Political Party Connections and the Diffusion of Technology:

Evidence from Britain's first transport Revolution

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Abstract

Britain's first transport revolution provides a revealing and important context to study the role of political party connections in the diffusion of technologies. This paper focuses on river navigation projects authorized by acts of parliament and the role of connections to the majority political party in the House of Commons. It exploits the frequent turnover in majority parties between the Whigs and Tories to construct exogenous changes in majority party representation near all towns in Britain. The empirical analysis shows that the extension of navigation to a town was less likely when the opponents of projects had more representation by the majority party in the Commons. It also shows that electoral outcomes for the majority party were better in opposition areas when river navigation bills were rejected in the Commons. The results provide the first rigorous evidence that political party connections among vested interests can block the diffusion of technologies.

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Good Roads, canals, and navigable rivers, by diminishing the expense of carriage, put the remote parts of the country more nearly upon a level with those in the neighborhood of the town. They are upon that account the greatest of all improvements….It is not more than fifty years ago that some of the counties in the neighborhood of London, petitioned the parliament against the extension of the turnpike roads into the remoter counties. Those remoter counties, they pretended, from the cheapness of labour, would be able to sell their grass and corn cheaper in the London market than themselves, and would thereby reduce their rents, and ruin their cultivation.

Adam Smith, *the Wealth of Nations*, Chapter XI, Of the Rent of Land (1976 p. 164).

I. Introduction

Adam Smith is well known for his observations on the gains from trade, but he also shrewdly observed that vested invested interests sometimes block the adoption of technologies that benefit most of society. In the passage above, Smith notes that landowners close to major markets lobbied against the extension of turnpike roads and river navigation during the early 1700s. The legal and political nature of these technologies made them especially prone to lobbying efforts. River navigation projects, for example, had to be authorized by acts of parliament because they involved the creation of corporate powers, like the compulsory purchase of land and the introduction of tolls on waterways previously in the public domain. The landowners and towns who opposed river projects exploited the political process by petitioning the House of Commons to reject authorizing bills. Vested interests were successful up to a point. The diffusion of river navigation projects was slow from 1690 to 1740, in part because many bills proposing projects failed in the Commons several times before approval.

In this paper, I offer a new interpretation for the diffusion of river navigation acts. Like Adam Smith my argument points to vested interests, but unlike Smith I emphasize the political party connections of vested interests opposing river projects. The Whigs and Tories were the two dominant parties in early eighteenth century Britain. They traded places as the majority party

seven times between 1690 and 1721, after which the Whigs remained as the majority party for over 40 years. The Whigs and Tories influenced national policies dealing with government finance and international trade, but they also influenced local economic policies. As I show below river acts were less likely to be adopted in towns where the likely opponents of these acts had stronger representation by the majority party in the Commons. Specifically, I show that opposition to river bills was strongest in areas 'downstream' from the project and within 25 miles. I then document that having more majority party Members of Parliament (MPs) in downstream areas within 25 miles meant that a town was less likely to get a river navigation act.

One potential concern is that opposition groups could campaign to get majority party MPs elected. In the baseline fixed effects model, identification comes from variation in the number of majority party MPs near a town and across parliaments. While time-invariant unobservable characteristics are controlled for, there is still a possibility that time-varying unobservable factors could influence the capability for opposition groups to get majority party MPs elected and to lobby for the rejection of bills. To address this problem I use cases where there was a new majority party in the Commons and the same MP was elected and remained affiliated with their previous party as an exogenous source of variation for changes in majority party MPs near the town. The results are similar to the baseline model and suggest that the political connections of opponents are not endogenous.

The same conclusion does not apply to the political connections of supporters. As I show below, support for river navigation acts was concentrated in towns where navigation was being extended or it was in upstream areas within 25 to 40 miles. Drawing on these patterns I use proximate and upstream majority party MPs as my indicator for the political connections of likely supporters. In the baseline model, there is evidence that having more upstream majority

party MPs meant that a town was more likely to get a river navigation act. However, these effects are not present when exogenous sources of variation in majority party MPs are used. Thus the political connection of supporters is likely to be endogenous.

Other political factors are incorporated in the analysis and complement the main findings. For example, greater political competition downstream from a town lowers its likelihood of getting a river navigation act. The effects of political competition also differ depending on whether the Whigs or Tories were in the majority. Under the Whigs political competition had a stronger negative effect on adoption. Interestingly, having more incumbent MPs upstream or downstream has no significant effect.

In the last section of the paper I examine the behavioral mechanisms underlying the results. One theory is that the promoters of river bills were informed about the political party connections of opponents to river bills and understood the implications for their bill's success in parliament. Another theory is that promoters were misinformed about connections or did not understand their implications. I find evidence in favor of the latter theory using data on the introduction of river bills and their success in parliament. Regression analysis shows that majority party strength downstream and within 25 miles has no significant effect on the introduction of bills in a town but it significantly increases the probability of a town's bill succeeding in Parliament. I also provide evidence that the majority party in the Commons targeted rejections to connected opposition groups in order to maintain their majority status. This finding is consistent with the political science literature which argues that political parties often target policies to core supporters in order to maximize their electoral success (Cox and McCubbins 1986, Lindbeck and Weibull 1987, Dixit and Londregan 1996).

My results contribute to several literatures. The first looks at the effects of political connections on firm-level outcomes. In the majority of these studies, connections are measured through campaign contributions or the personal relationships between politicians and either firm managers, corporate board members, or employees. These studies generally find evidence for a link between political connections and regulatory policies favorable to the firm (Faccio et. al. 2006) or between connections and the market value of firms (Faccio 2006, Blanes i Vidal *et. al.* 2012, Cingano and Pinotti 2013). However, relatively few papers rigorously study the effects of connections to the majority political party. An exception is Jayachandran (2006) who documents the effects of an exogenous change in majority party connections following Senator Jim Jeffords exit from the Republican Party that tipped control of the U.S. Senate to the Democrats. Another is Ferguson and Voth (2008) who show that connections to the National Socialist German Workers' Party increased the market value of German firms in the 1930s. This paper adds to this literature by demonstrating the effects of political party connections in Britain during a formative period in its history. This historical setting is especially revealing because there was frequent turnover in the majority party. In most modern contexts, the majority party changes infrequently, making the identification of political party connections challenging, if not impossible. This paper uses the frequent turnover to measure exogenous changes in majority party connections in a novel way.

This paper also relates to the broader literature studying political parties and their influence on economic outcomes. Most of the targeting literature has emphasized spending or national policies. For example, there is evidence that government spending patterns differ when a district or region is strongly represented by the majority party (Lee 2003, Levitt and Synder 2005, Knight 2008, Curto Grao *et. al.* 2012, Albouy 2013, Burgess *et. al.* 2013). In the British

historical context, Stasavage (2005, 2007) provides evidence that whether the Whigs or Tories were the majority party influenced government bond yields. This paper is novel because it relates political party connections to regulatory policies affecting technology and the granting of corporate powers. The only similar type of analysis in the literature is by Besley, Persson, and Sturm (2010) who provide evidence for a link between political party competition and anti-growth policies across US states.

Another related literature concerns the link between vested interests, institutions, and the diffusion of technologies. This literature is motivated by the stylized fact that poor countries are slower to adopt best practice technologies and hence have lower productivity (Parente and Prescot 2000, Bellettini, Berti Ceroni, and Prarolo 2014). Comin and Hobijn (2009) demonstrates that in countries with weak institutions, the existence of a close predecessor technology slows the diffusion of new technologies. Relatedly a number of historical works argue that resistance to technologies and corporations by vested interests is one of the main reasons economies grew slowly in the past, including Britain in the early eighteenth century (Mokyr 1990, Mokyr and Nye 2007, North, Wallis, and Weingast 2009). In these works, river navigation acts are not the typical example of blocked technologies; nevertheless they were significant in their time. As noted by Adam Smith, investments in the expansion of markets were among the most important innovations in the pre-industrial world. Moreover, powers of eminent domain and user-fee systems based on tolls are common in the modern world, but they were untested legal technologies in the early 1700s. In fact most countries did not develop infrastructure financing systems until the railway era of the nineteenth century. In short, the finding that political party connections slowed the diffusion of river navigation acts in the early 1700s meant that politics influenced the pace of Britain's economic growth.

II. Background on Political Parties and Government Policy in Britain

The Glorious Revolution of 1688 marked a significant turning point in the political history of Britain. Over the next two decades the House of Commons and Lords solidified a key role for Parliament in governing the country. The House of Commons, in particular, developed the fiscal and implicit constitutional power to check the authority of the Monarchy. Britain was fairly unique in this aspect because elsewhere in Europe representative institutions became dormant (North and Weingast 1989, Bosker, Buringh, and Luiten van Zanden, 2012).

Politics in the aftermath of the Glorious Revolution were strongly influenced by competition between Britain's first political parties: the Whigs and Tories. They differed in their policy positions with the Tories favoring privileges for the Church of England, lower taxes, and a small government debt. The Whigs generally favored religious toleration and an aggressive foreign policy based on a well-funded army. The two parties also differed in their supporters. The Tories were generally supported by small to medium landowners known as country gentleman. The Whigs drew more support from merchants and large landowners.

The Whigs and Tories vigorously competed in elections between 1690 and 1721, a period known as the 'Rage of Party.' There were 11 elections and the majority party in the Commons changed seven times (see table 1). Cruickshanks, Handley, and Hayton's (2002) estimates on the size of majority parties suggest they could be quite large as in the 1710 to 1713 Parliament with more than 60 percent of MPs being linked to the Tories. They could also be relatively small as in 1705 to 1708 when the Tories held a narrow majority close to 50 percent.

Table 1: Parliament and the Majority Party 1690-1741

Parliament	Majority Party	Estimated % of MPs with Majority Party
1690-1695	Tory	47.5
1695-1698	Whig	50.1
1698-1700	Whig	48
Jan. 1701	Tory	48.5
Nov. 1701	Whig	48.4
1702-1705	Tory	58.1
1705-1708	Tory	50.7
1708-1710	Whig	52.2
1710-1713	Tory	64.4
1713-1715	Tory	69
1715-1722	Whig	61.1
1722-1727	Whig	68
1727-1734	Whig	76.4
1734-1741	Whig	68.6

Sources: Majority Party and contested elections are from Cruickshanks, Handley, and Hayton (2002) and Sedgwick's (1970).

During the Rage of Party the Whigs were first led by a small group of party mangers known as the 'Junto.' They were particularly effective in mobilizing MPs on key votes in the Commons relating to trade and public finance. One of the fruits of their success was Whig control over the newly founded Bank of England (Carruthers 1999). The Tories were led by Robert Harley. One of Harley's main successes was the launch of the South Sea Company (a rival of the Bank of England) which was mainly controlled by individuals loyal to the Tories (Holmes 1987).

The Whig party came to dominate the Commons after 1721. The Whigs held a large majority in all parliaments from 1722 to 1741 and for some decades after. One reason was the demise of the Tories as an effective opposition party. Some Tories were associated with a failed Rebellion against the monarchy in 1715. The other reason was the emergence of Robert Walpole as the

leader of the Whigs. Serving as the first Prime Minister from 1721 to 1742, Walpole was especially effective in using government favors to secure a working majority in the Commons.

The organizational capacity and relevance of Britain's early political parties has been debated by historians. In an influential work, Namier (1957) and Walcott (1956) argued that political parties were largely irrelevant for policy-making. Research followed which showed that the Whigs and Tories were more capable than Namier and Walcott suggested. The current consensus is that from 1695 to 1740 Britain's early parties were not as effective as modern parties, but they were still capable of organizing and carrying out party strategies. Geoffrey Holmes, a leading historian of politics from 1702 to 1714, summarizes this view: "neither possessed a party machine in any strict sense, nor the regular income needed to maintain one; neither employed a system of official whips whose authority was generally recognized. Yet party organization of a kind was undoubtedly achieved in the years from 1702 to 1714, more susceptible to failure, inevitably, than its formalized modern equivalent, but also capable at times of surprising effectiveness (1987 p. 287)." [2]

The economic history literature provides some supporting evidence that political parties affected government policies, especially when they held a majority in the Commons. Stasavage (2003, 2007) provides evidence that British government bond yields were lower when the Whigs had a larger majority and higher when the Tories were in the majority. Stasavage argues that government bondholders were a key part of the Whig coalition and that the Junto and Walpole recognized that to stay in power the Whigs needed to protect bondholder rights. Dudley (2013) argues that the Whigs were more favorable to the manufacturing sector and worked to assist this

[2] For the historical literature on Britain's parties see Speck (1970), Hill (1976), Horowitz (1977), Harris (1993).

sector when they had a majority in the Commons. Pincus (2009) and Pincus and Robinson (2013) also see the Whigs as having an ideology more favorable to manufacturing.

Each of these studies is convincing to a degree. The only quantitative studies are by Stasavage (2003, 2007) and there the evidence comes from time-series variation in government bond yields and the identity or size of the majority party in the Commons. More compelling identification strategies are needed as in the contemporary literature on political connections and parties. Moreover, there is some doubt as to whether parties played a key role in some important policy areas. One example is the granting of corporate charters. After 1689 Parliament seized the Crown's authority to grant corporate charters and insisted that they be allocated through acts of parliament (Bogart 2011). Obtaining a corporate charter was valuable for a firm because it embodied 'legal technologies' which were unobtainable otherwise. However, corporate charters were also costly and sometimes impossible to get through an act. The reasons why are a matter of debate. One view points to the exclusive role of vested interests and eschews the role of politics. Ron Harris summarizes this perspective: "barriers on entry into the corporate world was not created by Parliament intentionally, nor was it to any considerable degree manipulated by Parliament….Parliament served only as the arena and set the procedural rules. The arena was left open to the active players in this game, the vested interests. And it was the vested interests which created the barriers on entry (2000, p. 135)."

This paper takes a different view and argues that access to charters *was* manipulated by Parliament, or at least the political parties that were central to its politics. One potential channel involves the general phenomenon of targeting in which political parties provide legislative benefits to groups or areas in order to mobilize supporters and sway swing voters (see Cox and McCubbins 1986, Lindbeck and Weibull 1987, Dixit and Londregan 1996). In this particular

setting, majority party leaders could have targeted favored vested interests by rejecting charters. Their aim might have been to win future elections by appeasing interest groups in areas where their party was well represented in the Commons. To prove there was an effect from political party connections requires detailed evidence along with rigorous methods. The next section provides background on river navigation acts, the subject of this paper.

III. Background on Early Transportation Improvements in Britain

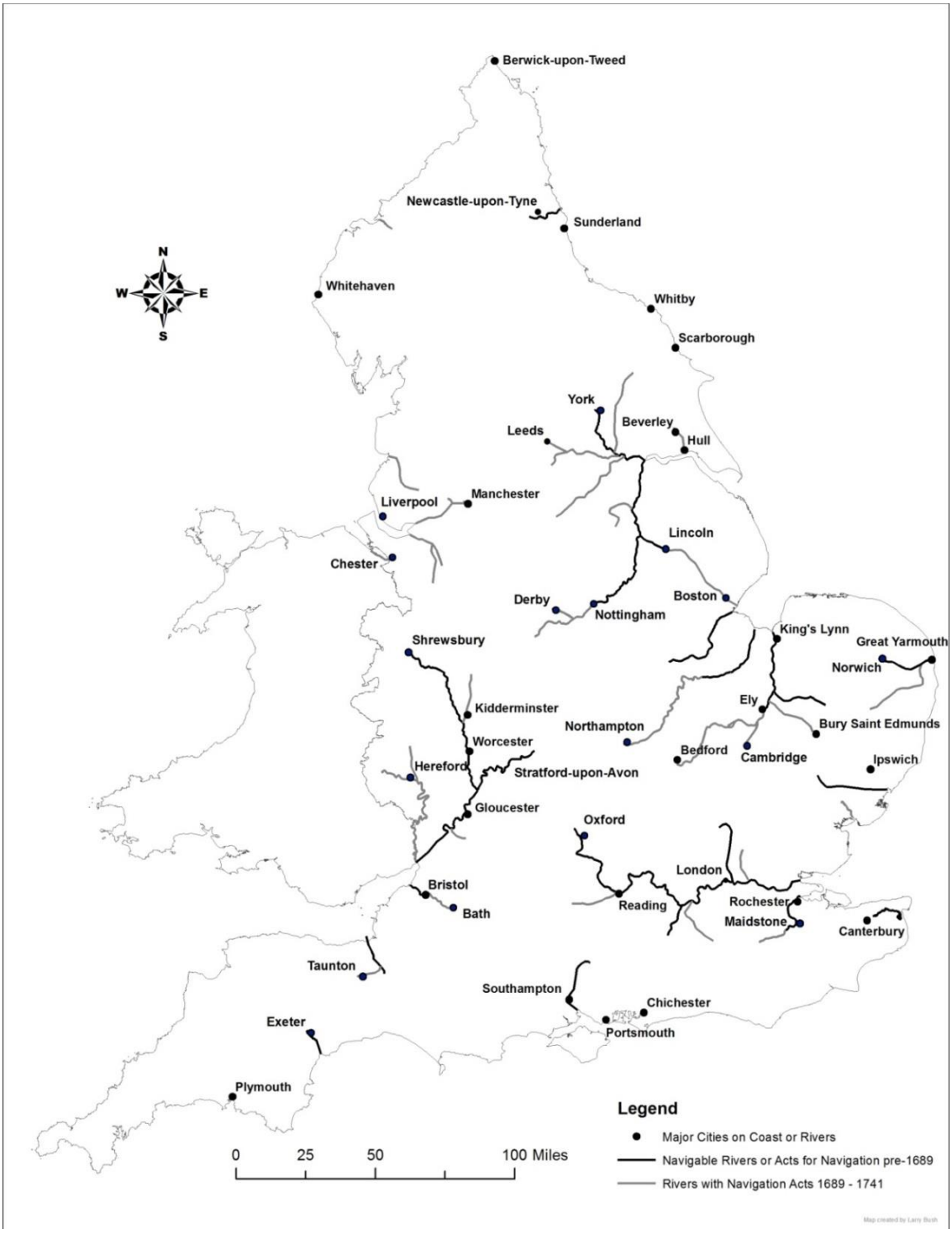
River navigation acts enabled the first significant improvement in Britain's transport infrastructure since the middle ages. In the early 1600s, most rivers were under the authority of Sewer Commissions. Sewer Commissions could compel landowners to cleanse waterways and could tax landowners along riverbanks to pay for upkeep, but they did not have the legal power to tax individuals who traveled on the river and they could not engage in the compulsory purchase of land along a waterway or divert its course. These limitations kept commissions from improving and extending navigable waterways (Willan 1964).

A river navigation act addressed these problems by establishing a river navigation company, similar to a corporation. The navigation company was granted rights to levy tolls and purchase land necessary for the project. The tolls were subject to a price cap and there were provisions on how the project was to be carried out. There were also provisions that allowed juries to determine the price of land if companies and property owners could not come to an agreement.

Through their statutory powers, river navigation companies played a key role in the extension of inland waterways. Nearly all the companies that got acts successfully built locks and dredged rivers. In the process, they substantially increased the length of navigable waterways in England and Wales. Figure 1 draws on Willan (1964) to illustrate the changes. The black lines show

rivers that were navigable in 1690 and the grey lines depict rivers with acts enabling improvements in their navigation by 1740. Generally acts extended navigation near the coast or on existing navigable rivers giving established as well as emerging towns, like Manchester and Leeds, new access to waterway transport.

Figure 1: Acts and Navigable Rivers, 1690-1741



Sources: see text.

The extension of river navigation to a town generally improved its economic prospects. Freight rates by inland waterway were approximately one-third the freight rates by road and many sources suggest that trade increased for a city when it was connected to the waterway network. As one illustration, the commentator, Daniel Defoe (1724), described how improvements on the Trent near Derby enhanced trade.

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

In light of the economic importance of waterway transport it is significant that the diffusion of river navigation acts was fairly slow. It took nearly 50 years from 1690 to 1740 to extend navigation on the rivers in figure 1. One immediate reason is that projects were proposed several times in parliament before being approved and some were never approved at all. It was more common for river navigation bills to fail than to succeed.

The House of Commons was the key decision-making body for river bills in Parliament. Projects started as an order for a bill by the House of Commons or as a petition by the public, with the latter becoming the dominant form after 1700. The majority of petitioners were local business interests or town officials who argued that navigation projects would benefit their locality and the nation. For example, in the case of the River Avon bill in 1712, the Mayor, Aldermen, and citizens of Bath argued that making the Avon navigable to the port of Bristol will employ the poor, promote the trade of Bath, train persons for sea-service, and preserve the roads

and highways.[3] Petitions like this were assigned to a special committee of MPs who would draft a bill to be reviewed by the entire Commons (there was no equivalent to the 'Transportation or Public Works Committee' found in modern legislatures). The committees generally had around 25 MPs and included a proviso that any MPs from neighboring counties and boroughs could attend. The committees played a key role in the fate of bills within the Commons. Most failed river bills did not make it out of their committees.

Opposition was a prominent feature for many river bills. Formal opposition occurred through petitions to the Commons against bills proposing river navigation. Opposition groups used a variety of arguments including property damage and the adverse effects of trade. In the case of the River Avon bill, Henry Parsons stated that his six mills on the river Avon would be rendered useless to the great loss of the poor and to himself. He prayed that 'the bill may not pass, or that such damages as the petitioner will sustain thereby may be made good to him by the undertakers.' The Mayor, Burgesses, and Common people of Bristol stated that the bill contained clauses that may be construed to interrupt their ancient Right, and encroach upon the rights lately granted to the petitioners. Bristol had been given authority to make the Avon navigable closer to the sea by an earlier act of Parliament. The gentlemen and freeholders of the county of Somerset, living near the River Avon, stated the project will 'be a great prejudice to all parts of the country near the Bath, by bringing of corn, and other commodities, from Wales, and other parts, where the value of lands are low.' They were also concerned about the 'damages and trespasses they may sustain by making the said River navigable.' The opponents of the River Avon Bill shared two key locational characteristics. They resided in towns or locations close to the proposed navigation project. Also they were 'downstream' from Bath and towards the navigation head

[3] The details of the petitions related to this bill are available in the Journals of the House of Commons, 1712.

near Bristol. As I shall document in the next section, these two characteristics were shared by most opponents to river bills.

The supporters of bills also petitioned to the Commons. The Mayor, Aldermen, and citizens of the city of Bath were already mentioned in the case of the river Avon bill. Other supporters were the freeholders, leaseholders, and occupiers of quarries near Bath. They stated that the river extension will 'be a means to carry great quantities of wrought and unwrought stone from the quarries near the said River into diverse parts of this kingdom.' Note that the two supporters of this project were in Bath where the proposed navigation would end. As I will document shortly, most supporters were in the towns where navigation was being extended or they were in towns upstream.

The location of opposition groups is important to the methodology of this paper. The hypothesis is that the promotion and passage of a river bill depended on majority party strength in the areas where there was opposition to these projects. Therefore it is crucial to identify the likely locations of opponents to river bills. The following section describes the data and the approach to measuring majority party strength in opposing areas and other factors which influenced the diffusion of river acts.

III. Data and Sources

The *Journals of the House of Commons* provide rich information on all river navigation bills. The details of every such bill were entered in a spreadsheet, including petitions, orders of the House, committee reports, votes, amendments, and whether the bill became an act.[4] The resulting

[4] See Hoppit (1997) and Bogart (2011) for more details on the *Journals* as a source. Note that votes are only occasionally reported. In those cases, the names of the 'tellers' for yes and no and the totals for each side are reported.

sample consists of 67 river navigation bills. Among these 31 became river navigation acts. The number of bills and acts in each parliament from 1690 to 1741 are shown in table 2.

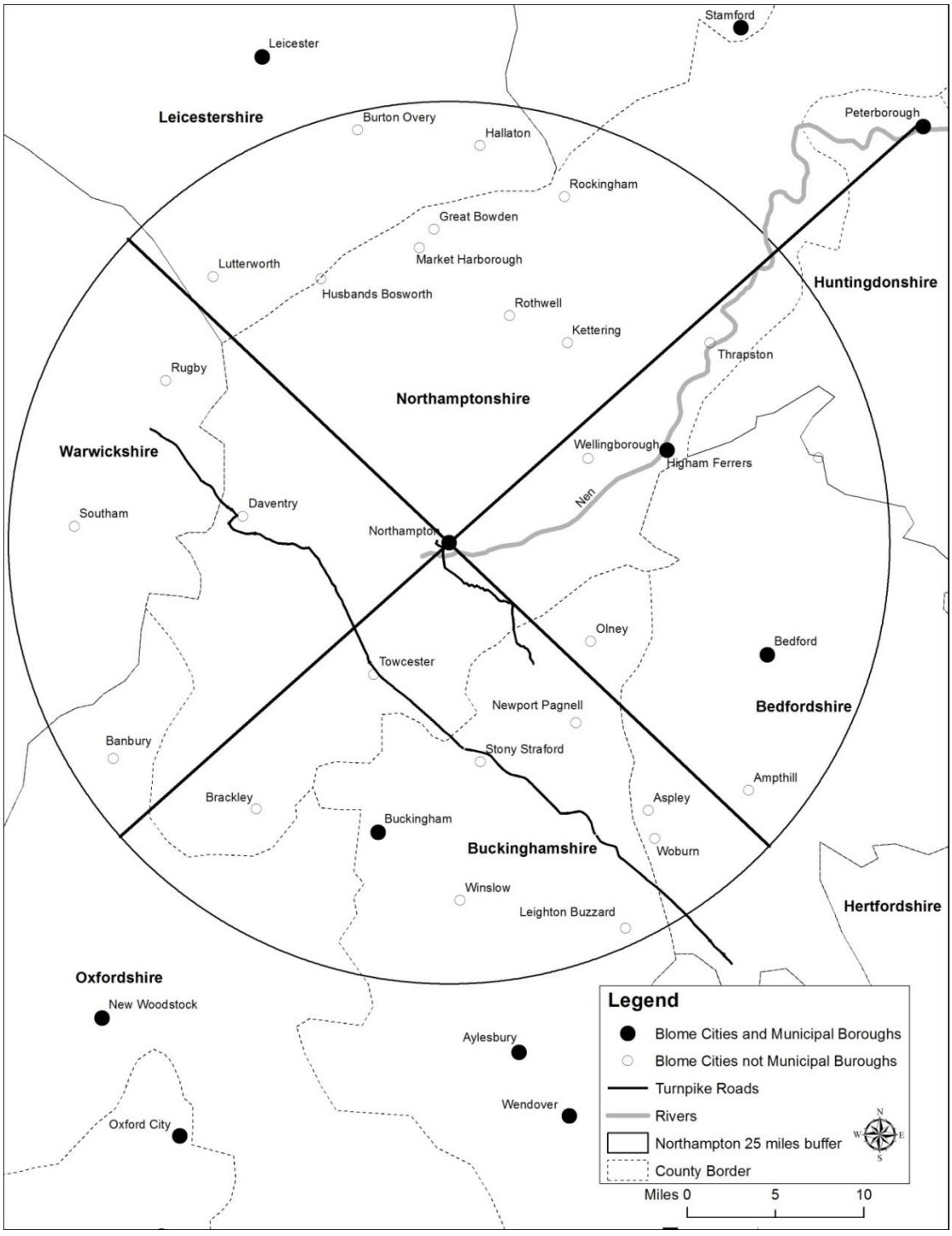
Table 2: Bills for new River Navigation Projects, 1690-1741

Parliament	Bills	Acts
1690-1695	2	0
1695-1698	8	2
1698-1700	10	5
Jan. 1701	1	0
Nov. 1701	2	1
1702-1705	5	1
1705-1708	2	1
1708-1710	1	0
1710-1713	5	1
1713-1715	1	1
1715-1722	12	9
1722-1727	4	4
1727-1734	5	3
1734-1741	9	3
All	67	31

Sources: see text.

The *Journals* give a brief description of each river project proposed in a bill, including the towns they passed through. I use this description to match bills with towns of economic significance. An example for the town of Northampton is shown in figure 2. In the 1713 to 1715 parliament, there was an act to extend navigation on the river Nene to Northampton. I also match other transportation improvements authorized by acts like the establishment of turnpike roads. In the 1708 to 1710 parliament there was an act creating a turnpike road in Northampton which is illustrated in figure 2.

Figure 2: Rivers and Towns near Northampton



Sources: see text.

I use Richard Blome's *Britannia* as my source for all British towns who are potential 'adopters' of river acts. Blome's lengthy book is a guide to all important market towns in England, Wales, and Scotland. It is rarely used in British economic history, but to my knowledge, there is no other source which gives such detailed data on urban areas in the late 1600s. Blome's guide includes large cities like London, Bristol, and Norwich. It also includes small and medium sized towns that would later become industrial and shipping centers like Manchester and Liverpool. Blome also describes towns' economic and political features in the 1660s and 1670s when he wrote. He identifies whether the town has manufacturing or mining and gives a description of infrastructure, such as whether the town had river navigation, notable roads, or a coastal harbor. Social services are also described including whether a free school was provided in the town and whether there was an alms house for the poor. Blome provides information on local government too such as whether the town had a mayor, council, or other types of public officials. Lastly, Blome also provides a map of each county that includes towns, waterways, and coastal features.[5]

Blome is used in several ways. First, his list of 782 towns in England and Wales is taken as the group of towns to be studied. Second, Blome's description is used to classify town's economic and political characteristics. As population data is not provided, I linked the towns in Blome with 1670 parish population estimates provided by the Cambridge Population History group. The town population data is used to construct a variable for each town's market potential. The details of the linking and variable construction are described in the appendix. Third, Blome's maps are used to identify which towns were inland and located near rivers or streams that could

[5] Blome's maps were supplemented by Robert Morden's, *The New Description of the State of England*, written in the 1690s. Morden provides maps of roads in each county before turnpikes.

be made navigable. The sub-population of 419 towns that could get river navigation in 1690 is labelled the list of 'candidate towns' for river navigation.

Crucially for the analysis all the towns in the Blome list are geo-coded to create spatial variables. Also the route of a river or stream is traced from each town in the candidate list to the coast or the head of river navigation using Google maps.[6] The total route distance in miles is recorded along with the starting elevation at the town and then again at the coast or navigation head. The difference between the two gives the elevation change. The traced river route also identifies the location of nearby towns that are 'downstream' and 'upstream' from the navigation project. An example is shown in figure 2. A straight line is drawn from Northampton to Peterborough, the navigation head for the Nene in 1690. A perpendicular line is also shown dividing the upstream region to the southwest of Northampton and the downstream region to the northeast. In the upstream and downstream spaces within 25 miles there are several towns from Blome's list.

Overlaid on the spatial data for towns and acts is political data for constituencies in the House of Commons. For England and Wales, there are 53 county constituencies and 220 municipal boroughs. Most county and borough constituencies are represented by two MPs but there are some with one or four. The boroughs are included in Blome's list of towns. Counties are identified in space by their most central point. As an illustration, in figure 2 the towns with dark-filled circles are boroughs represented in the Commons and dashed lines represent county boundaries.

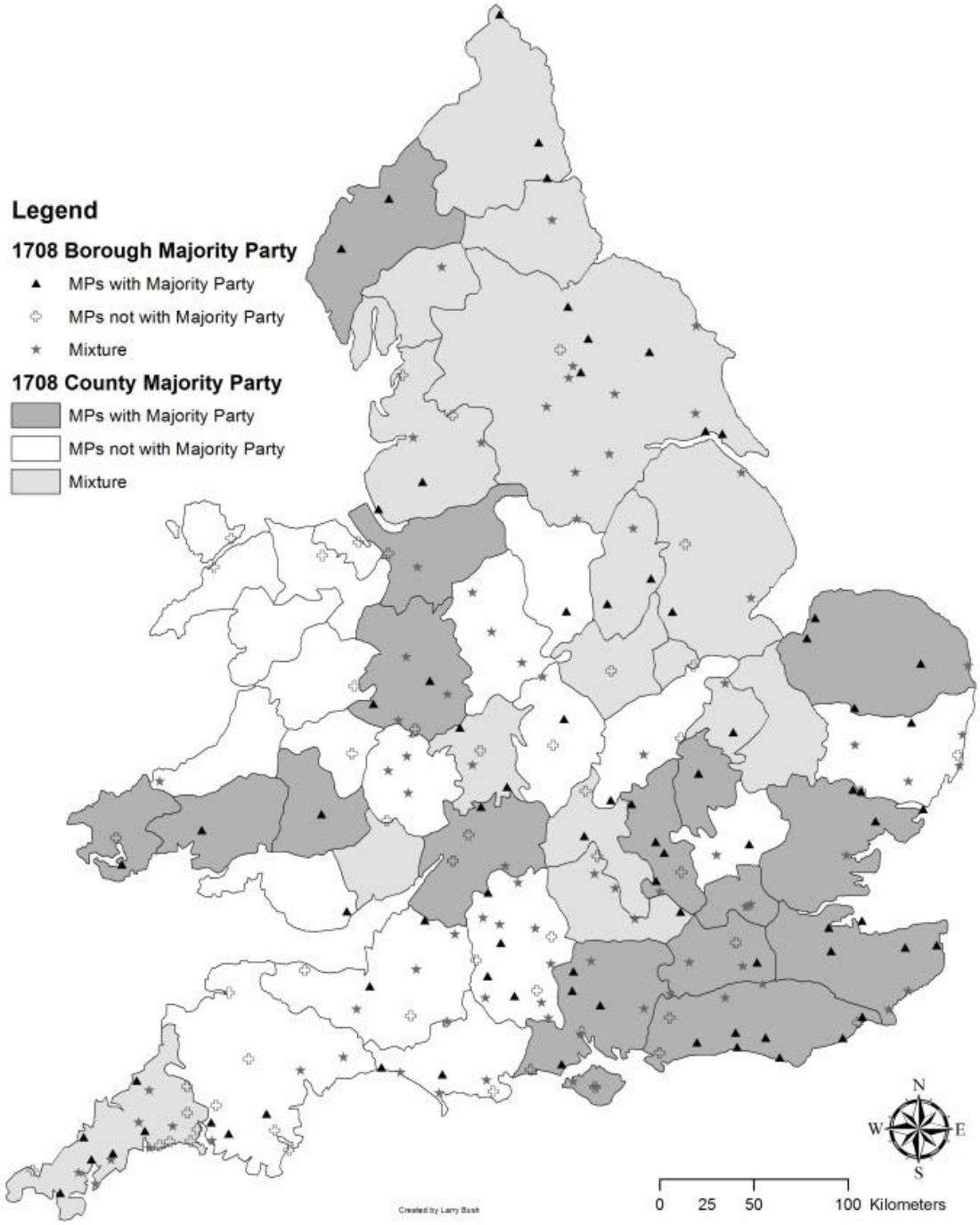
[6] A particularly useful program was http://bikehike.co.uk/index.php which provides a 'course creator' tool.

The political data for each constituency includes an indicator for whether it had a contested election in the most recent election. A contest involved two or more candidates for the same seat in the Commons and provides an indicator of local political competition. Contests are documented in *the History of Parliament* (Cruickshanks, Handley, and Hayton 2002, Sedgwick 1970). The same source also documents the political tenure of each MP in a constituency allowing for a measure of incumbency. I define an incumbent as an MP that served an entire parliament in the same constituency and was also the MP for that constituency at the end of the previous parliament.

Most important for this paper, the political data for each constituency includes information on whether MPs were affiliated with the majority party in the Commons. Until recently there has been no available data for the party affiliation of every MP. Elsewhere, I detail how to identify whether each MP was affiliated with the Whigs or Tories when they had a majority in the Commons for all parliaments from 1690 to 1741 (Bogart 2013). The political classification draws on division lists which identify party affiliation directly or voting on major pieces of legislation associated with the leaders of the two parties. The party-MP data are used to measure the number of majority party MPs across constituencies for every parliament. Figure 3 provides an illustrative map of party classifications for the 1708 parliament when the Whigs were the majority.[7] In this and other parliaments, there was variation in majority party representation across space with regions like the southeast tending to be more Whig.

[7] Municipal Boroughs are cities indicated with symbols. Counties are outlined with white, light grey, or dark grey backgrounds. The darkest boroughs or counties are where most MPs were with the Whig majority. A constituency is considering to be well represented by the majority party if the fraction of MPs in the majority is above 0.8. A constituency is not well represented if the fraction of MPs in the majority party is below 0.2. The consistency has mixed representation if the fraction of MPs in the majority party is in-between 0.2 and 0.8.

Figure 3: Geography of Whig Majority Party Representation in 1708



Sources: see text.

The final step is the creation of spatial variables for town's political characteristics based on nearby constituencies. As I will justify shortly, the key explanatory variables for river acts are the number of majority party MPs in the county of the candidate town and the number of upstream and downstream majority party MPs in constituencies within 25 miles of a candidate town. Other variables are the number of contests and incumbent MPs in upstream and downstream constituencies within 25 miles.

The summary statistics are provided in table 3. Each cell pertains to one of 419 candidate towns matched to one of the 14 parliaments spanning 1690 to 1741. The main outcome variable, 'River Act,' is an indicator for whether the town had a navigation act in that parliament. 51 out of the 419 candidate towns got river navigation acts from 1690 to 1741 and no town had more than one river act.[8] As a result if the adopting town got a river act in a parliament they are dropped from all subsequent parliaments. Note also that a single river act could apply to several towns. In the estimation, I address the cross-sectional dependence between towns.

Another outcome variable is 'River Bill,' an indicator for whether the town had a navigation bill introduced in that parliament. There were about two times as many river bills as river acts indicating that the success rate for bills was around 50%. Later in the paper I will separately analyze the factors affecting the introduction of bills and the success of bills once introduced.

The remaining variables incorporate political and economic characteristics of towns and nearby towns and constituencies. To give two examples: (1) 'Manufacturing' is an indicator if the town has manufacturing activity according to Blome and (2) 'Manufacturing, Upstream &

[8] Note also there are three towns that Blome records as having a harbor or having river navigation in 1670, but are included in the candidate list because by 1690 they report in the *Journals* that their navigation had deteriorated due to maintenance or changes in environmental conditions.

within 25 miles' counts the number of towns with manufacturing activity that are upstream and within 25 miles.

Table 3: Summary Statistics

Units: town-parliaments				n=5813	
		Adoption variables			
	mean	st. dev.		mean	st. dev.
River Act	0.009	0.093	Previous Turnpike Acts within 25 miles	45345	45345
River Bill	0.018	0.134	Previous Rivers Acts within 25 miles	45345	45345
		Political variables			
	mean	st. dev.		mean	st. dev.
Majority MPs upstream, 25 miles	4.426	3.65	Majority MPs downstream, 25 miles	3.854	3.057
Contests upstream, 25 miles	2.13	1.937	Contests downstream, 25 miles	1.869	1.639
Incumbent MPs upstream, 25 miles	4.351	3.57	Incumbent MPs downstream, 25 miles	3.862	3.235
Majority MPs county	0.844	0.789			
		Town characteristics			
	mean	st. dev.	variable	mean	st. dev.
Manufacturing	0.211	0.408	Alms House	0.02	0.141
Mining	0.037	0.19	Local Government Officials	0.211	0.408
Harbor	0.008	0.09	Market Potential Local (000s)	16.801	9.086
Major Highway	0.632	0.482	Market Potential distant (000s)	8.436	14.747
Coast or Navigable River	0.002	0.049	Elevation Change (feet)	146.53	132.51
Free School	0.079	0.27	Distance to navigation head (miles)	28.062	19.381
Southwest	0.208	0.406	Southeast	0.219	0.414
West Midlands	0.156	0.363	East Midlands	0.15	0.357
Wales	0.072	0.258	North	0.192	0.394

Characteristics all towns Up & within 25 miles

	mean	st. dev.		mean	st. dev.
Manufacturing	2.377	2.268	Local Government Officials	2.907	1.626
Mining	0.391	0.782	Market Potential Local (00,000s)	2.82	3.844
Harbor	0.642	1.005	Free School	1.029	1.243
Major Highway	8.148	6.061	Alms House	0.327	0.687
Coast or Navigable River	1.809	3.229			

Characteristics all towns down & within 25 miles

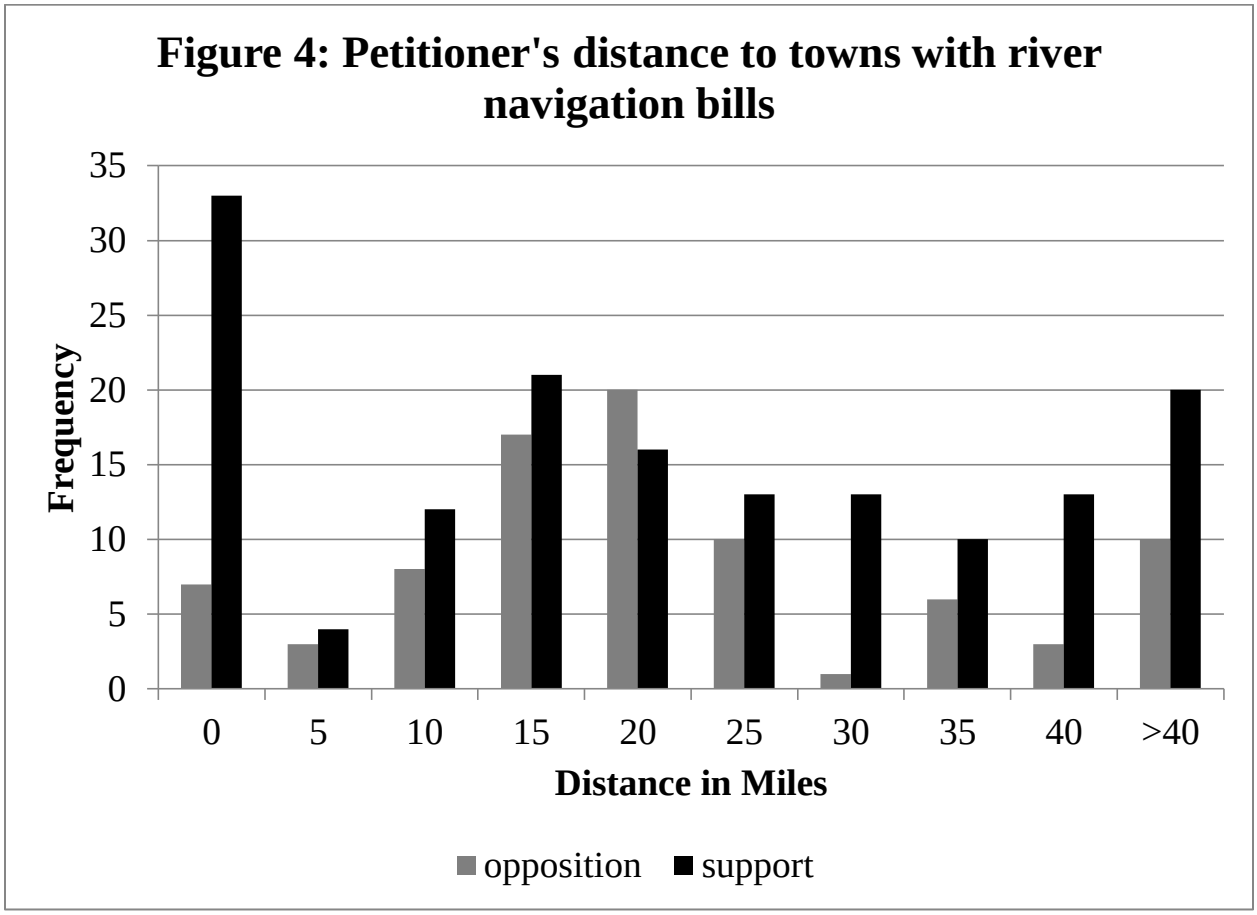
	mean	st. dev.		mean	st. dev.
Manufacturing	2.341	2.17	Local Government Officials	2.507	1.518
Mining	0.386	0.697	Market Potential Local (00,000s)	2.604	3.126
Harbor	0.408	0.751	Free School	0.871	1.154
Major Highway	8.308	5.856	Alms House	0.308	0.623
Coast or Navigable River	1.583	2.644			

IV. Identifying locations of Support and Opposition

The main explanatory variables in this paper are the number of upstream and downstream majority party MPs within 25 miles. They are meant to capture the political connections of locations where opposition and support to acts was most likely. A justification for this approach comes from the evidence on petitions supporting and opposing bills found in the *Journals of the House of Commons*. The petitions data is processed through several steps. The first is to classify all petitions as supporting, opposing, or neither. Next, the stated locations of petitioners are matched to the towns in Blome. Not all petitions could be matched because some groups came from villages or rural areas not in Blome. There were 152 matched supporting petitions and 85 matched opposing petitions. The supporting petitions include the original petition that started the

bill. As a last step I compare the locations between supporting and opposing towns and the town to whom the bill was matched. If there are multiple towns matched to the bill, I chose the most upstream town to represent the bill's location.

Figure 4 shows the distribution of the distances between supporting petitioners and the most upstream towns associated with a river bill and the same for opposing petitioners. Supporting petitioners are clustered at distance zero which means they were in the town with the river navigation bill. There was support for river bills outside of the town too. In these cases, it appears to be roughly uniform over a 40 mile span. Most of the opposing petitioners were between 15 and 25 miles from the town with the river navigation bill.



Sources: see text.

There is another result that most supporting petitioners were upstream from the town with the river navigation bill and most opposing petitioners were downstream. Earlier I discussed how towns can be assigned to upstream and downstream areas using the direction between the navigation head and the candidate town (see figure 2). It is arbitrary to assign the petitioners from the candidate town to upstream and downstream areas, so I experiment with this definition. Panel A of table 4 shows the counts in upstream and downstream areas for opposing petitions and supporting petitions when the candidate town is included in the upstream. It is apparent that opposition groups tended to be downstream and supporters tended to be upstream. The standard t-test confirms that downstream status is significantly different in the two samples. Panel B shows the counts when the candidate town is dropped. The same pattern applies. Opposition groups tended to be downstream and supporters tended to be upstream.

Table 4: Opposition and Support for Bills in Upstream and Downstream towns

	Panel A: when candidate town is upstream			
	opposition		support	
	Upstream	Downstream	Upstream	Downstream
Number of obs.	31	54	122	33
t-stat for hypothesis that mean for downstream dummy is same in opposing and support sample				-7.71
p-value				0
	Panel B: when candidate town is dropped			
	opposition		support	
	Upstream	Downstream	Upstream	Downstream
Number of obs.	24	54	89	33

t-stat for hypothesis that mean for downstream dummy is same in opposing and support sample	-6.541
p-value	0

The patterns for support and opposition motivate my measurement of political connections. As most opponents to a town's river bill were downstream and within 25 miles of a town, the political connections of likely opponents for a candidate town's river act are measured by the number of downstream majority party MPs or downstream incumbent MPs within 25 miles. As most supporters were in the candidate town or were upstream some distance, the political connections of likely supporters to a candidate town's river act is measured by the number of upstream majority party MPs or upstream incumbent MPs within 25 miles. The number of majority party MPs in the county of the candidate town is also likely to reflect the political connections of supporters as they tended to be located uniformly within 40 miles. The degree of political competition in likely supporting and opposing areas is measured analogously by the number of upstream and downstream constituencies with a contest in the previous election.

V. Estimation and Identification Strategy

The 'baseline' equation describing the diffusion of river acts across England and Welsh towns is the following:

$$y_{it} = \beta_1 politics_{it} + \beta_2 acts25_{it-1} + \alpha_i + \delta_t + \varepsilon_{it}$$

where the variable $y_{it} = 1$ if candidate town *i* has a river act in parliament *t* and 0 otherwise, $politics_{it}$ is a vector of political characteristics in the town's county, in upstream areas within 25 miles, and in downstream areas within 25 miles, $acts25_{it-1}$ is a vector containing the total number of past river and turnpike acts for all towns within 25 miles after parliament $t-1$, α_i is

a town fixed effect, δ_t is a parliament fixed effect, and ε_{it} is the error term. In some specifications, the time-invariant town characteristics are included when interacted with a time trend. In the baseline model the standard errors are clustered on the town. Alternative estimates for the standard errors are also shown.

Readers will note that the baseline model is a linear probability model. Although it is not perfect, a linear probability model is a better alternative to the logit and probit models because it easily allows for the inclusion of town and parliament fixed effects, which capture unobservable factors.[9] Later I incorporate a probit a model when analyzing the introduction of bills and their success. The results are qualitatively similar to the linear model.

The key identification assumption is that political characteristics, like the number of upstream and downstream majority party MPs, are exogenous conditional on the inclusion of town fixed effects, parliament fixed effects, controls for past acts, and town-characteristic-specific trends. While the controls address some unobservable factors, one could still argue that time-varying unobservable factors contributed to the election of majority party MPs. Note there are at least two channels of behavior behind this argument. The first channel is that supporters who were considering the promotion of bills in the next parliament campaigned to get majority party MPs elected. The second is that opposition groups campaigned to get majority party MPs elected in order to improve their chances of rejecting a river navigation bill in a nearby town. The second channel is the least plausible because opposition groups could not easily anticipate if or when nearby towns would promote bills. Thus they could spend resources campaigning only to find out that the candidate town never planned to promote a bill.

[9] See Allison and Christakis (2006) for a discussion of fixed effects models for non-repeated events like technology adoption.

The first channel is more plausible because supporters knew of their plans and thus could take appropriate actions. The case of the river Avon bill suggests that this is not a theoretical consideration. Recall that the inhabitants of Bath promoted the bill. The two MPs who first presented the bill to the House of Commons were Trotman and Codrington, both of whom represented Bath in the Commons and were part of the Tory majority in the 1710 to 1713 parliament. In the election leading up to 1710, one Bath MP, Codrington, was supported by the Second Duke of Beaufort. The Duke is an important character because he is thought to have paid the fees to introduce the river Avon bill (Hanham 2002). It would appear that Codrington was elected in part to serve Beaufort's interest in the Commons.

To address these endogeneity concerns I decompose changes in the number of majority party MPs into two terms: one that is plausibly exogenous and the other that is potentially endogenous. The sources of variation in majority party affiliation for all MP-seats (e.g. John Smith representing Bedford borough) in the Commons between 1690 and 1740 are shown in table 5. On average 23% of the MP-seats went from the majority party to out of the majority party between parliaments and 24% of MP-seats went from out of the majority party to in the majority party. What caused these changes? In the case where MP-seats went from the majority party to out of the majority party, 49% (817 out of 1677) of the time there was a new majority party in the Commons and the same MP was elected and remained affiliated with their party now in the minority. The remaining reasons involve the election of new MPs or changes in incumbent MPs party affiliation. There is a similar pattern for cases when MP-seats changed from out of the majority to in the majority.

Table 5: sources of Variation in the Party affiliation of MP-Seats, 1690-1741

Number of MPs with seats at start of Parliament	7182
Number of MP seats that went from Majority Party to out of Majority Party	1677
Number of MP seats that when from out of Majority Party to with Majority	1689
Reasons for a seat going from Majority Party to out of Majority Party	
Same majority party and new MP that is not with majority	366
Same majority party and same MP that is not with majority anymore	76
New majority party and new MP that is not with majority	418
New majority party and same MP that does not change to majority	*817*
Reasons for a seat going from not with Majority Party to with Majority Party	
Same majority party and new MP with majority	348
Same majority party and same MP that changed to majority	136
New majority party and new MP that is with majority	353
New majority party and same MP now with majority	*852*

I use the constituencies where there was a new majority party in the Commons and the same MP was elected and remained affiliated with their party as an exogenous source of variation for changes in the majority party MPs near towns.[10] The idea is that in these constituencies the skills and party connections of MPs did not change, but because there was a change in the majority party in the Commons beyond their control they experienced an exogenous change in *majority party* connections. The next section reports the results for the baseline model and for several extensions including specifications that test whether the number of majority party MPs is endogenous.

VI. Results

[10] More specifically, I calculate the change in majority party status for each MP-seat and then I calculate the change that was exogenous and potentially endogenous as just described. Then I sum over the changes in MP-seats within a 20 or 25 mile distance of a town.

Table 6 shows the estimation results. Column 1 is the baseline and includes town and parliament fixed effects. Column 2 adds region-specific time trends and town-characteristic-specific time trends as controls. Column 3 is the same as 2 but adds a set of characteristic-specific time trends for all upstream and downstream towns within 25 miles. Column 4 is the same as 3 but reports Driscoll-Kraay standard errors which incorporate cross-sectional dependence between towns (see Driscoll-Kray 1998, Hoechle 2007). Across all specifications, having more majority party MPs in the county significantly raises the probability of river acts. The opposite pattern is observed for majority party MPs downstream and within 25 miles. Here the coefficient has a negative and significant sign in all specifications. Having more majority party MPs upstream and within 25 miles raises the probability of river acts, but the coefficient is not significant in the baseline model and when Driscoll-Kraay standard errors are reported. With the exception of the last result, these results suggest that the adoption of river acts was indeed affected by the political connections of likely supporters and opponents.

Other results in table 6 show that more incumbents within 25 miles had little influence as did more upstream contests. On the other hand, having more contests downstream and within 25 miles significantly lowers the probability. The result suggests that political competition in areas where opposition was more likely worked against river acts. Having more turnpike acts increases the probability of a river act suggesting there was a complementarity between the two. There is no significant complementarity between previous river acts nearby and current river acts.

Table 6: River Acts: baseline regressions

Variables	1 coeff. st. error	2 coeff. st. error	3 coeff. st. error	4 coeff. st. error
Majority MPs, county	0.0046 0.0021**	0.0049 0.0021**	0.0047 0.0021**	0.0047 0.0026*
Majority MPs, up 25 miles	0.0011 0.0007	0.0012 0.0007*	0.0015 0.0008**	0.0015 0.001
Majority MPs, down 25 miles	-0.0021 0.0001***	-0.002 0.0007***	-0.0021 0.0007***	-0.0021 0.0008**
Incumbent MPs, up 25 miles	0.0001 0.0005	0.0001 0.0006	0 0.0006	0 0.0006
Incumbent MPs, down 25 miles	0.0008 0.0005	0.0007 0.0005	0.0005 0.0005	0.0005 0.0005
Contests, up 25 miles	-0.0006 0.0011	-0.0003 0.0011	-0.0006 0.0011	-0.0006 0.0013
Contests, down 25 miles	-0.0028 0.0012**	-0.0023 0.0011*	-0.0028 0.0012**	-0.0028 0.0016*
Previous turnpike acts, 25 miles	0.0014 0.0007**	0.0019 0.0008**	0.0025 0.0008***	0.0025 0.0011**
Previous river acts, 25 miles	0.0039 0.0028	0.0041 0.0031	0.0032 0.0031	0.0033 0.0049
Parliament and town fixed effects	yes	yes	yes	yes
Region and town-characteristic trends	no	yes	yes	yes
town-characteristics trends, 25 miles	no	no	yes	yes
Driscoll-Kraay standard errors	no	no	no	yes
N	5813	5813	5813	5813
R-square	0.007	0.01	0.011	0.04

Notes: Standard errors are clustered on towns. *,**, and *** represent statistical significance at the 1%, 5% and 10% level.

Endogeneity Concerns

As noted earlier I decompose changes in the number of majority party MPs into two terms: one that is exogenous and the other that is potentially endogenous. The exogenous changes come from parliaments where there was a new majority party in the Commons and in constituencies where the same MP was elected and remained affiliated with their party. It is exogenous because the constituency did not control who was the majority party and it did not elect a new MP to influence its affiliation with the majority party. To make use of this information, I analyze a 'differences' version of the baseline model. In the case of river acts, the differences model is

$$\Delta y_{it} = \beta_1 \Delta majority\ MPs_{it} + \beta_2 \Delta acts25_{it-1} + \beta_3 x_i + \delta_t + \varepsilon_{it}$$

where Δy_{it} is the change in town *i's* river act outcome from parliament *t-1* to *t*, $\Delta majority\ MPs_{it}$ is a vector representing the change in majority party MPs at the county or in nearby constituencies from parliament *t-1* to *t*, $\Delta acts25_{it-1}$ is defined analogously, and x_i includes regional indicators, economic characteristics for the town, and characteristics for all up and downstream towns within 25 miles. I estimate three versions of this model. The first is OLS and is potentially biased. The second is IV where $\Delta majority\ MPs_{it}$ is instrumented with the exogenous component. The third is a reduced form of the IV model and includes only the exogenous component of $\Delta majority\ MPs_{it}$.

The results are reported in table 7. In OLS the three variables for changes in majority party MPs have the expected sign, but none is statistically significant. In the IV model, the coefficients for changes in county majority MPs and upstream majority MPs within 25 miles decrease significantly in magnitude. However, in the IV model the coefficient for changes in downstream majority party MPs within 25 miles is similar and in fact increases slightly to become

statistically significant (albeit at the 10% level only). In fact, the chi-square test implies that I cannot reject the hypothesis that the change in downstream majority party MPs within 25 miles is exogenous. In the last model the conclusions are similar. The exogenous component of the change in downstream majority party MPs within 25 miles is similar in magnitude and statistically significant. Variables for the change in county and upstream majority party MPs are not significantly related to river acts.

Table 7: River Acts: OLS and IV models for differences specification

Variables	(1) OLS coeff. st. error	(2) IV coeff. st. error	(3) Exogenous component only coeff. st. error
Change Majority MPs, county	0.0016 0.0016	0 0.0017	0 0.0016
Change Majority MPs, up 25 miles	0.0008 0.0006	0.0001 0.0006	0.0001 0.0006
Change Majority MPs, down 25 miles	-0.001 0.0006	-0.001 0.0006*	-0.0011 0.0006*
Change previous turnpike acts, 25 miles	0.0013 0.0009	0.0013 0.0009	0.0013 0.0009
Change Previous river acts, 25 miles	0.0131 0.0070*	0.0129 0.007*	0.013 0.0069*
Parliament FE, region FE, town characteristics, characteristics for all up and downstream towns	yes	yes	yes
N	5378	5378	5378
First Stage			
Cragg-Donald Wald F statistic		1737.97	
Endogeneity Test: Change Majority MPs, down 25 miles			

Chi-sq(1)	0.626
P-value	0.429

Notes: Standard errors are clustered on towns. *,**, and *** represent statistical significance at the 1%, 5% and 10% level.

Based on these results it would appear that OLS is biased upwards for variables measuring the political connections of likely supporters to river acts. The most likely explanation is that supporters campaigned for majority party MPs in order to assist in getting river bills passed. On the other hand, OLS does not appear to be biased for variables measuring the political connections of likely opponents to river acts. Opponents had a more difficult time campaigning for majority party MPs to reject bills because they did not know when such bills would be introduced. As a result, they might needlessly expend resources with little gain.

Further Robustness Checks

In the previous models, majority party strength is measured at 25 miles because petitioner's opposing river bills were generally within 25 miles from candidate towns. While there is good justification for using 25 miles in the estimation other distance scales could give different results. To check this, the model was re-run replacing variables measured at 25 miles with variables measured at 20 miles or 30 miles. The results are shown in table 8. The specification is the same as column 3 in table 6. It includes town and parliament fixed effects, region specific time trends, town characteristic specific time trends, and characteristic specific trends for all towns upstream and downstream. For comparison the results where variables are measured at 25 miles are also reported in the first column. As might be expected the coefficients change in magnitude when variables are measured at 20 or 30 miles, but they do not change in terms of statistical

significance. Thus none of the conclusions reached thus far is sensitive to 5-mile changes in the geographic scale of the variables.

Table 8: River Acts: Alternative Distance Scales

Variables	25 miles coeff. st. error	20 miles coeff. st. error	30 miles coeff. st. error	25 miles coeff. st. error
Majority MPs, county	0.0047 0.0021**	0.0041 0.0021*	0.0044 0.0021**	0.0041 0.0021*
Majority MPs, up	0.0015 0.0008**	0.0022 0.001**	0.0016 0.0007**	0.0013 0.0007*
Majority MPs, down	-0.0021 0.0007***	-0.0021 0.0008***	-0.0018 0.0006***	-0.0025 0.0008***
Incumbent MPs, up	0 0.0006	0 0.0008	0 0.0005	0 0.0006
Incumbent MPs, down	0.0005 0.0005	-0.0002 0.0006	0.0006 0.0005	0.0005 0.0005
Contests, up	-0.0006 0.0011	0.0001 0.0013	-0.0002 0.001	-0.0007 0.0011
Contests, down	-0.0028 0.0012**	-0.0012 0.0012	-0.0021 0.0011*	-0.0028 0.0011**
Previous turnpike acts	0.0025 0.0008***	0.0026 0.0011**	0.0018 0.0006***	0.0025 0.0008***
Previous river acts	0.0032 0.0031	0.0081 0.0047*	0.0024 0.0022	0.0033 0.0031
Majority MPs, 10 miles				0.0024 0.0014*

Parliament & town FE, all characteristic specific trends	yes	yes	yes	yes
N	5813	5813	5813	5813
R-square	0.012	0.013	0.012	0.012

Notes: Standard errors are clustered on towns. *,**, and *** represent statistical significance at the 1%, 5% and 10% level.

The last specification in table 8 reveals a result of additional interest. It has the 25 mile scale as in the baseline model but now the number of majority party MPs within 10 miles is added as an additional variable. The results show that conditional on all other variables, having more majority party MPs within 10 miles raises the probability of a river act (albeit at a marginal statistical significance). This variable could reflect the political connections of river bill supporters who tended to be very close to the candidate town and thus were within 10 miles.

The results thus far are based on the assumption that political variables have the same effect when the Whigs or Tories were in the majority. They need not be the same however if the two parties employed different targeting strategies. The differences between the Whigs and Tories are investigated by including an indicator variable for parliaments with Whig majorities interacted with all the political variables. The model again includes town and parliament fixed effects and the previous time trend controls.

The results are shown in table 9. The first column reports the direct effect of each political variable and the second shows the coefficients on the interaction terms. The last column tests whether the sum of the direct and interaction terms are different from zero. It indicates whether the political variable had a statistically significant effect under Whig majorities. The results show a number of differences between the parties. Under Whig majorities the positive effect of having more majority party MPs in the county and the negative effects of more majority party MPs and

contests downstream are all greater in magnitude. Also there is a positive effect of having more incumbents downstream under Whig majorities, but there is no effect of downstream incumbents under Tory majorities.

Table 9: River Acts: Baseline with Whig Majority Interactions

Variables	Direct Effect coeff. st. error	Interaction with Whig Majority coeff. st. error	Hypothesis test: direct + interaction effect=0 F stat P-value
Majority MPs, county	0.0026 0.0028	0.0039 0.0051	3.07 0.08
Majority MPs, up 25 miles	0.0015 0.0009*	-0.0002 0.0011	1.83 0.177
Majority MPs, down 25 miles	-0.0015 0.0009	-0.0011 0.0011	8.9 0.003
Incumbent MPs, up 25 miles	-0.0005 0.0006	0.0014 0.0007**	1.45 0.229
Incumbent MPs, down 25 miles	-0.0003 0.0006	0.0017 0.0009*	4.16 0.042
Contests, up 25 miles	0.0006 0.0012	-0.0022 0.0015	1.19 0.277
Contests, down 25 miles	-0.0013 0.0013	-0.0027 0.0014*	7.73 0.006
Previous turnpike acts, 25 miles	0.0027 0.0008***		
Previous river acts, 25 miles	0.0031 0.0031		

Parliament & town FE, all characteristic specific trends			yes
N	5813	R-square	0.012

Notes: Standard errors are clustered on towns. *,**, and *** represent statistical significance at the 1%, 5% and 10% level.

The quantitative difference between the two majority parties is illustrated in table 10. It shows the effects of increasing various downstream variables relative to the mean probability that a town got a river act. For example, in the upper left hand box the numbers imply that a town was 13.6% less likely to get a river act relative to the mean if there was a Whig majority and it had one more majority party MP, one more incumbent, but the same number of contests downstream and within 25 miles. What is most notable is the large quantitative effects of contests under Whig majorities. It appears that Whig majorities were more susceptible to the effects of political competition. One explanation is that the Whigs were more effective in targeting their policies to gain votes. Interestingly they appear to be targeting vested interests more aggressively, which goes against theories that Whig majorities were pro-economic development compared to Tory majorities.[11]

While there are differences between Whig and Tory majorities, it would be an over-statement to argue that the two parties implemented very different strategies. Notice that having more majority party MPs downstream lowered the probability of an act under both party majorities. The same is true of downstream contests. Therefore, many of the same patterns of political and economic behavior were present under the Whig and Tory majorities.

[11] It has been argued that the rise of the Whig party following the Glorious Revolution was especially important for Britain's development. The Whigs are claimed to be more pro-development than the Tories by fostering a manufacturing and financial sector (Pincus 2009, Pincus and Robinson 2012, Dudley 2013) and by providing a stronger commitment to protect bondholder rights (Stasavage 2005).

Table 10: Differences in the effect of Downstream Political Connections and Contests under Whig and Tory Majorities

	Same # Contests			1 more contest	
	Whig Majorities			Whig Majorities	
	Same # majority MPs	1 more majority MP		Same # majority MPs	1 more majority MP
Same # Incumbents	0	-0.296	Same # Incumbents	-0.456	-0.752
1 more Incumbent	0.16	-0.136	1 more Incumbent	-0.296	-0.592
	Tory Majorities			Tory Majorities	
	Same # majority MPs	1 more majority MP		Same # majority MPs	1 more majority MP
Same # Incumbents	0	-0.171	Same # Incumbents	-0.148	-0.319
1 more Incumbent	-0.034	-0.205	1 more Incumbent	-0.182	-0.353

Notes: the effects come from the coefficients in table 9. They are divided by 0.0088, the unconditional probability of a river act.

VII. Behavioral Mechanisms

The results show a strong negative relationship between the political connections of likely opponents and the diffusion of river acts. What type of behavior can explain this outcome? In this final section, I examine the promotion of river navigation bills across towns, the success of river bills in the Commons, and the relationship between river bills and the electoral success of the majority party in constituencies where opposition was most likely.

In order for a town to get a river navigation act someone had to petition for a river navigation bill. The decision to 'promote' a bill was presumably carefully thought out as it involved

significant time and expense. One possibility is that promoters were rational, informed, and forward looking. They understood how political connections influenced the likelihood of their bill's success and they were informed about the connections of likely supporters and opponents. Promoters understood how lobbying would influence the likelihood of success and they anticipated how much lobbying supporters and opponents would undertake. In short, they took all of these factors into account when making the decision to promote a river navigation bill. Another possibility is that promoters did not understand how political connections influenced the success of their bill in parliament or they were misinformed about the connections of others. They might have also failed to anticipate how much lobbying would occur. In this view of the world, promoters only considered the likely financial returns to projects once approved, and not the political factors that would influence a bill's success in Parliament.

A simple model can illustrate these possibilities. Suppose the promoter has an exogenously given expected financial return *b* if the project is approved and completed. To get approved, the promoter needs to pay a fixed processing cost *F* and their bill needs to succeed in Parliament. Supposing that a bill is introduced, let its probability of success be $= \frac{\pi+A_p+L_p}{1+A_p+L_p+A_o+L_o}$, where A_p measures the political connections of the promoter, A_o measures the political connections of the opposition, L_p is lobbying in favor of the promoter's bill, L_o is lobbying by the opposition against the bill, and π represents the baseline probability of success when political connections and lobbying are zero. Notice that higher lobbying by the opposition or greater political connections for the opposition lower the bill's probability of success. The promoter is assumed to have a belief about their bill's probability of success which may differ from reality because of misinformation about connections, lobbying, and their effects. Let the promoter's belief for their

bills probability of success be $p_p = \frac{\pi + I_p A_p + E[L_p]}{1 + I_p A_p + E[L_p] + I_p A_o + E[L_o]}$, where all previous variables are the same and I_p is an indicator function that equals 1 if the promoter has the correct belief about political connections and 0 otherwise. $E[L_p]$ is the promoter's expectation about how much lobbying will be done by supporters and $E[L_o]$ is their expectation about how much lobbying will be done by opponents. Notice that if the promoter has the correct beliefs and rational expectations about lobbying then $p_p = p$, otherwise $p_p \neq p$.

The next step is to consider the promoter's decision to introduce a bill. They will do so if their expected gain $p_p b$ exceeds the fixed cost F. In the case that the promoter has incorrect beliefs about political connections then they will introduce the bill if $b\pi + (b - F)E[L_p] > F(1 + E[L_o])$. Here political connections will not influence their decision. Instead what matters are the projects expected financial returns b, fixed costs F, and the expected lobbying amounts $E[L_p]$ and $E[L_o]$. In the case that the promoter has correct beliefs then they will introduce the bill if $b\pi + (b - F)(E[L_p] + A_p) > F(1 + E[L_o] + A_o)$. Here greater political connections by opposition groups A_o will decrease the likelihood that the promoter introduces the bill and greater political connections by supporters A_p will increase the likelihood.

In the data I can easily examine whether political connections influenced the introduction of river bills by running the same regressions as before except replacing the river act outcome variable with an indicator for whether a town had a river bill introduced in that parliament. The results are reported in column 1 in table 11. It is the same specification as the river act regression in table 6 that includes all controls including town fixed effects, parliament fixed effects, region specific trends, and all town characteristic specific time trends. Interestingly none of the variables for political connections has a significant effect on the probability of a river bill being

introduced in a town. The only result that carries over from the river act model is that having more contests downstream and within 25 miles lowers the likelihood of a river bill. Drawing on the theoretical model above, it appears that promoters did not have the correct beliefs about political connections.

It follows from the previous results that political connections must have influenced the success of bills once introduced in Parliament. To investigate this channel, I estimate a probit model where the probability of a bill's success is a function of political variables along with the number of opposing and supporting petitions matched to nearby towns. Recall that the matched petitions were used earlier to identify the locations of likely supporters and opposition groups. Here I use them as proxies for the amount of lobbying by supporters and opponents. Note that there is a potential problem in analyzing the success of bills because unobservable factors correlated with political variables might influence which bills got introduced and thus bias the estimates. There is another potential problem in that supporting and opposing petitions are endogenous. I deal with this in two ways. First, I estimate a Heckman selection equation for bills along with a probit equation analyzing the determinants of a bill's success. Second, in a standard linear probability model I instrument for the number of opposing and supporting petitions using characteristics for towns, for downstream towns within 25 miles, for upstream towns within 25 miles along with region fixed effects and parliament fixed effects. Neither solution is perfect. The Heckman selection equation for whether a town has a river bill introduced includes the main political variables, town characteristics, characteristics for towns upstream and downstream within 25 miles, region fixed effects, and parliament fixed effects. It cannot include town fixed effects because convergence in the likelihood could not be achieved otherwise. In the IV model, the instruments for supporting and opposing petitions are weak and over-identification tests do

not provide strong evidence that they should be excluded. Despite the flaws in these two approaches, they still provide some insights on the role of political connections, which is the main focus here.

The results are reported in columns 2 to 4 in table 11. In column 2 the estimates from a standard probit model show that having more majority party MPs downstream and within 25 miles significantly lowers the probability of a bill's success. The same pattern holds in the Heckman selection model in column 3. In fact, the coefficients are nearly identical. One reason is that there is no evidence for a selection effect of bills as noted by the insignificant estimate of rho.[12] The IV linear probability model in column 4 yields the same finding for majority party MPs downstream and within 25 miles. Therefore, the general conclusion is that the main channel by which the political party connections of likely opponents influenced the adoption of river acts was through the approval process in Parliament and not through the selection of bills.

There are two other results of interest in table 11. First, having more incumbents upstream and within 25 miles increased a bill's probability of success, although the coefficient is marginally significant in two specifications and marginally insignificant in the other. Second more petitions opposing a bill lowered its likelihood of success and more petitions supporting increased its likelihood of success. This result is expected, but complicated to interpret given the potential endogeneity of lobbying.

[12] The results from the Heckman selection equation are not reported and are available upon request. The results appear reasonable. For example, towns with greater elevation changes have a lower likelihood of a river bill and towns with manufacturing and with greater market potential have a greater likelihood.

Table 11: River Bill Promotion and Bill success

	Baseline FE	Probit	Heckman Selection	IV Linear Probability
	Bill Promotion	Bill Success		
	1	2	3	4
Variables	coeff. st. error	coeff. st. error	coeff. st. error	coeff. st. error
Majority MPs, county	0.0027 0.0025	0.348 0.2039*	0.3339 0.2543	0.0866 0.0651
Majority MPs, up 25 miles	0.0007 0.0009	0.0215 0.1007	0.027 0.1152	-0.0014 0.031
Majority MPs, down 25 miles	-0.0003 0.0008	-0.4989 0.1279***	-0.4888 0.1406***	-0.1185 0.0317***
Incumbent MPs, up 25 miles	-0.0009 0.0007	0.166 0.0983*	0.1662 0.0977*	0.0424 0.0277
Incumbent MPs, down 25 miles	0.0007 0.0007	0.0873 0.0857	0.0825 0.0879	0.0133 0.0235
Contests, up 25 miles	-0.0026 0.0012**	0.1886 0.1307	0.1885 0.1294	0.0403 0.0391
Contests, down 25 miles	-0.0045 0.0017***	0.0076 0.1652	0.0095 0.1656	-0.0263 0.0423
Previous turnpike acts, 25 miles	0.0038 0.001***			
Previous river acts, 25 miles	0.0012 0.0035			
Opposing Petitions Towns		-0.1802 0.0635***	-0.184 0.0699***	-0.1001 0.0276***

Supporting Petitions Towns		0.1543	0.1546	0.0645
		0.0702**	0.0701**	0.0283**
parliament & town FE, all town characteristic specific trends	yes			
rho				
P-value for Wald test of indep. eqns. (rho = 0)			0.8818	
First Stage				
Cragg-Donald Wald F statistic				1.019
Hansen's J Statistic for overidentification				58.914
P-value for Hansen's J Statistic				0.0657
N	5813	107	107	107
R-square or Pseudo R-square	0.016	0.27		

Notes: Standard errors are clustered on towns. *,**, and *** represent statistical significance at the 1%, 5% and 10% level. The instruments for supporting and opposing petitions in column 4 are characteristics for towns, characteristics for downstream towns within 25 miles, characteristics for upstream towns within 25 miles, region fixed effects, and parliament fixed effects

The significance of political party connections in the approval of bills within Parliament suggests that party leaders were pursuing a targeting strategy. As noted earlier, there is a theory that majority parties target legislative benefits to core supporters in order secure their support in elections (Cox and McCubbins 1986). In this setting, the idea is that majority party leaders targeted rejections to the opponents of river bills when the majority party was well represented in their area because they wanted to retain opponent's electoral support. If party leaders behaved this way then one would expect that the success of the majority party in the next election would be better in downstream areas if they rejected river bills and worse if they approved bills. To test this theory I analyze a variable for the electoral outcomes for the majority party in downstream areas. It equals the number of MPs gained or lost by the majority party from the last election if it

maintained the majority in the Commons. If there is a new majority party then electoral outcomes equals the number of majority party MPs in the previous parliament minus the number of majority party MPs in the current parliament.[13] The second term is a proxy for the number of MPs that the previous majority party gained or lost to the new majority party. I am interested in majority party electoral outcomes only near towns where a river bill was introduced in the previous parliament. The main variable of interest is an indicator for whether the river bill failed. As I have argued throughout, the success or failure of a river bill is endogenous. To address this issue, I instrument for the failure of river bills with the number of majority party MPs downstream, upstream, and in the county in the previous parliament based on the fact that they determined the success or failure of bills. In another specification I also include the number of supporting and opposing petitions.

The results are reported in table 12. In column 1, OLS results show no significant effect from the failure of a river bill. However, in columns 2 and 3 the IV results indicate that the failure of a river bill significantly improves electoral outcomes for the majority party in downstream areas. These results provide a strong clue as to why the majority party was targeting the opponents of river bills. It helped them maintain their majority. In other words, there were electoral consequences to ignoring the power of vested interests. Were there any electoral gains from targeting the supporters of river bills? The answer is no. An unreported regression explaining majority party electoral outcomes upstream shows no relationship with failed river bills.

[13] More specifically Downstream majority party electoral outcomes near town *i* between parliament *t* and *t-1* is equal to (Majority MPs, down 25 milesit) − (Majority MPs, down 25 milesit -1) if there is no change in the majority party and (Majority MPs, down 25 miles$it-1$) − (Majority MPs, down 25 milesit) if there is a change in the majority party.

Table 12: Majority Party Electoral Outcomes Downstream and the Rejection of River Bills

Variables	OLS 1 coeff. st. error	IV 2 coeff. st. error	IV 3 coeff. st. error
River bill failed in previous parliament	0.1368 0.4304	2.9321 1.322**	2.1263 0.973**
Whigs Previous Majority Party	0.0189 0.596	0.924 0.7232	0.6631 0.5956
Change in majority party	-0.0158 0.5152	-0.5051 0.5985	-0.3641 0.5354
MPs, down 25 miles	0.1498 0.085*	0.2259 0.0822***	0.2039 0.0768***
Contests, down 25 miles	-0.3135 0.2102	-0.5938 0.2673**	-0.513 0.2307**
regional FE	yes	yes	yes
First Stage			
Cragg-Donald Wald F statistic		7.436	6.548
Hansen's J Statistic for over-identification		0.937	4.712
P-value for Hansen's J Statistic		0.626	0.3181
N	92	92	92
R-square or Pseudo R-square	0.204		

Notes: Standard errors are clustered on river bills. *,**, and *** represent statistical significance at the 1%, 5% and 10% level. The instruments in column 2 are the number of majority party MPs downstream, upstream, and in the county in the previous parliament. Column 3 adds instruments for the number of supporting and opposing petitions.

VIII. Conclusion

There were remarkable changes in Britain's political system after the Glorious Revolution. One of the most important was the emergence of a competitive two party system. The Whigs and Tories traded places as the majority party in the House of Commons seven times between 1690 and 1721. At the same time Britain embarked on many new policies, including the establishment of river navigation companies which extended the waterway network. In this paper, I study whether political party connections of vested interests influenced the diffusion of river navigation acts. The empirical analysis shows that the extension of navigation to a town was less likely when opponents of projects had more representation by the majority party in the Commons. I also show that political party connections affected the success of bills in parliament but not the selection of which bills got introduced. Lastly, I provide evidence that the rejection of river bills contributed to better electoral outcomes for the majority party in areas where opposition to river bills was more likely.

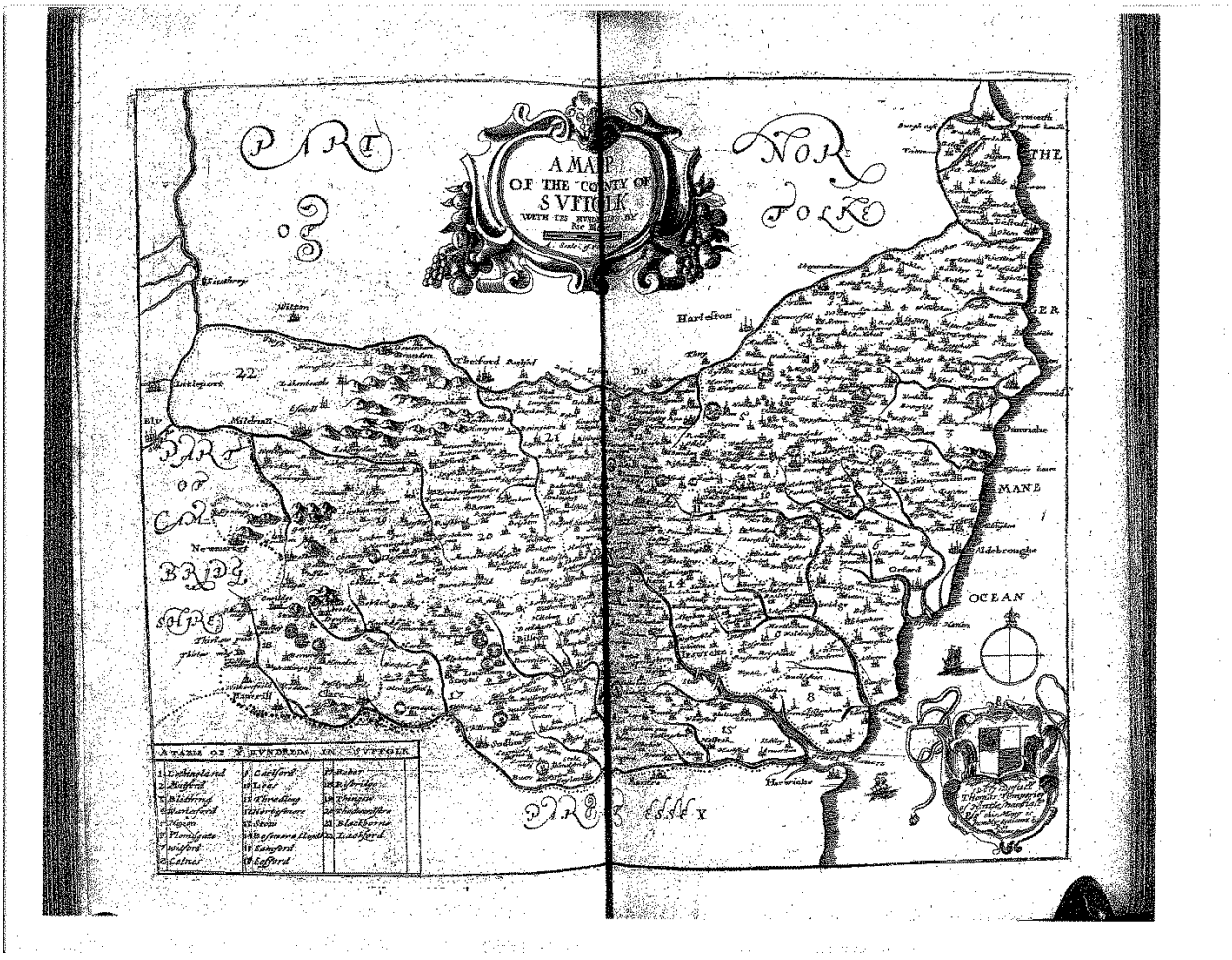
This paper contributes to the broader literature by identifying the effects of connections to the majority political party in a novel way. There is a potential endoegenity problem in which groups campaign to get majority party politicians elected in order to achieve legislative outcomes. I address this issue by decomposing changes in the number of majority party MPs into two terms: one that is exogenous and the other that is potentially endogenous. The exogenous changes come from parliaments where there was a new majority party in the Commons and in constituencies where the same MP was elected and remained affiliated with their party. The estimation results show that the political party connections of supporters are endogenous but they also show that the political party connections of opponents are likely to be exogenous allowing for an identification of their effects.

In establishing this result, the paper provides the first rigorous evidence that political party connections among vested interests can affect technology adoption. It complements the literature showing that political parties affect economic outcomes in historical contexts and today. It also complements the literature on vested interests, institutions, and the diffusion of technologies. This literature is motivated by the stylized fact that poor countries are slower to adopt best practice technologies and hence have lower productivity. Britain c.1700 was certainly not a poor country relative to its neighbors, but like poor countries today its politics sometimes slowed the adoption of legal technologies which Adam Smith believed were the greatest of all improvements.

Data Appendix

Richard Blome's *Britannia* provides a useful source for studying British towns in the eighteenth century. Blome has been criticized for plagiarizing other's work, but for the present purposes that is not relevant as Blome provides comprehensive information on towns. Blome also provides a map of each county that includes cities, waterways, and coastal features. An example of Blome's map for Suffolk County is provided in appendix Figure 1. Notice that the coastline is easily identified as are the main rivers and streams. Town names can be identified by a zoom on the map.

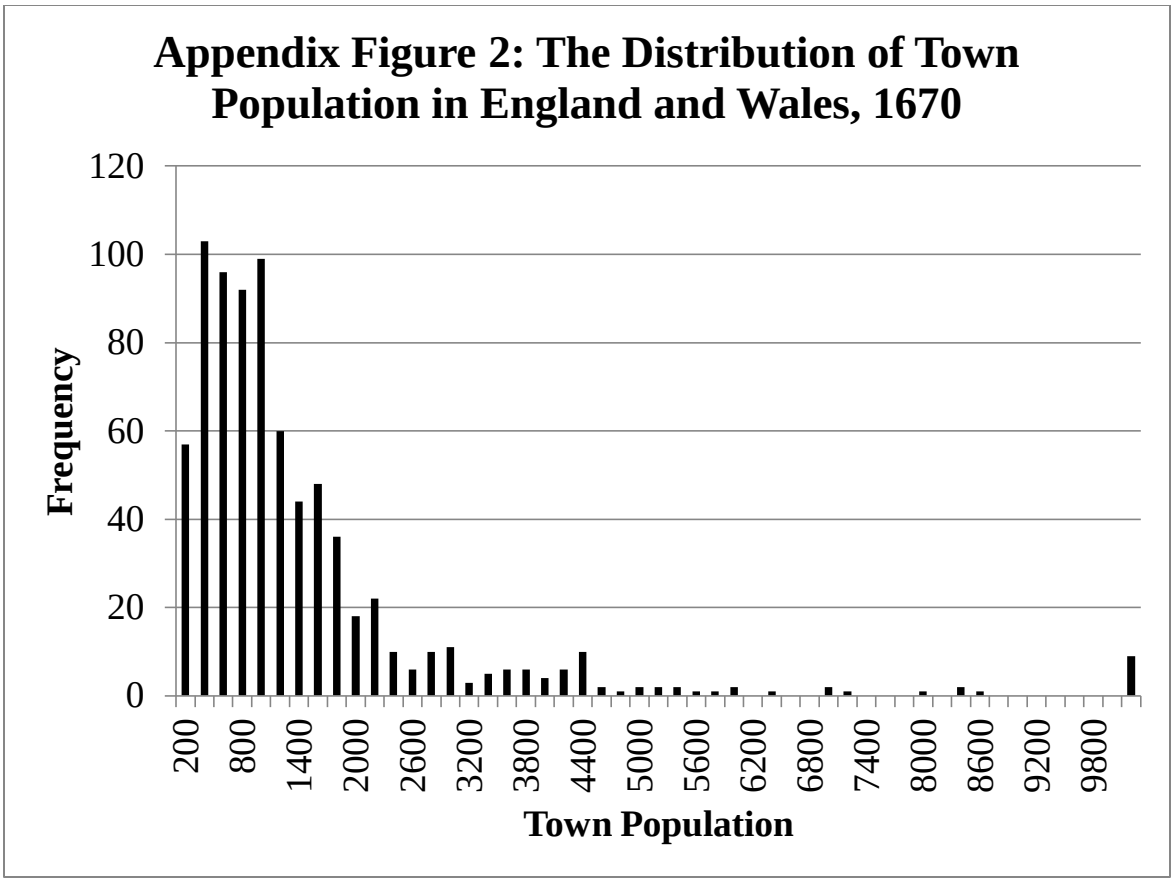
Appendix Figure 1: Richard Blome's Map of Suffok, 1673



Source: Blome (1673).

Blome's *Britannia* serves as a starting point for the analysis but it is necessary to supplement with other data. Not surprisingly Blome did not know the population of towns when he wrote in 1673. Official census-data on town populations was not available until 1801. Nevertheless the Cambridge Population History group has estimated the pre-1801 population of all parishes in England and Wales using census-like sources. The Cambridge Population History group has kindly provided their estimates of parish population in 1670 which I use to reconstruct the population of cities listed in Blome. The latter are matched with parishes in the Cambridge data and if necessary parishes are aggregated to form the boundaries of a town. Out of the 782 towns in the Blome list, 717 were successfully matched with the Cambridge data. The population of the remaining 65 towns was estimated using a model that predicts population from Blome's characteristics, most notably the amount of text he devotes to descriptions of each town.

The resulting town-level population data is to my knowledge the best that can be done with current information. The population distribution across towns suggests that the estimates are reasonable (see Appendix figure 2). The distribution is skewed to the right as is often the case with modern data. Over half of the towns had a population under 1000 in 1670, while the mean population is 1584. A few large cities like London pull the average population higher.



As discussed in the text, many of the key variables in this paper have a spatial component. The first step in building these spatial variables is to geo-code the cities in the Blome list. I was able to successfully match all cities to the Ordinance Survey based on city name. From there, latitude and longitude coordinates are obtained. Locational data allows geographic features to be incorporated, like elevation changes and distance to the navigation head.

The market potential variables follow from the geo-coding of Blome cities. Market potential is calculated in two ways. In the first, the market potential for town i is $\sum_{j=1}^{782} Pop_j/d_{ij}$, where Pop_j is the population of town j and d_{ij} is the Euclidean distance between town i and town j. The sum is over all 782 towns in the Blome list. The distance between town i and itself is taken

to be $0.333 * \sqrt{1/\pi}$ following the convention adopted by Keeble et al. (1982). The first market potential variable is meant to capture the size of nearby towns that could use the waterway network. It is referred to as 'market potential local.'

The second market potential variable captures the size of major cities that could be more easily reached if the navigation project was completed. It is referred to as 'market potential distant.' A major city is defined as a city with a population above 2500 in 1700 that was already on the waterway network. The second market potential formula for town i is $\sum_{j=1}^{M} MajPop_j/d_{ij}$, where $MajPop_j$ is the population of major city j and d_{ij} is the distance between town i and major city j if the river navigation project was completed and a shipper followed the shortest waterway transportation route. For this variable a GIS map of the waterway network in 1690 was created including inland waterways and a coastal route. Then a network analysis tool was used to calculate the distance from each town in the candidate list to major cities.

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