious bias in favor of greater security after 1689. It is clear that undertakers suffered a violation when they lost their rights to the rivers Avon, Great Ouse, and Wey following the Civil War and Restoration. Henry Lambe's rights also appear to have been violated by the rulings of Charles I. Thus if only these four cases are considered the likelihood of a violation before 1689 would still be significant. There are also cases after 1689 that may not have been violations. For example, an act in 1743 lowered the maximum tolls for the Company of Proprietors for the River Dee. The company submitted its own petition stating that they "consented" to an act lowering their tolls.[67] It was very rare for undertakers to give consent to lower their maximum tolls and therefore it is likely they were not aggrieved by the act. If this case is dropped then the likelihood that river undertakers had their rights violated after 1689 would be close to zero.[68]

Undertakers who received their authority before 1689 did not necessarily enjoy the same protections after 1689. Recall that these undertakers received their rights from patents in the 1630s or through acts in the 1660s and 1670s. Many of these undertakers failed in making their rivers navigable and starting in the 1690s local groups began submitting petitions requesting that new undertakers be allowed to complete the navigation. Thus Parliament had to decide whether it would maintain the rights of old undertakers who did not complete the navigation. There were

[67] See *H. of C. Journals,* XXIV (1743), 31 January.

[68] There is also likely to be a bias in the estimates against greater security for turnpike trustees after 1689. For example, an act in 1740 reduced the maximum tolls for the trustees of the Stokenchurch to Oxford road. The MPs from the committee reported that the debts issued by the trust had been paid off, and therefore it is unlikely that trustees were harmed by the act. In another case the trustees of the Fornhill to Stony Stratford road appear to have lost their rights because they misinformed creditors about the revenues from the tolls. If these two cases are dropped then the probability that trustees suffered a violation of their rights drops to 0.12.

also political aspects. Several undertakers from the 1630s and 1660s were closely affiliated with the Stuart monarchy. How would Parliament deal with their rights given the political tensions of the 1690s?

The evidence suggests that in most cases Parliament did not violate these undertakers' rights and when they did it was linked with their failure to complete the navigation. Table 8 summarizes what happened to the rights of undertakers who received their authority from patents or acts before 1689. In 14 of the 20 cases undertakers' rights were not altered by acts or they were renewed by acts. In one other case there was an act that eliminated a patentee's rights, but they received compensation from the new undertakers.[69] In yet another case involving the Yorkshire Ouse, new undertakers were named but the original undertakers had already lost their rights following the Restoration. In the four remaining cases (the Lark, the Soar, the Stower, and the Wye and Lugg) acts were passed naming new undertakers, but in all of these instances undertakers did not complete the navigation. For example, Henry Lambe's patent was effectively voided by an act in 1698 that named new undertakers for the river Lark, but Lambe was never successful in making the Lark navigable in the 1630s.[70] In another case the Sandys family lost their rights to collect tolls on the Wye and Lugg after they were not successful in making the rivers navigable. The opening passage of the 1695 act confirms that the failure of the Sandys to complete the navigation was the official reason why their rights were revoked.[71]

[69] Haskell, 'River Tone', states that patentees for the Tone were paid £330 for their rights to the river after an act was passed in 1698.
[70] Willan, *River Navigation*, p. 151.
[71] The opening passage states that Sandys 'never did anything towards the making of the said River of Lugg navigable. And what they did towards the said Work upon the said River of Wye was performed so slightly that most of the Locks and Passages by them made did in a very few years fall utterly to decay and ruin'. See *Statutes of the Realm: volume 7: 1695-1701*, pp. 78-84.

There are two cases in the 1690s and early 1700s where undertakers who received their authority before 1689 successfully defended their rights in Parliament. They are described in detail because they illustrate that the rights of undertakers who made investments were often maintained. They also illustrate that attempts by local interest groups to alter rights through acts were often unsuccessful after 1689. The first case involved the Baldwyn family who invested more than £6000 in making the river Salwerpe navigable after an act was passed for this purpose in 1662. In 1693 a bill was introduced in the Commons that would give the Earl of Shrewsbury and Lord Coventry sole rights to improve the river. Sir Timothy Baldwyn submitted a petition to the Commons opposing the bill on the grounds that his father had already invested in the river and that the proposed bill "tends to make void the said Act, and to take away all the works and materials done in pursuance thereof."[72] Despite Baldwyn's petition, the Commons passed the bill on March 9, 1693. In mid-March, the Lords began deliberations on the river Salwerpe bill. Baldwyn submitted a petition to the Lords stating that "it is of dangerous consequence to take away any persons right, purchased under an act of Parliament, without their consent."[73] The Lords ultimately dropped the Salwerpe bill and the rights of the Baldwyn family were protected.

The second case involved the river Itchen, where an act in 1664 was used to make the river navigable. In 1714 property owners near the river submitted a petition to the Commons requesting that provisions in an earlier act be modified because "it hath not been of effect to answer the ends for which it was made; but becomes a grievance to the petitioners."[74] The bill was read twice and refereed to a parliamentary committee consisting of several MPs. Numerous counter-petitions were submitted to the committee. George Huxley, one of the undertakers,

[72] See *H. of C. Journals,* XIII (1693), 2 October.
[73] Details on the petition are available in the Parliamentary archives, HL/PO/JO/10/1/455/733.
[74] See *H. of C. Journals,* (1714), 12 March.

stated in a petition that "should it pass, it would not only defeat the petitioners of their right, but utterly destroy the said navigation."[75] Inhabitants in the towns of Andover, Stockbridge, Whitchurch, and Winchester asked that no bill be passed in prejudice of the navigation because the river was "of great advantage to [their] city and country, by the cheap and safe carriage of all goods and merchandizes."[76] The bill did not proceed any further after these counter-petitions were referred to the committee.

VI.

The transportation revolution gained speed in the eighteenth and early nineteenth century, but it had its roots in the seventeenth century with the promotion of road and river improvements. This paper argues that the political settlement following the Glorious Revolution contributed to investment in transportation infrastructure because it reduced uncertainty about the security of improvement rights. For most of the seventeenth century, promoters turned to the Crown for patents or to Parliament for acts. Some undertakers lost their rights following major shifts in power like the Civil War and the Restoration. Others were forced to lower their fees and pay damages to local landowners. The low level of proposed and completed investment in the 1600s suggests that promoters were reluctant to invest in part because of these risks. The Glorious Revolution marked a turning point. Investment surged in the 1690s and remained relatively high in the 1700s and 1710s compared to the 1640s, 1650s, 1670s, and 1680s. The increase in investment coincided with a lower likelihood that undertakers' rights would be violated.

[75] See *H. of C. Journals,* (1714), 14 May.
[76] See *H. of C. Journals,* (1714), 31 May-June 3.

Promoters and investors responded to greater security by proposing and completing more projects.

There are several views in the literature on which factors contributed to the greater security of property rights after the Glorious Revolution. Some emphasize checks and balances, while others emphasize the structure of political parties and coalitions.[77] The findings in this paper do not resolve this debate, but they do suggest some reasons why improvement rights became more secure. The evidence suggests that the reduction of conflict between the Crown and Parliament played some role. The fact there was no equivalent to the Restoration after 1689 contributed to the greater security of undertakers' rights. There are also some indications that the multi-layered procedures for passing bills made it difficult to violate rights through acts. Bills had to pass through a committee where witnesses and juries gave testimony on the merits or demerits. The House of Lords also had the ability to veto any bill passed by the Commons.

The most important conclusion in this paper is that the Glorious Revolution contributed to the transportation Revolution. Acts creating river navigation authorities and turnpike trusts contributed to lower transport costs and generated social savings equaling several percentage points of G.D.P. in the early nineteenth century. The Glorious Revolution contributed to these savings by encouraging greater investment in transport infrastructure.

[77] See Stasavage, *Public Debt*, and 'Partisan Politics'.

Appendix I: Road and River Projects

Projects proposed to Parliament are identified through road and river bills listed in the indices for the Journals of the House of Commons and the Journals of the House of Lords. A list of failed bills from 1660 to 1750 is also available from Hoppit, *Failed Legislation*. Some bills were for rights to improve the navigation of a river or to better maintain and improve a road. Others proposed to amend the rights of an existing authority. Based on their description, bills that proposed to improve a road or river were separated from bills that amended existing rights. For rivers I identify whether the bill was for an improvement using the petitions and committee reports. For roads I only included bills that proposed a new turnpike trust.

Projects proposed to the Crown are identified in the Calendar of State Papers, Domestic series, for James I, Charles I, the Interregnum, Charles II, James II, William & Mary, and Queen Anne. The Calendar of State Papers also documents most patents or royal grants of privilege. Priestley and Shead provide information on the length of rivers improved by acts or patents.[78] The data in these two sources were used to determine the number of miles of river that were proposed to be made navigable in each petition. In the case of roads, Albert provides data on the length of London roads improved by turnpike acts.[79] A report in the Parliamentary Papers provides information on the length of roads managed by each turnpike trust, including all those formed before 1750.[80] These sources were matched with petitions to determine the number of miles of road that were proposed to be improved.

Not all proposals for road and river improvements were completed. Some proposals failed to be approved by Parliament or the Crown, and among those that were approved some were not

[78] Priestley, *Historical Account;* Shead, 'Jim Shead's Waterways Information'.
[79] Albert, *Turnpike Road System*, pp. 224-229.
[80] *Appendix to the Report of the Select Committee on Turnpike Roads and Highways*, (P.P. 1821 IV).

completed. Several sources were consulted to identify the number of miles of river that were made navigable through royal grants or acts. These include Willan's description of all navigable rivers at benchmark dates (c. 1600, 1660, 1724) and Priestly and Shead's catalogue of river projects.[81] If an act was approved for a project and no information could be found, then it was assumed that the river project was completed.

The number of miles of road improved through acts was approximated using information in the Journals of the House of Commons. All turnpike acts had to be renewed every 21 years. The petitions for renewal acts usually indicate the progress of improvement. In cases where no renewal act was sought or when it is stated that little progress had been made, then the miles were not counted as being completed; otherwise the mileage approved by an act was counted as being successfully improved.

The details of every road or river improvement proposal before 1689 are summarized in tables 9 and 10. The projects proposed after 1689 are not listed, but they can be readily identified in the Journals of the House of Lords or Commons. The first column identifies the name of the river or the location of the road. The second column gives the year the proposal was made based on the first entry of the project in the Journals or Calendar of State Papers. The third column shows the mileage of river proposed to be made navigable or the mileage of road proposed to be improved. The fourth column identifies whether the project was completed with a one. The fifth column gives the source where the proposal was identified. If the Journals of the House of Commons (or Lords) are listed as the source then the project was proposed to the Commons (or the Lords) first. If the Calendar of State Papers is listed as the source then the project was proposed to the Crown.

[81] See Willan, *River Navigation*, pp. 146-152, Shead, 'Waterways Information', Priestly, *Historical Account*.

Appendix II: Estimating Road and River Investment and its Determinants

Annual proposed and completed investment is estimated using the average investment by per mile for a sample of 12 river navigations and 43 turnpikes trusts.[82] These samples indicate that turnpike trusts invested £160 per mile on average in 1750 prices and river navigations invested £1340 per mile on average in 1750 prices. These figures were multiplied by the number of miles proposed and completed in each project. Completed investments were assumed to have been completed immediately, although they were implemented over several years. A moving average can be used to adjust for the completion time. The estimates are not reported here to save space but they are available from the author upon request.

The determinants of investment include the average growth rate of coastal trade, the real return on land, years when there was a foreign war, and years when the wheat harvest was bad or deficient. Ward provides a data series on the growth rate of coastal ships entering and leaving for a sample of 16 ports starting in 1675.[83] Ward also provides data on the number of coastal ships entering and leaving 4 ports (Hull, King's Lynn, Bridgwater, Minehead) before 1675. The annual growth rate of coastal trade up to 1670 was calculated based on Ward's sample and additional data from Southampton and Portsmouth collected in the Public Record Office.[84] The real return on land comes from the Charity Commission records described by Clark. They indicate the purchase price or rental value of various plots. Based on this information Clark calculates a rate of return on each plot.[85] Clark's estimates for each plot were averaged to form

[82] Bogart, 'Did Turnpike Trusts', p. 464 and Bogart, 'Were Statutory Authorities', p. 36.
[83] Ward, *the Financing of Canal Building*, p. 165.
[84] PRO E190 826-1827 and E190 819-827.
[85] Clark, 'Political Foundations', pp. 577-78.

the annual series on the rate of return. The inflation rate was then subtracted from the real return on land to get an estimate of the real interest rate. [86] Years when Britain was in a foreign war include the first Anglo-Dutch War (1652-1654), Spanish War (1655-1660), the second Anglo-Dutch War (1665-67), the third Anglo Dutch War (1672-4), the Nine years War (1689-97), the War of Spanish Succession (1702-13), and the War of Jenkins Ear (1739-48).[87] Years when the wheat harvest was bad or deficient are taken from Smith and Holmes.[88]

Appendix III: Acts altering the Authority of Existing River Undertakers or Turnpike Trusts

Table 11 lists all acts where rights of river undertakers established between 1689 and 1749 were diminished or voided. Table 12 lists all acts where rights of turnpike authorities established between 1689 and 1719 were diminished or voided. Table 13 lists all acts where the rights of river undertakers established between 1606 and 1688 were altered. They were identified by studying all acts relating to road and river improvements in the *Statutes of the Realm* before 1714. The statutes do not contain private acts so these were obtained from the Parliamentary Archives. The Statutes of the Realm also omit most river and turnpike acts after 1714. For these the Acts of Parliament Collection at the Clark Library in Los Angeles was used.

The 1623 act changing undertakers for the Thames near Oxford was coded as a case where undertakers' rights were violated. A 1606 act gave the Lord Chancellor the right to appoint 18 commissioners to oversee the improvement of the river between Oxford and London. One commissioner was to come from Oxford University, one from the city of Oxford, and four from

[86] Inflation comes from the Cost of Living index in Clark, 'The Condition of the Working Class', pp. 1324-25.
[87] Smith, *The Emergence*, pp. 307-308, Holmes, *Making of Great Power*, p. 439.
[88] Smith, *The Emergence*, pp. 436-437, Holmes, *Making of Great Power*, p. 446.

each of the counties of Oxfordshire, Berkshire, Wiltshire, and Gloucestershire. The commissioners had the right to improve the river, including the authority to force property-owners to sell their land and assess taxes in their respective districts. The 1623 Thames act vested sole authority in the commissioners from Oxford, and thus voided the authority of commissioners in Berkshire, Wiltshire, and Gloucestershire.

There are two acts worth noting which changed rights but were not coded as violations. The first involved an Act in 1726 (Public 13 George I, c. 34) which named trustees for the rivers Wye and Lugg. In the preamble it states that the former undertakers of the previous act have not done anything to the river Lugg and little work was done on the river Wye. This passage referred to the Sandys family who lost their rights by an act in 1695 because of negligence (Public 7 & 8 William III, c. 14). The l695 act named a new body of trustees including the Lord Bishop of Hereford, the Mayor of the City of Hereford, and the Bailiff of Leominster. The 1726 acts states that several trustees have died and no provisions were made for filling up new trustees or taking in the heirs of deceased trustees. The act named a body of trustees and created rules for the appointment of new trustees. The body included many of the same political or religious office holders as the original act including the Lord Bishop of Hereford, the Mayor of the City of Hereford, and the Bailiff of Leominster. There are also individuals with the same family name who were trustees in both the 1695 and 1726 acts.

The second case involved an act in 1732 (6 George II, c. 30) which named Nathaniel Kinderley as the new undertaker for the river Dee. By an act in 1698 (11 William III, c. 24) the Mayor of Chester was given authority to levy tolls to improve the river for 21 years. The river was not successfully completed and after its authority expired in 21 years the city of Chester did not apply for a new act. In 1732 the Mayor and inhabitants of Chester submitted a petition in

favor of Nathaniel Kiderley's proposal to improve the river Dee (see JHC 18.1.1732). It does not appear that this act violated the rights of the city of Chester which had already expired for 13 years.

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Appendix to the Report of the Select Committee on Turnpike Roads and Highways, (P.P 1821 IV).

Tables

Table 1: Proposals to Improver Rivers in the 1620s and 1630s

Panel A: Rivers Proposed to be improved through bills introduced in Parliament	
Yorkshire Ouse	1621
Thames	1621
Wey	1621
Thames	1624
Wey	1624
Colchester haven	1624
Aire and Calder	1626
Medway	1628
Lark	1629
Panel B: Rivers Proposed to be improved through grants by the Crown	
Great ouse, near Bedford	1626
thames and severn canal	1633
Soar	1634
Rother	1635
Lark	1635
Avon, in Warwickshire	1636
Teme	1636
Fossdyke	1636
Witham	1636
Tone, Bridgewater to Ham mills	1638
Stour, in Essex	1638

Notes: Bills in Parliament are taken from the sessions beginning in Jan. 1621 through the session beginning in January 1629.

Sources: see appendix table 9 for sources on proposals.

Table 2: Proposals to Improver Rivers 1665 to 1685

Panel A: Rivers Proposed to be improved through bills introduced in Parliament	
Bristol and London	1667
Dee	1669
Weaver	1670
Brandon and Waveney	1670
Witham	1670
Parret and Tone	1673
Derwent in Derby	1675
Derwent in Derby	1677
Vale in Cornwall	1678
Wye and Lugg	1685
Panel B: Rivers Proposed to be improved through grants by the Crown	
Cam	1665
Dee	1666
Dee	1669
Blyth in Northumberland	1682

Notes: Bills in Parliament are taken from the sessions beginning in September 1665 through the session beginning in May of 1685.

Source: see appendix table 9.

Table 3: Chow test for a Structural Break in Proposed and Completed Investment in 1689

Null Hypothesis: No Structural Break in the constant term in 1689	
Proposed investment	
F-statistic	11.37
Prob. F(1,137)	0.001
Period	Constant (standard error)
1605-1688	3676 (10,505)
1689-1749	49,057 (16,525)
Completed investment	
F-statistic	23.03
Prob. F(1,137)	0.000
Period	Constant (standard error)
1605-1688	3494 (226)
1689-1749	21,532 (8629)

Notes: The Chow test is conducted for the constant term α in regression (1). The constant term for 1605 to 1688 is estimated using observations only from these years. The constant term for 1689 to 1749 is estimated using observations only from these years.

Table 4: Quandt-Andrews test for Unknown Structural break in the Constant

Proposed investment	
Maximum Wald F-statistic	13.93
Probability	0.004
Year when Wald-F-statistics is maximized	1692
Completed investment	
Maximum Wald F-statistic	31.99
Probability	0
Year when Wald-F-statistics is maximized	1695

Notes: The tests statistics are calculated using software in Eviews. The program calculates probabilities calculated using the method in Hansen, 'Approximate Asymptotic P-Values'.

Table 5: Acts Violating Rights of River Undertakers established between 1689 and 1749

River Provision in Act	Year
Colne, near Colchester Maximum Tolls reduced by two acts	1718, 1739
Dee Maximum Tolls reduced by act	1743
# of Undertakers established by act between 1689 and 1749	33
Estimated Likelihood that undertakers established between 1689 and 1749 had their rights violated by at least one act after 1689	6%

Sources: see text.

Notes: the Undertakers established by acts between 1689 and 1749 controlled the following rivers and were established by the following public acts: the Wye and Lugg (est. 7 & 8 William III, c. 14), the Colne (est. 9 William III, c. 19), the Tone (est. 10 William III, c. 8), the Dee (est. 11 William III, c. 24), the Lark (est. 11 William III, c. 22), the Trent (est. 10 William III, c. 26), the Aire and Calder (est. 10 William III, c. 25), the Avon and Frome (est. 11 William III, c. 23), Yorkshire Derwent (est. 1 Anne, c. 14), the Cam (est. 1 Anne Statute 2, c. 11), the Stower in Essex (est. 4&5 Anne, c. 2), The Avon from Bath to Hanham Mills (est. 10 Anne, c. 2), the Nene (est. 13 Anne, c. 19), the Kennet (est. I Statute 2, c. 24), the Wear (est. 3 George I, c. 3), Darwent in Derby (est. 6 George I, c. 27), the Douglass (est. 6 George I, c. 28), the Idle (est. 6 George I, c. 30), the Weaver from Frodsham Bridge to Winsford Bridge (est. 7 George I Statute 1, c. 10), the Mercey and Irwell (est. 7 George I Statute 1, c. 15), the Dane (est. 7 George I Statute 1, c. 17), the Eden (est. 8 George I, c. 14), rivers near Great Yarmouth (9 George I, c. 10), The Don from Holmstile to Tinsley (est. 12 George I, c. 38), the Beck (est. 13 George I, c. 4), the Don from Holmstile to Barnby Dun (est. 13 George I, c. 20), Yorkshire Ouse (est. 13 George I, c. 33), Stroudwater (est. 3 George II, c. 13), new undertaker for the Dee (est. 14 George II, c. 8), the Weaver from Winsford Bridge to the Town of Namptwich (est. 7 George II, c. 28), Worsley Brook (est. 10 George II, c. 9), Rodon (est. 10 George II, c. 33), and the Lea from Hertford to Ware (est. 12 George II, c. 32).

Table 6: Political Settlements, Royal Decrees, and Acts Violating the Rights of River Undertakers established between 1605 and 1688

River Act or Decree	Year
Thames Commissioners from Several counties eliminated by new act	1624
Great Ouse (St. Neots to St. Ives) Maximum tolls reduced by decree from Privy Council	1626
Lark Route cut in half by decree from King	1638
Avon (Warwickshire) Patentees rights voided by Commons and later by an act.	1641, 1661
Ouse (Yorkshire) Undertakers rights voided by Restoration Settlement	1661
Wey Undertakers rights voided by Restoration Settlement	1661
Great Ouse (Bedford to St. Neots) Undertakers rights voided by act	1665
# of Undertakers established between 1605 and 1688	21
Estimated Likelihood that undertakers established between 1605 and 1688 had their rights violated by at least one settlement, decree, or act.	33%

Sources: see text.

Notes: the Undertakers established by act or patent between 1605 and 1688 controlled the following rivers and were established in the following acts or patents: the Thames near Oxford (est. Public 3 James I, c. 20), the Great Ouse from St. Ives to St. Neots (est. patent 1617), the Thames near Oxford (est. act 1623, second group of undertakers), the Colchester Haven (est. act 1624), the Soar (est. patent 1634), the Lark (est. patent 1635), the Avon in Warwickshire (est. patent 1636), the Tone (est. patent 1638), Stower (est. patent 1638), Wey (est. act of the Interregnum 1651), Yorkshire Ouse (est. charter Lord Protector, 1657), Stower and Salwerpe (est. private act 14 Charles II, c. 14), Wye and Lugg (est. private act 14 Charles II, c. 15), Bristowe Causey (est. private act 16 & 17 Charles II, c. 6), Avon from Christchurch to New Sarum (est. private 16 & 17 Charles II, c. 11), Medway in Kent and Sussex (est. private 16 & 17 Charles II, c. 12), Itchin, Great Ouse, and Mole (private 16 & 17 Charles II, c. 13), Witham (private 22 & 23 Charles II, c. 25), Wey (est. private 22 & 23 Charles II, c. 26, second set of undertakers), Branden and Waveney (est. private 22 Charles II, c. 16), and Vale (est. private 30 Charles II, c. 20).

Table 7: Acts Violating the Rights of Turnpike Trusts Established between 1689 and 1719

Road Provision in Act	Year
Northfleet to Rochester Trustees forced to pay a subsidy to surveyors on nearby road	1725
Cherrill to Studley Bridge Maximum Tolls Reduced by two acts	1726, 1744
Hockliffe to Woborne Maximum Tolls Reduced by act	1728
Shepards Shord to Horsley Trustees eliminated by act	1729
Stokenchurch to Oxford Maximum Tolls reduced by act	1740
Fornhill to Stony Stratford Road Trustees eliminated by act	1740
# of Turnpike Trusts created between 1689 and 1719	34
Estimated Likelihood that turnpike trustees established between 1689 and 1719 had their rights violated by at least one act	18%

Sources: see text.

Notes: Tusts established by acts between 1689 and 1719 controlled the following roads and were established by the following public acts: Wadesmill to Stilton (est. 4 WM, c. 9), Shenfield to Harwich (est. 7,8 WM c.9), Wymondham to Attelborough (est. 7,8 WM c.26), Reigate to Crawley (est. 8,9 WM c.15), Gloucester to Birdlip Hill (est. 9 WM c.18), Woodford to Thornwood (est. 1 A 2 c.10), Barnhill and Hutton Heath (est. 4,5 A c.26), Fornhill to Stoney Straford (est. 6 AN c.4), Hockliffe to Woburn (est. 6 AN c.13), Bath roads (est. 6 AN c.42), Cherill to Studley Bridge (est. 6 AN c.76), Stratford to Dunchurch (est. 6 AN c.77), Sevenoaks to Tunbridge Wells (est. 8 AN c. 20), Stoke Goldington to Northampton (est. 8 AN c. 9), Dunstable and Hockliffe (est. 9 AN c.34), Petersfield to Portsmouth (est. 9 AN c.33), Royston to Wandsford Bridge (est. 9 AN c.14), Ipswich to Cleydon (est. 10 AN), Highgate to Barnet (est. 10 AN c.4), Kilburn Bridge to Sparrow Herne (est. 10 AN c.3), Northfleet to Rochester (est. 10 AN c.16), St. Leonard to Chestnut (est. 12 AN c.19), Reading to Puntfield (est. 13 AN c.28), Shepherd Shord to Bagdon (est. 13 AN c.17), Tittensor to Butlane (est. 13 AN c.31), Worcester to Droitwich (est. 13 AN c.27), St. Albans to South Mimms (est. 1 GI c.12), Tyburn to Uxbridge (est. 1 GI 25), St. Giles to Hornsey, Islington to Highgate (est. 3 GI c.4), Kensington to Cranford Bridge (est. 3 GI c.14), Maidenhead Bridge to Henley (est. 4 GI c.6), Reading to Basingstoke (est. 4 GI c.7), Beaconsfield to Stokenchurch (est. 5 GI c.1), and Stokenchurch to Woodstock (est. 5 GI c.2).

Table 8: Summary of River Undertakers with Rights from Patents and Acts before 1689

River	Original undertaker	Year Granted	Completed	Rights changed by act, 1689-1749
Great Ouse, St. Neots to St. Ives	Jason Gason	1617	Yes	Act in 1719 gives undertaker in 1687 more rights.
Thames, near Oxford	Commissioners	1623	Yes	Acts in 1694 and 1729 renew authority
Colne, near Colchester		1623	No	Act in 1698 names undertakers
Great Ouse, near Bedford	Arnold Spencer	1627	No	None
Soar	Thomas Skipworth	1634	No	None
Lark	Henry Lambe	1635	No	Act in 1698 names new undertakers.
Avon, Warwickshire	William Sandys	1636	Yes	None
Tone	John Mallet	1638	Yes	Act in 1698 establishes new undertakers. Undertakers compensate patentees who renewed rights in 1684
Stour in Essex	Arnold Spencer	1638	No	Act in 1705 names new undertakers
Wey	James Pitson	1651	Yes	None
Yorkshire Ouse		1657	No	Act in 1725 names new undertakers, but old undertakers rights were already voided by Restoration.
Stower and Salwerpe	Sir Thomas Baldwyn	1662	Yes	None
Wye and Lugg	William Sandys	1662	No	Act in 1695 voids Sandy family rights
Bristowe Causey	Henry Hastings	1664	No	None
Avon, Christchurch to New Sarum	Lord Keeper of the Seal	1664	Yes	None
Medway in Sussex	Lord McCoskery and others	1665	No	Act in 1739 names new undertakers
Itchen, Great Ouse near Bedford, and Mole	Sir Humphrey Bennet and Others	1665	Itchen only	None
Witham	Mayor Lincolnshire	1670	Yes	None
Bradon and Waveney	Mayor of Yarmouth	1670	No	None
Vale	Charles Erebanion	1678	Yes	None

Sources: see text.

Table 9: Proposals for River Improvement, 1606-1688

River	Year	Miles	completed	Source
Avon	1606	12	0	*JHC: volume 1: 1547-1629*, pp. 273, 24 February 1606.
Thames	1606	15	0	*JHC: volume 1: 1547-1629*, pp. 299, 16 April 1606.
Great ouse, St. Neots to St. Ives	1617	23	1	Summers, *Great Ouse*, p. 48.
Avon, bath to Bristol	1619	12	0	CSP, Domestic*: James I, 1619-23*, pp. 57-68, July 1619.
Yorkshire Ouse	1621	18	0	*JHC: volume 1: 1547-1629*, pp. 605-606, May 1621.
Thames	1621	15	0	*JHL: volume 3: 1620-1628*, pp. 37-38, 6 March 1621.
Wey	1621	20	0	*JHC: volume 1: 1547-1629*, pp. 560-561, 17 March 1621.
Thames	1624	15	1	*JHC: volume 1: 1547-1629*, 19 March 1624.
Wey	1624	20	0	*JHC: volume 1: 1547-1629*, pp. 704, 14 May 1624.
Colchester haven	1624	5	0	*JHC: volume 1: 1547-1629*, 04 May 1624.
Aire and Calder	1626	25	0	*JHC: volume 1: 1547-1629*, pp. 836-837, 15 March 1626.
Great ouse, near Bedford	1626	10	0	*CSP: Charles I, 1625-26*, pp. 299-311, April 1-15, 1626.
Medway, maidstone to penhurst	1628	22	0	*JHL: volume 3: 1620-1628*, pp. 781-782, 6 May 1628.
Lark, Bury to the Ouse	1629	14	0	*JHC: volume 1: 1547-1629*, pp. 931-932, 20 February 1629.
thames and severn canal	1633	60	0	*CSP: Charles I, 1633-4*, pp. 41-61, May 1-17, 1633.
Soar, leceicester and trent	1634	16	0	Willan, *River Navigation*, p. 26.
Rother, bodiham to rye	1635	20	0	*CSP: Charles I, 1635*, pp. 51-76, May 1-16, 1635.
Lark, Bury to the Ouse	1635	14	0	*CSP: Charles I, 1635*, pp. 519-559, December 1-13, 163.
Avon, in Warwickshire	1636	25	1	*CSP: Charles I, 1635-6*, pp. 521-549, June 1-9, 1636.
Teme towards Ludlow	1636	40	0	*CSP: Charles I, 1635-6*, pp. 264-292, March 1-12, 1636.
fossdyke, enlargement	1636	11	0	*CSP: Charles I, 1636-7*, pp. 254-268, Undated 1636.
Witham, boston to washingborough	1636	30	0	*CSP: Charles I, 1636-7*, pp. 254-268, Undated 1636.
Tone, Bridgewater to Ham mills	1638	11	0	Willan, *River Navigation*, p. 27.
Stour, in Essex	1638	23	0	*CSP: Charles I, 1637-8*, pp. 289-314, March 1-18, 1638.
Wye	1641	20	0	*JHC: volume 2: 1640-1643*, pp. 89, 19 February 1641.
Arrundel, to the Thames	1641	13	0	*JHL: volume 4: 1629-42* , pp. 167, 19 February 1641.
Welland, stamford to deeping	1650	10	0	*JHC: volume 6: 1648-1651*, pp. 507, 11 December 1650.
Wey	1650	20	1	*JHC: volume 6: 1648-1651*, pp. 515, 26 December 1650.
Wye and Lugg	1651	20	0	*JHC: volume 6: 1648-1651*, pp. 542, 26 February 1651.
Ouse in Yorkshire	1651	18	0	*JHC: volume 6: 1648-1651*, pp. 542, 26 February 1651.
Darwent in Yorkshire	1651	38	0	*JHC: volume 6: 1648-1651*, pp. 542, 26 February 1651.
avon, bath to Bristol	1654	12	0	*CSP: Interregnum, 1654*, pp. 194-232, June 1654.
Wye and Lugg	1656	20	0	*CSP: Interregnum, 1655-6*, pp. 88-154, January 1656.
Ouse in Yorkshire	1657	18	0	*JHC: volume 7: 1651-1660*, pp. 504-505, 16 March 1657.
Avon, bath to Bristol	1657	12	0	*JHC: volume 7: 1651-1660*, pp. 510-511, 24 March 1657.
Nyne	1657	25	0	*JHC: volume 7: 1651-1660*, pp. 536-537, 21 May 1657'.

Avon, bath to Bristol	1658	12	0	*JHC: volume 7: 1651-1660*, pp. 588, 26 January 1658.
Dee	1660	8	0	*CSP: Charles II*, 1660-1, pp. 372-400, November 1660.
Stower and Salwerp	1661	20	1	*JHL: volume 11: 1660-1666*, pp. 249-251, 11 May 1661.
London to Bristol	1662	50	0	*JHC: volume 8: 1660-1667*, pp. 369-370, 21 February 1662.
Avon, Salisbury to Christ Church	1662	36	0	*JHC: volume 8: 1660-1667*, pp. 369-370, 21 February 1662.
Yorkshire Ouse	1662	18	0	*JHC: volume 8: 1660-1667*, pp. 369-370, 21 February 1662.
Wye and Lugg	1662	20	0	*JHC: volume 8: 1660-1667*, pp. 389-390, 19 March 1662.
Great Ouse, near Bedford	1663	23	0	*JHC: volume 8: 1660-1667*, pp. 447-448, 10 March 1663.
Mersey and Weaver	1663	20	0	*JHC: volume 8: 1660-1667*, pp. 444, 5 March 1663.
Vale in Cornwall	1664	10	0	*JHC: volume 8: 1660-1667*, pp. 570, 1 December 1664.
Darwent	1664	10	0	*JHC: volume 8: 1660-1667*, pp. 575-576, 13 December 1664.
Bristol and London	1664	50	0	JHC*: volume 8: 1660-1667*, pp. 546, 19 April 1664.
Bristol and London	1664	50	0	*JHC: volume 8: 1660-1667*, pp. 570-571, 2 December 1664.
Avon, to Christ Church	1664	36	1	*JHC: volume 8: 1660-1667*, pp. 575-576, 13 December 1664.
Bristowe Causey into thames	1664	16	0	*JHL: volume 11: 1660-1666*, pp. 635, 9 December 1664.
Itchen	1664	10	1	*JHL: volume 11: 1660-1666*, pp. 638, 15 December 1664.
ouse, lewes to Newhaven	1664	10	0	*CSP*: Charles II, 1663-4, pp. 631-657, July 1664.
Medway	1665	22	0	*JHL: volume 11: 1660-1666*, pp. 644, 19 January 1665.
Great ouse, near Bedford	1665	23	0	Summers, *the Great Ouse*, p. 53
Mole	1665	20	0	*JHL: volume 11: 1660-1666*, pp. 638, 15 December 1664.
Cam	1665	7	0	*CSP: Charles II, 1665-6*, pp. 38-58, November 1-14, 1665.
Dee	1666	8	0	*CSP: Charles II*, 1665-6, pp. 424-441, June 1-14, 1666.
Bristol and London	1667	50	0	*JHC: volume 9: 1667-1687*, pp. 6, 22 October 1667.
Dee	1669	8	0	*CSP: Charles II, 1668-9*, pp. 258-305, April 1669.
Dee	1669	8	0	*JHC: volume 9: 1667-1687*, pp. 109, 19 November 1669.
Weaver	1670	20	0	*JHC: volume 9: 1667-1687*, pp. 186-187, 20 December 1670.
Brandon and Waveney	1670	23	0	*JHC: volume 9: 1667-1687*, pp. 130-131, 2 March 1670.
Witham, boston to trent	1670	30	1	*JHC: volume 9: 1667-1687*, pp. 159-160, 3 November 1670.
Parret and Thone, Bridgewater to Bradford Bridge	1673	22	0	*JHL: volume 12: 1666-1675*, pp. 539-541, 1 March 1673.
Derwent in Derby	1675	10	0	*JHC: volume 9: 1667-1687*, pp. 368-369, 6 November 1675.
Derwent in Derby	1677	10	0	*JHC: volume 9: 1667-1687*, pp. 393, 6 March 1677.
Vale in Cornwall	1678	10	1	*JHC: volume 9: 1667-1687*, pp. 453-454, 14 March 1678.
Blyth in Northumberland	1682	8	0	*CSP Domestic: Charles II, 1682*, pp. 279-321, July 1682.
Wye and Lugg	1685	20	0	*JHC: volume 9: 1667-1687* (1802), pp. 739-741, 18 June 1685.

Sources: see text.
Notes: JHC is the Journal of the House of Commons, JHL is the Journal of the House of Lords, and CSP is the Calendar of State Papers, Domestic Series.

Table 10: Proposals for road Improvement, 1606-1688

Road	Year	miles	completed	Source
Between London and watford	1605	15	1	*CSP: James I, 1603-1610*, pp. 265-277, Dec., 1605.
Between Nonsuch and Talworth	1606	40	0	*JHC: volume 1: 1547-1629*, pp. 288, 21 March 1606.
Between London, royston and newmarket	1609	25	1	*CSP: James I, 1603-1610*, pp. 524-540, July, August, 1609.
Between Highgate and Barnet	1610	6	1	*CSP: James I, 1603-1610*, pp. 590-605, March, April 1610.
Biggleswade	1610	12	0	*JHC: volume 1: 1547-1629* , pp. 403, 01 March 1610.
Between Puckeridge and Royston	1612	13	1	*CSP: James I, 1611-18*, pp. 109-117, January 1612'.
Hertfordshire Roads	1622	5	1	*CSP: James I, 1619-23*, pp. 401-418, June 1622.
Near Biggleswade Bedfordshire'	1622	12	0	Emmison, 'the First Turnpike Bill'.
Between chelsea and fulham	1626	5	1	*CSP: Charles I, 1625-26*, pp. 533-582, Appendix.
between Maidenhead and Reading and Maidenhead and Henley	1634	20	1	*CSP: Charles I, 1633-4*, pp. 537-559, April 1-19, 1634.
London and Middlesex roads	1650	25	0	JHC: volume 6: 1648-1651, pp. 442-443, 18 July 1650.
London, near East Smithfield and the tower	1650	5	0	*JHC: volume 6: 1648-1651* , pp. 486-487, 23 October 1650.
Near Standon Bedfordshire	1661	15	0	*JHC: volume 8: 1660-1667* , pp. 292-294, 6 July 1661.
Great North Road in Cambridge	1663	15	1	*JHC: volume 8: 1660-1667*, pp. 455, 21 March 1663.
Watlingstreet Road near Bedford	1663	15	0	*JHC: volume 8: 1660-1667*, pp. 438-439, 23 Feb. 1663.
Standon Road	1663	15	0	*JHC: volume 8: 1660-1667*, pp. 455, 21 March 1663.
London to Chester	1664	170	0	*JHC: volume 8: 1660-1667*, pp. 583-584, 17 January 1665.
Highways in Bedford, Bucks, Northampton, and Warwick	1664	50	0	*JHC: volume 8: 1660-1667*, pp. 570, 1 December 1664.

Sources: see text.

Notes: JHC is the Journal of the House of Commons, JHL is the Journal of the House of Lords, and CSP is the Calendar of State Papers, Domestic Series.

Table 11: Acts altering the rights of River Undertakers created between 1689 and 1749

River Public Act	year	Details
Channel from Colchester to Wivenhoe/ 5 George I, c. 31	1718	Extension initiated by a petition from Mayor, Aldermen, Assistants, and Common-Council of Colchester, who served as undertakers for the earlier act. They stated that they had an outstanding debt of 12,000 pounds and could not repay the debt without an extension of their authority. An act was passed extending their rights for another 21 years. The tolls were reduced on all commodities.
Channel from Colchester to Wivenhoe/ 13 George II, c. 30	1739	Extension initiated by the commissioners of the act and the city leaders of Colchester. They request that their powers be extended for another 21 years so they can maintain a lock. The act was passed extending their rights for another 21 years. Toll on coal was reduced further to 3 pence.
Dee/ 17 George II, c. 28	1743	Amendment initiated by mayor and citizens of Chester requesting that the tolls on the river be reduced to encourage trade. The Dee company also submitted a petition consenting to the reduction in tolls. The act was passed reducing the tolls on all types of vessels.

Sources: See text.

Table 12: Acts altering rights for Turnpike Trusts created between 1689 and 1719

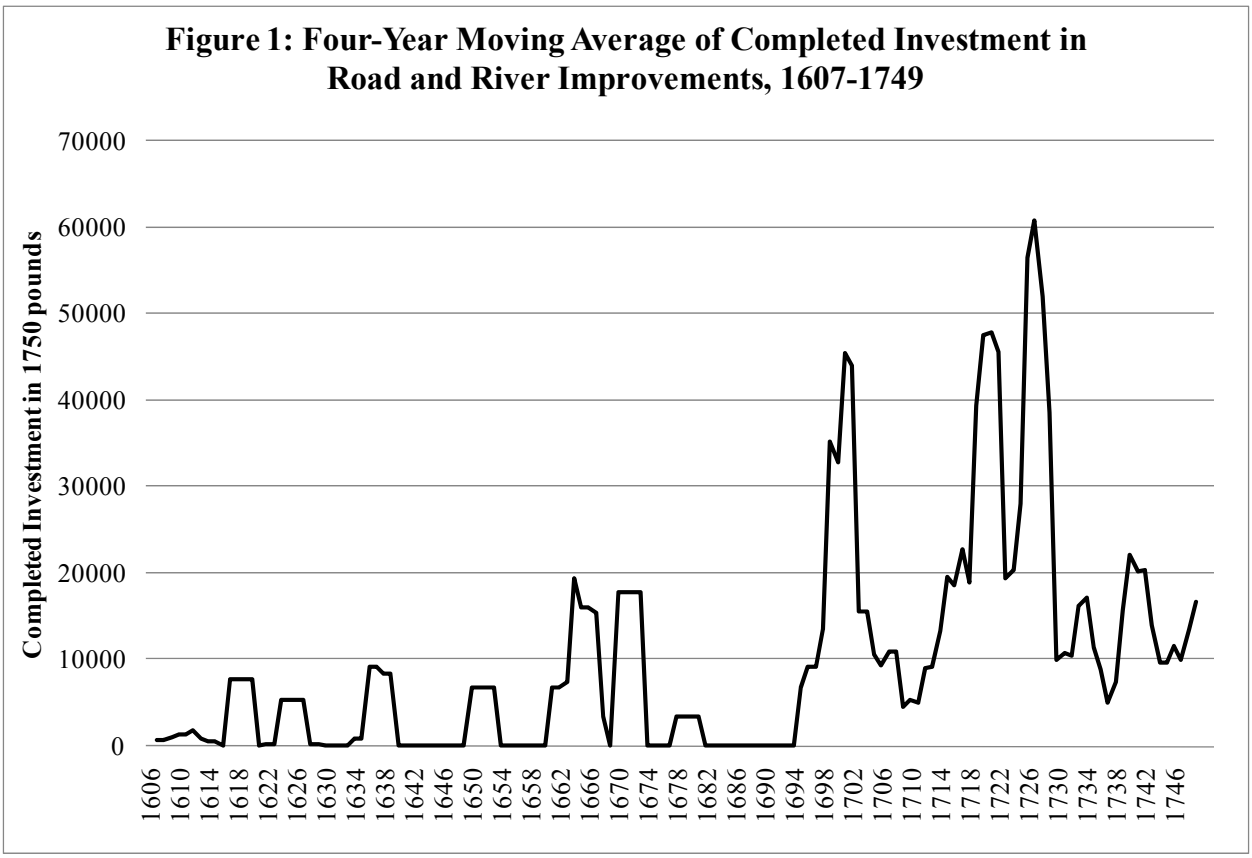
Road Public Act	Year	Details
Hockliffe to Woborne, 1 GII 10	1728	Original act names Bedfordshire JPs as trustees. First renewal initiated in year that the original act was set to expire. J.P.'s state that roads still need repair. Act is passed extending the term for 21 years and transferring authority to a body of trustees. Tolls on wagons and coaches are reduced.
Fornhill to Stony Stratford, 13 GII 9	1740	Original act names 33 trustees. Creditors state that they borrowed 6400 pounds, but cannot be paid unless the term is extended and the tolls are increased. Act is passed extending the term of the original act to 30 years. It also requires that trustees borrow new funds and repay creditors; otherwise the creditors could take receivership of the tolls. Trustees were unable to borrow and creditors took over temporarily, before commissioners appointed a new body of trustees. Second Act is passed extending the term for 23 years. Authority is vested in the trustees for the first act and those who took over after receivership. The rights vested in third act expired in 1739. A new act was initiated by inhabitants of Buckinghamshire and Bedfordshire stating that the road was still out of repair. It named a new body of trustees.
Cherrill to Studley Bridge, 12 GI 7, 17 GII 24	1726, 1744	Original act names Wiltshire JPs as trustees. First renewal act initiated 2 years before original act was set to expire. J.P.'s state that term needs to be extended to repay the 5000 pounds in debts. Act is passed extending term for another 21 years. The tolls on cattle are reduced, all others remain unchanged. Second renewal is initiated 3 year before previous act expired. J.P.'s state that the term needs to be extended to pay off a debt of 700 pounds. The act is passed extended the term for another 21 years. The tolls are reduced on coaches.
Northfleet to Rochester, 11 GI 5	1725	Original act names JPs as trustees. First renewal is initiated one year before original act is set to expire. JP's petition that road cannot be further improved unless term is extended. JP's from eastern portion of Kent also petition that tolls should be used to pay for road from Chatham and Boughton under the Bleane. Act is passed extending the term. It also requires JP's to pay a subsidy to surveyors on road from Chatham and Boughton under the Bleane.
Shepards Shord to Horsley, 2 GII, c. 12	1729	Original act names JPs as trustees. The first amendment act is initiated six years before it was set to expire. Trustees petition that debts cannot repaid and road cannot be repaired if the term is not extended. After the second reading the committee reviewing the bill is instructed by someone in the House that "they have power to provide in the bill that the trusts, by the former act shall cease and determine, and that proper powers, for the effectual amending the highways, directed to be repaired by the former act, be vested in other trustees." Act is passed naming a new body of trustees.
Stokenchurch to Oxford, 13 GII 15	1740	Original act names trustees. First renewal act was initiated in the year the original act was set to expire. Trustees petition that the term needs to be extended to keep the road in repair. MP reported from the committee that the debts had been paid off. Act is passed extending the term. The tolls on coaches are reduced.

Sources: see text.

Table 13: Acts after 1689 altering rights for River Undertakers created between 1605 and 1688

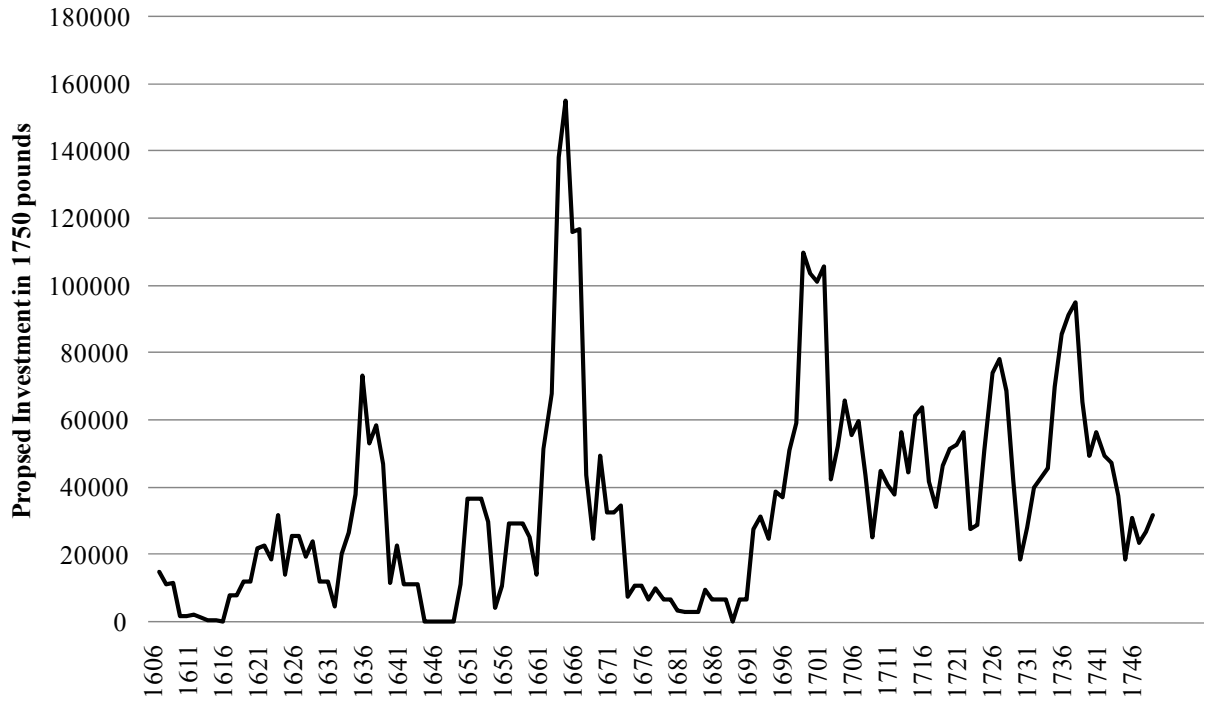
River, Act	Year	Details
Great Ouse, St. Neots to St. Ives, 6 G I, c. 29	1719	Original undertaker Jason Gason had sold rights to Arnold Spencer. Spencer lost his rights to his creditors in 1650s. Samuel Jemmatt purchased the rights from Spencer's creditors. Henry Ashley purchased Jemmatt's rights in the 1680s, but it was disputed. Court case in 1687 split ownership between Jemmatt and Ashley. Ashley is given further powers to improve the river by the act in 1719.
Thames, near Oxford, 6&7 WM	1694, 1729	Original Commissioners in Oxford are named to oversee improvements by act in 1624. Act in 1694 allows Justices of the Peace the right to regulate water carriage rates on the Thames. The act does not change the authority of commissioners near oxford, but it does allow for appeals to the Justices of Assize for Oxfordshire. The 1729 act renews the provisions of the 1694 act.
Colne, near Colchester, 9 William III, c. 19	1698	Act in 1698 establishes the mayor's of Colchester's authority to improve the Colne. The original undertaker is not known.
Lark, 11 William III, c. 22	1698	Henry Lambe was originally given rights to improve the Lark. The 1698 act gave Henry Ashley authority as undertaker. There is no mention of Lambe's patent in the act or in the petitions to Parliament.
Tone, 10 William III, c. 8	1698	John Mallet originally had a patent for the Tone. The patent was renewed by Mallets heirs in 1684. The 1698 act named new undertakers. The act confirmed the conveyance of rights in the Tone from Mallet's heirs to the new undertakers.
Stour, 4&5 Anne, c. 2	1705	Arnold Spencer was originally given a patent for the Stour. Act in 1705 names new undertakers. Assignees of patent John Little and Benjamin Dodd lose authority.
Yorkshire, 13 George I, c. 33	1725	Undertakers received rights by charter from Cromwell. Their rights were voided by Restoration settlement. Act in 1725 names city leaders as undertakers
Wye and Lugg, 7 & 8 William III, c. 14	1695	Sandys family originally has rights by an act in 1662. 1695 act names new undertakers.
Medway, 13 George II, c. 26	1739	Lord McCoskory and others are original undertakers. Committee for 1739 act states they did not complete the navigation. 1739 act names new body of undertakers.

Sources: see text.



Sources: see appendix
Notes: The four-year moving average is equal to the average of completed investment in t-3, t-2, t-1, and t.

Figure 2: Four-year Moving Average of Proposed Investment in Road and River Improvements, 1607-1749



Sources: see appendix
Notes: The four-year moving average is equal to the average of proposed investment in t-3, t-2, t-1, and t.