Policy Risk, Uncertainty, and Investment: Evidence from the English East India Company*

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Abstract

Governments can have large effects on investment by raising policy risks and uncertainty. This paper estimates their effects by studying the famous English East India Company. It had difficult relations with some English governments and positive relations with others. This translated into either hostile or friendly policies. New time-series data on the Company's shipping and port capacity are used to analyze the effects of English governments and government changes on investment. Econometric results show that investment rates were lower in years with a new monarch and when elections changed the majority party in the House of Commons. Investment also differed depending on which monarch or majority party governed. This paper shows the relevance of policy risk and uncertainty over a long time-span, especially for companies involved in prominent public partnerships. It also illustrates the value of studying evolving policy risks in historical settings.

Keywords: Policy risk, policy Uncertainty, Investment, English East India Company.

JEL Codes: N4, P1, L9

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1 Introduction

Changes in policies, like tax rates and regulations, are one of the risks facing firms when they make investment decisions. Governments are crucial in determining these policy risks because they have different political preferences and connections. Some governments are more pro-business than others or they favor certain sectors. Viewed from this perspective, a government change, say from an election, can create uncertainty about future policies, and thus uncertainty about the value of investing.

History offers insights as to whether policy risk and uncertainty affect firm investment. This paper examines one of the world's first corporations, the English East India Company. It shows the relevance of policy risk and uncertainty, especially for companies involved in prominent partnerships with the government.

The English East India Company (or EIC) was founded in 1601 and operated until 1858. It was originally engaged in trade between England and Asia. Its business required large investments in physical capital, like ships and ports, and an organizational structure spanning the globe. The EIC later became what Philip Stern (2011) calls a 'Company-State,' jointly controlling territory in India and servicing trade. It had a lasting impact by establishing British rule in India and by transforming markets and consumption in England.

The EIC faced substantial policy risk for much of its history. The English monarch granted a monopoly over all trade between England and Asia in return for the payment of additional customs duties. However, several English monarchs amended the monopoly and forced the EIC to lend and pay extraordinary taxes. The English House of Commons was another problematic actor from the perspective of the EIC. The Commons came to play a larger role after the Glorious Revolution of 1688 and its policies were often set by the majority party. At various times, the EIC's monopoly trading privileges were questioned by the majority party. The same applied to the EIC's activities in India, where boundaries of control and claims on Indian wealth were open questions. Ultimately, the Commons voted

to end the monopoly and create government control of India.

This paper creates and combines several time series to examine whether governments and government changes affected EIC investment. There are two new annual series on shipping tons employed by the EIC and ports regularly visited by EIC ships from 1601 to 1833. The rate at which employed shipping tons and visited ports increased or decreased provides a useful measure of net investment in the EIC's trading capacity.[1] The baseline empirical model regresses net investment rates for shipping and ports on indicators for governments in power and government changes. These include indicator variables for years when a certain monarch reigned, indicators when monarchs changed, indicators when a certain party held a majority in the House of Commons, and indicators for elections changing the majority party. Additional variables include the growth of EIC sales, the ratio of sales to existing capacity, and depreciation of ships. All together the series cover 170 years.

The key identification assumption is that government changes are exogenous to the EIC's trading environment. This is reasonable because new monarchs usually came from deaths of the previous monarch and elections were often driven by broader politics. Nevertheless, to minimize concerns about omitted variable bias I also use government changes with exogenous timing, like only those changes in the monarchy caused by deaths and only elections whose timing was fixed by law.

The results show that some government changes had large effects. In the main specification for shipping capacity, elections changing the majority party in the Commons reduced the net investment rate by 0.5 standard deviations. In the main specification for ports, elections changing the majority party reduced the net investment rate by 0.8 standard deviations. These findings are robust to using elections with fixed timing. Years with new monarchs are found to be negatively related to net investment in shipping and ports, but the estimates are less robust. In terms of magnitudes, I compare my estimates for government

[1]The data sources are discussed below, but in brief they come from appendices in Sutton (1981), Farrington (1999), and Hackman (2001), which include information on tonnage of all ships employed by the EIC, the years of employment, ports visited, and the reason for the ship's retirement.

changes with a one standard deviation increase in sales growth. The latter increases the net investment rate in shipping and ports by 0.34 standard deviations, which implies that elections changing the majority party had larger effects than a typical shock to sales.

The results also show that EIC investment could differ substantially depending on which government was in power. As one example moving from a Whig party to a Tory party majority lowered net investment rates in shipping by 0.9 standard deviations.

As a final analysis, I examine how shipping and port capacity evolved surrounding 4 major political changes in the 17th century. These include (1) the beginning of the Civil War in 1642, (2) the execution of King Charles I in 1649, (3) the Restoration of the monarchy in 1660, and (4) the Glorious Revolution of 1688. If my arguments are correct then one would expect the EIC's shipping and port capacity to decrease in their wake. Consistent with this prediction, both series declined significantly following each of these major political changes.

The paper contributes to the broader literature on the connection between policy risk, uncertainty, and investment.[2] There are few studies examining this issue over a long time-span. The main reason is that historical investment data are scarce, especially before the 20th century. This paper fills this void by studying the same investment activity over a 170-year time span. It also focuses on one of the earliest public-private partnerships, where policy risks are thought to be especially important.[3]

This paper also contributes to our understanding of the factors affecting the EIC's performance.[4] Some previous works emphasize English politics. For example, Philip Lawson (1993, p. 74) argues that when the EIC experienced its worst troubles, there was matching

[2]See Julio and Yook (2012), Handley and Limao (2015), Gulen and Ion (2016), Fernandez-Villaverde et. al. (2015), and Baker et. al. (2016) for a sample of works on policy uncertainty and investment. There are also related papers on political instability which tend to use macroeconomic data, including Rodrick (1991), Alesina and Perotti (1996), Svensson (1998), Feng (2001), and Henisz (2002) among others.

[3]See Newberry (2002), Guasch (2004), and Laffont (2005) for overviews of policies towards infrastructure and private partnerships.

[4]See Scott (1912), Chaudhuri (1965, 1978, 1993), Sutherland (1962), Horwitz (1978), Watson (1980), Desai (1984), Carlos and Nicholas (1991), Lawson (1993), Bowen (2005), Hejeebu (2005), Robins (2006), Webster (2009), Stern (2011), Philips (2013), Solar (2013), Erikson (2014), and Bogart (2017) for works on the EIC. See De Vries (2003, 2010), Rei (2011), Gelderblom et. al. (2013), and Dari-Mattiacci et. al. (2014) for comparative works, especially relating to the Dutch Company.

instability in national politics. However, no previous work has empirically analyzed the effects of governments and government change on EIC investment.

Another contribution is to the larger economic history literature studying political institutions. It is common to treat policy risks in static terms. In other words, 18th century England is classified as having secure property rights. France is not.[5] This paper suggests that policy risks were constantly evolving and at times they were uncertain due to changing governments and political circumstances. Such an approach can yield more insights on the dynamics of investment and growth, even in economies with generally good institutions like England.[6]

The rest of the paper is organized as follows. Section 2 provides background on the EIC and government relations. Sections 3 and 4 provide the theoretical and empirical frameworks. Section 5 introduces the new series on EIC shipping and ports and further data. Section 6 shows the estimation results. Section 7 revisits the general argument by focusing on the 17th century. Section 8 concludes.

2 Background

The English East India Company or EIC was one of several European trading companies operating in the East Indies (i.e. modern day China, India, and Indonesia). There were also Dutch, Portuguese, French, Danish, and Swedish East India companies. The main business of the EIC in its early years was to import highly valued spices and textiles from the East Indies. The EIC sold some manufactured goods, but most of its export revenues came from New World silver, which was highly valued in the East.

Table 1 reports the total shipping tonnages bound for Asia for all companies in each European country. The Portuguese are the leaders in the 16th century. The Dutch leapfrog

[5]See North and Weingast (1989) and Acemoglu, Johnson, and Robinson (2005) for two prominent studies on their differences in property rights. See Cox (2012) and Jha (2015) for recent studies on the formation of institutions in England.

[6]Another paper exemplifying this approach in England is Bogart (forthcoming).

the Portuguese in the early 17th century. The English emerge as well, but are in second place. From 1630 to 1730, English shipping tonnage grows, but its share of total tonnage falls. This was mainly due to the continued growth of the Dutch and the emergence of the French trade. The turning point for English trade is the mid-18th century. English tonnage grows faster at that point and is the clear leader in the 1820s.[7]

Table 1: Asian Bound Shipping Tonnage Among European Companies

Period	English	Dutch	Portuguese	French	Danish	Swedish	England % of Total
1581-90	0	0	55,419	0	0	0	0
1631-40	31,179	63,970	20,020	3000	4000	0	25.5
1681-90	47,879	130,849	11,650	17,500	4000	0	22.6
1731-40	67,880	280,035	13,200	53,891	12,267	7,368	15.6
1781-90	228,315	243,424	8,250	130,490	63,461	0	33.9
1820-29	859,090	178,000		168,180	22,770	6730	60.0

Source: De Vries (2003, pp. 46-49), Solar (2013, p. 649).

The EIC was more than a trading company. It came to control vast territory in India and acted as a colonial authority. The process began in 1757 when the EIC defeated the Nawab of Bengal. It gained control of Bengal's fiscal system by the 1760s. Similar events occurred elsewhere and by the 1820s the EIC controlled over 40% of the land area in modern-day India (Fisher 1994). The rise of the English in India is not the main focus here, but it does have bearing because it led to policy conflicts between the EIC and the English government, which is the main issue of this paper.

2.1 The Company and the English Government

This sub-section briefly summarizes the relationship between the EIC and the English monarch and House of Commons. The main theme is that the EIC had difficult relations with some governments and positive relations with others. Those relations translated into

[7]The dominance of the English in the 1820s is partly due to the end of the Indian monopoly in 1813 and British naval hegemony following the Napoleonic wars (see Solar 2013). Much of the reported English tonnage in the 1820s was associated with private ships which could not have sailed in the more violent monopoly era.

either hostile or friendly policies.[8]

To begin, the EIC's initial business model relied on the support of the English monarch. It was granted a monopoly over all trade between the East Indies and England. In addition, it was granted corporate powers, rights to export silver, and assistance from the Royal Navy. These privileges were specified in charters, the first of which was given by Queen Elizabeth in 1600. That charter and those that followed also stated that the monarch had the right to collect special duties on East Indian imports, and when necessary the EIC had to follow its foreign policy directives. The charters also gave the monarch a legal tool to renegotiate. The final clause allowed any provision to be voided with three years notice if it was not profitable to the current monarch, its heirs and successors, or to its realm (Hill 1887).

Several monarchs used their right and forced renegotiation.[9] The most aggressive was King Charles II, who often needed funds to wage war. It was a usual practice for Charles II to demand loans from the EIC in exchange for a new charter. For example, the new charter of 1677 was accompanied by £150,000 in loans. Some monarchs would demand a loan or impose new taxes with the implicit threat they would renegotiate the EIC's charter if it did not go along. Table 2 lists all forced loans from 1641 to 1744 and details about repayment when available. It is clear that forced loans were common and not all were repaid. Table 3 shows all tax levies and known bribes paid to the monarch by the EIC from 1620 to 1730. The long list shows that bribes and extraordinary levies were also common.

[8] A longer summary of the political relations and policies towards the EIC is given in Bogart (2017).

[9] The same also applied to Oliver Cromwell, who governed in the Interregnum from 1649 to 1660 when England did not have a monarch.

Table 2: Forced Loans and Repayments to the EIC before 1750

Year	Amount	Description
1641	£63,283	Charles I forces Company to give its pepper stock. £31,500 unpaid
1643	£6,000	Loan to Committee of Navy in Long Parliament. Repayment unknown
1655	£50,000	Loan to Council of State. £46,000 unpaid
1659	£15,000	Loan to Council of State. Canceled at Restoration
1662	£10,000	Loan to Charles II. Repayment unknown
1666	£50,000	Loan to Charles II. Repaid in 1667
1667	£70,000	Loan to Charles II. Repayment unknown
1676	£40,000	Loan to Charles II. Repaid in 1678
1678	£110,000	Loan to Charles II. Repaid in 1679
1698	£2,000,000	Loan to William by New East India Company. Redeemed in 1793
1708	£1,200,000	Loan to Anne. Redeemed in 1793
1744	£1,000,000	Loan to George II. Redeemed in 1793

Source: see Bogart (2017) for details.

Table 3: Tax levies on the EIC and Known Bribes before 1730

Year	Description
1620	James I demands £20,000 payment following the Company's capture of Ormuz
1636	Duties on pepper imports increased by 70%
1660	Gift of £4000 to Charles II and James II at Restoration
1681-88	Annual Gift to King of 10,000 guineas
1685	Additional duty of 10% on imports of Indian linens and silks
1690	Additional duty of 20% on East Indian imports
1692	Tax of 5% on value of Company's stock
1692-95	Gifts to King and bribes to MPs estimated at £200,000
1697	Additional duty of 5% on imports of Indian linens and silks
1703	Additional duty of 5% on imports of Indian linens and silks
1730	Payment of £200,000 to government to renew charter

Source: see Bogart (2017) for details.

The role of the House of Commons in regulating the EIC changed substantially after the Glorious Revolution of 1688. From that time, all policies relating to trade and taxation required the consent of the Commons, generally through an act of parliament. The Commons was an elected body, and its members (MPs) had different views about the EIC. Most of the actions taken by the Commons were initiated by the leadership of the majority party. It had the power to mobilize votes on bills. What is notable is that the leading party in the Commons supported some of the forced loans and levies on the EIC. The new tax duties of the 1690s and the £1 million loan in 1744 are examples. In both of these cases, the leading

party was pushing for greater government revenues in order to pay for England's wars.

Besides taxes and loans, tolerance of interlopers was the other main policy issue for the EIC in its early years. Interlopers were traders seeking to enter the Asian market and capture some of the EIC's profits. In the typical case, interlopers offered bribes to the monarch in order to gain market access. The monarch would then leverage these bribes to extract more from the EIC. Sometimes interlopers would approach the leading parties in the Commons and offer political support. A list of all documented interloper cases prior to 1760 is provided in table 4. It is clear that interloper challenges were an ongoing issue through the mid-18th century. In the vast majority of cases interlopers were defeated and the EIC maintained its monopoly, but the process was often protracted and costly.

Table 4: Interloper Challenges to the Monopoly

Year	Description
1604	James I gives charter to interlopers to trade in Asia
1607	James I gives interlopers license to discover Northern passage to Asia
1617	James I gives Scottish East India Company charter to trade in Asia
1635	Charles I gives Courteen Association license to trade in Asia
1637	Charles I gives Courteen Association charter to trade in places with no EIC factories
1649	Assada Adventurers appeal to Council of State for voyage to Asia
1658	Richard Cromwell gives interloper license to trade in Asia
1681	Interlopers linked to Whigs petition Charles II to form a rival joint stock company
1689	Interlopers led by Papillion petition William to dissolve EIC and incorporate new
1695	Act of Scottish Parliament gives Darien Company license to trade in Asia
1698	Act of Parliament authorizes new East India Company with monopoly trading rights
1730	Interlopers petition Commons to form company licensing trade to India for a fee
1758	Tea dealers petition Treasury for licenses to import tea from China

Source: see Bogart (2017) for details.

An important episode in the 1690s provides a good example of how interloper challenges were resolved. Several influential traders lobbied the new King William asking permission to enter the trade. At first their efforts were unsuccessful thanks to significant bribes paid by the EIC to government ministers and MPs. Matters changed in 1697 when William desperately needed a war-time loan. The EIC offered £0.7 million at 4% interest. An

interloper syndicate offered £2 million at 8% interest with the expectation that they would get the monopoly. To put these figures into perspective, the net value of the EIC's assets were a little over £1 million in 1695, and its annual sales were approximately £0.5 million.[10] King William accepted the larger offer of the interlopers, and, by an Act of Parliament in 1698, monopoly rights over the trade were given to a 'New' East India Company. The 'Old' EIC was supposed to wind up by September 1701. However, the Old EIC began a successful lobbying campaign to re-establish its trading rights. In 1702, the monarch approved a merger between the New and Old Companies. The merger took several years to implement and was only finalized in 1709 following a new £1.2 million loan to Queen Anne.[11]

It is important to point out that political parties played a role in the interloper challenge of the 1690s. The New Company had the support of the Whig party. In 1697 the Whigs had a majority in the Commons, and their leaders encouraged King William to accept the offer of the New Company. But in 1701 and 1702 the Tories regained the majority and the Old Company re-established its position in these years. The turn to the Tories was significant because they were supporters of the Old EIC.[12]

2.1.1 Government relations after the expansion in India

New policy issues emerged following the EIC's territorial expansion in India starting in the early 1760s.[13] Some MPs argued that the EIC's actions in India were egregious or that its new fortunes should be shared with the government. The first major Act of Parliament to regulate the EIC's management came in 1773. It created a Governing Council in India with 3 of the 5 members being appointed by the government. The Regulating Act of 1773 did

[10] Assets and liabilities are taken from Scott, Constitutions and Finance, (1912 Vol II, pp. 123-128, 177-179). Chaudhuri (1978) provides data on export and import revenues, which together I define as sales.

[11] For a full discussion of these events see Scott (1912, pp. 150-189). The forced loan of 1709 was not the last extraction of the 18th century. In 1730 and 1744 parliament and the monarchy secured additional loans or payments from the EIC. The 1730 event is notable because it coincided with a proposal by interlopers to transfer the monopoly to a new company (Sutherland 1962, p. 29). The EIC got an act of parliament extending its monopoly trading rights to at least 1769. In return the Company made a £200,000 payment to King George II and accepted a lower interest rate on the £3.2 million debt owed to it by the government.

[12] For details on parties in this episode see Horwitz (1978) and Bogart (2017).

[13] For a full treatment of the EIC in this period see Bowen (2005).

not achieve most of its aims, one of which was to share in the EIC's newly gained wealth. The Act required the EIC to pay £400,000 annually to the government. The EIC did not make these tax payments. It was in financial crisis and had to get loans and support from the government to continue.

Governments again tried to extract concessions and gain control of the EIC in the 1780s. These efforts were led by prime ministers and their legislative coalitions in the Commons, including Lord North's coalition, the Fox-North coalition, and the followers of Pitt the Younger. North and Fox did not succeed. The failure of Fox's India bill even contributed to the downfall of his coalition (Philips 1971, pp. 24-25). Pitt was the most successful and enacted legislation in 1784, which eventually brought greater government control over affairs in India.

2.1.2 The end of the monopoly

The EIC's trade monopoly reemerged as a policy issue in 1793. In that year, the EIC had to renew its charter through an act of parliament. The EIC's monopoly was opposed by free trade interests in Liverpool and Manchester. They hoped to gain from opening textile exports to India. The EIC was able to convince the government to reject free trade and renew its monopoly for another 20 years. One key factor was the EIC's political strength in the Commons. It had numerous MPs representing its interest (Philips 1961, pp. 307-335).

The monopoly over trade with India ended in 1813 through the Charter Act. It was undone by the greater popularity of free trade and the expanded lobbying efforts of Manchester and Liverpool (Webster 2009). The most important factor for our purposes was the change of government in 1812. The EIC was closely connected to the existing Prime Minister Perceval. But matters changed after Perceval was assassinated. An election was later held, which led to a new governing coalition under Lord Liverpool. Importantly, the EIC's MPs were far less likely to be linked to Liverpool than Perceval (Bogart 2017). Weak political

connections hurt the EIC's cause when the Charter Bill was being debated in the Commons. An EIC director reflected on their new position. He states, "I had no idea we stood on such weak ground... from that moment I felt myself humbled." (quoted in Phillips 1961, p. 90).

3 Policy Risks, Uncertainty, and Investment

The rest of this paper examines whether the identity of the government and government changes affected the EIC's investment. The proposed mechanism is through changes in policy risk and uncertainty. A model focusing on commitment problems illustrates this idea.[14] Suppose the government can take an action to extract all profits from the EIC, but it must then pay a fixed political or reputation cost. The government will choose to extract only if its financial gains exceed the fixed political or reputation costs. As a baseline case, suppose the EIC knows the government's fixed costs and can adjust its investment level prior to the government's decision. As shown in the appendix, the EIC will choose to reduce its investment, and necessarily its profits, until extraction by the government becomes non-optimal. The EIC must reduce its investment more if the political or reputation costs to the government are low.

Now consider a case where there is a new government and the EIC is uncertain about whether its political or reputation costs are high or low. Suppose further that the EIC expects at some future date to learn about these costs with certainty. If it invests today, it takes a chance that it will over-invest and become an attractive target for a low cost government. If it waits, it may lose some profits, but it will learn about the costs and make optimal investment decisions later. A simple model of this decision shows the EIC will delay its investment if there is a high probability that the government's costs are revealed to be low in the future or if the EIC is sufficiently patient. The appendix provides the details.

[14] See Persson and Tabellini (2002, ch. 12) for a review of the literature on commitment problems.

4 Econometric Framework

The prediction that new governments lowered investment is testable with time-series data on the EIC's trading capacity. The time series will be introduced in the next section. This section develops the econometric framework. It draws on the literature studying uncertainty and investment.[15] The baseline model is given in equation (1)

$$\frac{\Delta K_t}{K_{t-1}} = \alpha_0 + \alpha_1 deprec_t + \alpha_2 \Delta y_t + \alpha_3 (y-k)_{t-1} + \beta_1 newmonarch_t + \beta_2 electnewparty_t + \varepsilon_t \quad (1)$$

where K_t is the EIC's capacity in year t, $\frac{\Delta K_t}{K_{t-1}}$ is the net investment rate in capacity in year t, $deprec_t$ is the depreciation rate in capacity in year t, Δy_t is the log difference in EIC sales from year t to $t-1$, $(y-k)_{t-1}$ is the log difference of EIC sales and EIC capacity, $newmonarch_t$ is a dummy variable for years when there was a change in the English monarchy, and finally $electnewparty_t$is a dummy for years when there was an election changing the majority party in the Commons.

The coefficients in (1) are interpreted as follows. The first, α_1, measures the reduction in net investment if there is more depreciation in year t, say due to accidents or obsolescence. The second, α_2, captures the net investment response to changes in trade conditions, represented by the growth in sales Δy_t. The third, α_3, captures the response of net investment when the log level of sales differs from the log level of capacity. It is similar to an error correction term in dynamic models.

The key coefficients are β_1 and β_2. They identify whether government changes affect net investment. Notice they are dated in year t. The assumption is that political shocks have instantaneous effects. In some specifications, there is a lead and lag because there could be anticipation or delayed responses in decision making. Also note that EIC sales data is

[15]See Leahy and Whited (1996), Bond and Lombardi (2006), Bloom et. al. (2007), Bloom (2009), Fuss and Vermeulen (2008), and Stein and Stone (2013) for empirical analyses of uncertainty and investment.

only available from 1661, and thus the regression cannot test for government changes before. The last section of the paper examines the 17th century by studying differences in the time series around major government changes, like the Civil War and Restoration.

An important extension to equation (1) includes indicators for the reigning monarch and the majority party in power. In equation (2) below, Ω_{it} contains dummy variables equal to one if monarch i reigned in year t and Π_{jt} contains dummies if party j had a majority in the Commons in year t. In this specification, $newmonarch_t$ and $electnewparty_t$ measure the uncertainty effects of changing governments. The estimates for the government indicators Ω_{it} and Π_{jt} measure the effects of the individual monarchs and majority parties, including their differences in policy risk. The caveat is that unobservable shocks may be associated with the times that certain monarchs and parties governed.

$$\frac{\Delta K_t}{K_{t-1}} = \alpha_0 + \alpha_1 deprec_t + \alpha_2 \Delta y_t + \alpha_3 (y-k)_{t-1} + \beta_1 newmonarch_t + \beta_2 electnewparty_t + \Omega_{it} + \Pi_{jt} + \varepsilon_t \tag{2}$$

Another potential concern is that unobserved shocks influence the variables $newmonarch_t$ and $electnewparty_t$. This is not a major issue for new monarchs because in the 1661 to 1832 period all but one monarch left the throne upon dying of natural causes. The Glorious Revolution is the exception, where King James II abdicated. Elections to the Commons are more concerning because monarchs could call a new election and it is possible they were called when the economy was volatile. There is also some evidence that the EIC itself influenced the stability of governments as in the case of Fox's coalition noted earlier (see Sutherland 1962 and Bogart 2017).

I address identification issues in two ways. First, more control variables are added to equation (2), including the ratio of government deficits to revenues, indicators for years when Britain was at war with European powers, measures of British and French naval capacity, and the share of Indian land area controlled by the EIC. Several of these could

influence investment and may be correlated with elections changing the party. Second, I analyze three alternative government change variables: (1) $newmonarchdeath_t$ is one when the new monarch followed the death of the previous monarch, (2) $electmandate_t$ is one when there was an election mandated by law, (3) $electnewpartymandate_t$ is one when there was an election mandated by law *and* it changed the majority party. For (2) and (3) I use the Triennial Act of 1694 and the Septennial Act of 1716, which mandated elections if parliament extended beyond 3 or 7 years. These laws help in identification because the timing of mandated elections could not be influenced by events associated with trade.

5 Data

This paper is the first to make estimates of total EIC shipping capacity annually. It is based on ship-level data provided in Sutton (1981) and Farrington (1999). Sutton lists 1,236 ships in the service of the EIC from 1600 to 1834, including the ship name, its tonnage, number of voyages, the first and last year of the season it sailed from England, and its ownership status.[16] Farrington (1999) provides similar information for 1,474 ships and includes the voyages of each ship, ports of call, and dates of ship departure and arrival.[17]

Sutton and Farrington are each comprehensive sources, but to minimize the risk of missing information I combine them. I start with Sutton's list of 1,236 ships. I then match all Sutton ships with Farrington ships based on name and years of sailing. Next I add 182 ships in Farrington that sailed from England but did not have a match in Sutton. In total, 1,419 ships are studied. Regarding dates of sailing, I adopt Sutton's convention. Seasonal winds meant that ships were outfitted in the fall and usually sailed between November and

[16]Sutton (1981) relies on Krishna (1924) to identify ships from 1601 to 1672. Krishna uses a variety of sources, but in the period under study here (1660-1673) two main sources are used: Home Miscellaneous Vol. 15 and Court Book 25a (see Krishna p. 332). From 1673 Sutton uses information from Ship Book, East India Company Records Vol. II at the British Library.

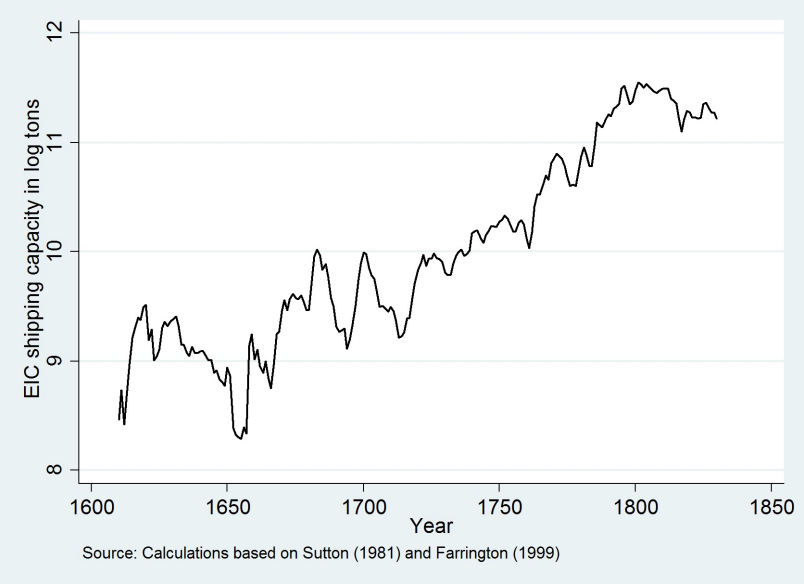
[17]I thank Emily Erikson for kindly sharing data on Farrington's data on ships and ports of call.

May, which is known as the sailing season. Sutton dates the voyage by the calendar year when the fall sailing season started and thus avoids assigning ships to different calendar years because of delays, like a ship leaving in January instead of December. Also Sutton reports tonnage for 98% of the ships, while Farrington reports tonnage for 83% of ships. Missing tonnage is estimated using the average for ships that first sailed in that year.

The ship-level data set is the basis for my series on total EIC shipping capacity in each year. To arrive at this figure, I sum the tonnage of all ships actively employed by the EIC in a year. Ships are active the first year they sailed and one year after their last sailing given that voyages generally lasted two years. An example illustrates the calculation. The African was a 240 ton ship which first sailed from London during the season starting in 1660 and for the last time in 1664. The African's 240 tons are recorded from 1660 to 1665. The same procedure is repeated for all ships in the Sutton-Farrington data set. As a robustness check, I restrict the sample of ships to more than 399 tons to measure capacity of larger ships only. Size differences between ships were greater before 1710 (see the appendix for details).

The ownership and contractual nature of shipping is worth extra discussion because it affects which ships are included in the series. After around 1660 the EIC hired most ships on a long-term contract. Under the so-called chartering system, the EIC would pay a fixed freight rate for a voyage plus an additional daily fee if the ship stayed in India beyond an agreed date (see Chaudhuri 1993 for more details). A minority of ships, labeled by Sutton as extra, merchant, or private, had a different contractual relationship with the EIC, and were usually hired for a single voyage. Sutton also includes New Company ships in the list. Recall they were in competition with the incumbent EIC during the 1690s and early 1700s. In the baseline tonnage series, I include extra, merchant, private, and New Company ships because they contribute to total English shipping to Asia, which is of most interest. The assumption is that all types of shipping reacted to government changes in the same way. Below I also construct an alternative series which omits merchant, private, and New

Figure 1: EIC shipping capacity, 1610-1830



Company ships to check whether this assumption is crucial. Finally, note the Sutton and Farrington lists do not include non-EIC ships that sailed to India after the monopoly ended there in 1813. Thus I do not observe all English ships to Asia after 1813.

Figure 1 plots the EIC shipping capacity series in log tons from 1610 to 1830. There are large fluctuations in capacity during the 17th century. As I show in the last section of the paper, many of these fluctuations occurred around major regime changes. The level of the EIC's capacity rises significantly in the second half of the 18th century. There are several big changes occurring at this time, including the EIC's conquest of India.

For the regression analysis, I am interested in studying changes in shipping capacity as it captures investment. I construct a series on tonnage added, which is the tonnage of ships entering the employment of the EIC in a given year. I also construct the tonnage exiting based on the tonnage of ships that left the employment of the EIC in the previous year. A third series, net tonnage added, is the difference between tonnage added and exiting. From these three, rates are calculated dividing (1) tonnage added, (2) tonnage exiting, or (3) net tonnage added by the stock of tonnage in the previous year. A second exit rate due to depreciation and accidents is also constructed based on ships that left the employment of

the EIC because they were broken up, sold as storage space, or sunk due to weather and non-war events. The data comes from Hackman (2001) who lists EIC ships and notes why they left the service of the EIC.[18]

5.1 Ports

There are estimates of the size of the EIC's port network in the literature. Erikson (2014) creates a series on the number of ports visited by EIC ships in each year between 1600 and 1830. But, as Erikson notes, the EIC might have had a regular trading relationship with a port that its ships did not visit every year. Erikson produces an additional series on the size of the EIC's 'active' port network. It only includes ports that EIC ships regularly visited.[19]

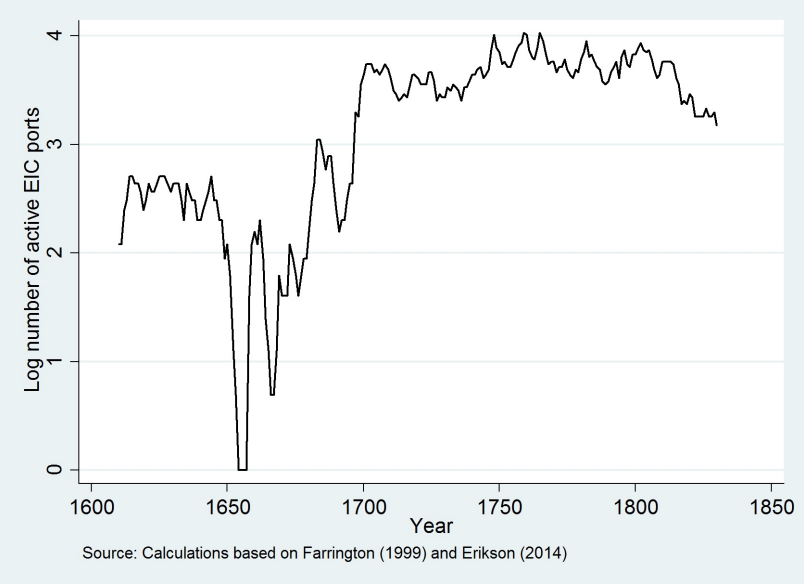
I build on Erikson's approach and count the number of 'active' ports. The steps are the following. First, a list of all ports ever visited by the EIC is generated using the unique name of ports recorded in Farrington. Second, for each year t all ports with at least one ship arriving in the last three years or more than one ship arriving in that year are identified. If a port meets this criteria in a year, it is labeled an active port. I also create a series identifying new ports (i.e. ports visited for the first time in year t). This series partly captures the EIC's investment in finding new trading posts in Asia.

The log number of active EIC ports from 1610 to 1830 is shown in figure 2. The EIC's active port network was highly volatile in the mid-17th century. The number then increases and stabilizes in the early 18th century. A three-year moving average of new ports is shown in figure 3. After an initial surge during the early 1600s, few new ports were added in the 17th century. During the 18th century, new port addition was higher on average, but also

[18] I was able to match 1,018 of 1,419 ships in my Sutton-Farrington list to Hackman. There are a number of interesting factors causing exit, but for present purposes I am interested in exits due to old age, accidents, and weather.

[19] Erikson uses the port series to study how networks affected the behavior of captains and discoveries of new trade (see chapter 4, 2014).

Figure 2: EIC's active port capacity, 1610-1830



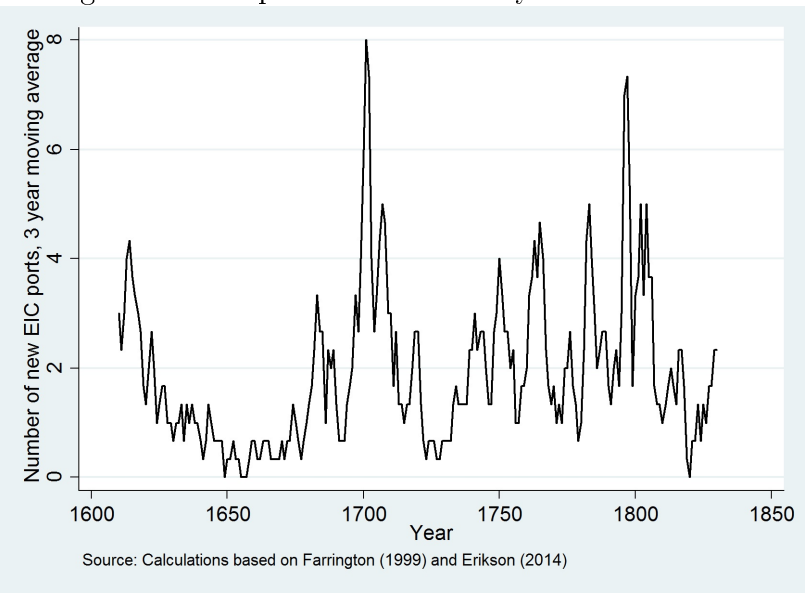
more volatile. For example, there is a huge increase in new ports in the early 1700s. This appears to be linked to the competition between the New and Old East India Companies between 1698 and 1708.

In the regression analysis below the number of new ports is analyzed along with three series capturing changes in the EIC active port network. The three are (1) the rate at which active ports were added, (2) the rate at which active ports exited, and (3) the net addition rate of active ports. The rates are calculated dividing ports added, ports exiting, and net ports added in year t by the stock of active ports in year $t-1$.

5.2 Government Variables

The identities of English monarchs and their reigns are taken from political histories of Britain (Holmes 1993, Holmes and Szechi 1993, Evans 2014). In terms of timing, I assign a monarch to a year if their reign lasted until at least July 1st of the calendar year. The timing is useful because all ship hires in the season from November to May are assigned to November's year which would coincide with a new monarch, only if they assumed the throne

Figure 3: New ports established by EIC 1610-1830



before July 1st. There are 8 changes in the monarchy between 1663 and 1832 occurring in 1685, 1688, 1702, 1715, 1727, 1760, 1820, and 1830. There are 9 indicators for individual monarchs starting with Charles II.

The same political histories also identify years with elections to the House of Commons and those elections that changed the majority party. Elections mostly occurred in the spring and so elections generally occurred one-half year before the start of the sailing season. It is important to note that my coding of political parties incorporates their evolution from 1660 to 1833. Initially there was a Royalist Court party, which held a majority in the Commons during the 1660s and 1670s. The Whigs and Tories were the leading parties from 1679 to 1715. They often alternated as the majority party. I classify the elections in 1679, 1685, 1689, 1690, 1695, 1701, 1702, 1708, 1710, and 1715 as changing the majority party from Court to Whig and after 1679 from Whig to Tory and vice versa.

From 1715 to the late 1760s the Whigs held a majority in the Commons, and thus there were no elections changing the majority party. But, by the mid-18th century, party identities had become weaker. In their place, legislative coalitions formed centering around the prime minister. The main ministers included Lord North (1774-1783), Pitt the Younger

(1784-1801), Addington (1802-1805), and Grenville (1806). I code the elections in 1774, 1784, 1802, and 1806 as changing the majority 'party.' I also code each of these coalitions as a separate majority party for the indicator variables.

From 1807 parties re-formed under the labels Whig and Tory. The 'New Tories' were in the majority from 1807 to 1831, and the 'New Whigs' had the majority from 1831 to 1833 when this study ends. I code elections in 1807 and 1831 as changing the majority party. The New Tories and New Whigs are coded as separate from the old Whigs and Tories for the majority party indicators. In total, there are 16 elections changing the majority party between 1663 and 1832 and there are nine majority party indicators.

The elections mandated by law are coded based on the Triennial Act of 1694 and the Septennial Act of 1716. Between 1694 and 1715 an election was coded as mandated if there was a gap in elections lasting three legislative sessions. After 1716 the same was coded if there was a gap in elections lasting more than seven legislative sessions. There are 16 mandated elections, occurring in the years 1698, 1701, 1705, 1708, 1713, 1722, 1734, 1741, 1754, 1761, 1768, 1774, 1790, 1796, 1802, and 1826.

5.3 EIC Sales and other Controls

The data on EIC sales come from Chaudhuri (1978) and Bowen (2005, 2007). Specifically, Chaudhuri's (1978) series on the value of total exports of commodities and treasure to Asia from 1660 to 1760 (p. 507) is merged with Bowen's (2007) series on the value of all commodity and silver exports from 1760 to 1834 (series 12). Chaudhuri's series on the value of total imports from Asia between 1664 and 1760 (pp. 508-510) is merged with Bowen's series for the value of total Asian imports from 1761 to 1834 (series 16). Chaudhuri and Bowen's export series share data for 1760, and the figures are close. The import series do not overlap, but the numbers in neighboring years are similar.

It is important to clarify the timing of the sales data. In Chaudhuri and Bowen, the

accounting year for sales runs from 1 July to 30 June, and the year refers to the date on 30 June. I adjust the timing so that sales are applied to the previous year (i.e. the date on 1 July) because ship departures are assigned to the year when the sailing season began around November even though some ships left in February and March of the following year. Therefore in the model, the EIC is assumed to be making decisions about hiring ships using current sales revenues. In the specifications for ports, I use one-year lagged values of sales because decisions to visit ports were made before they are observed in the data.

The EIC sales series is divided by the GDP deflator of Broadberry et. al. (2011). Britain experienced significant inflation from 1790 to 1815 and nominal sales growth is inflated in this period. Fortunately none of the results below are different if nominal sales are used instead of real sales.

The remaining control variables include the ratio of government deficits to revenues, indicators for years when Britain was at war with European powers, measures of British and French naval capacity, and the share of Indian land area controlled by the EIC. Deficits are taken from Dincecco (2011). Indicators for wars are from Holmes (1993), Holmes and Szechi (1993), and Evans (2014). Naval capacity is taken from Modelski and Thompson (1988). The share of Indian land area controlled by the EIC is taken from Fisher (1994). Interested readers should consult these sources for details on the trends.[20]

5.4 Summary Statistics

Summary statistics for the main variables are shown in table 5. Focusing on the key outcomes, the average net investment rate in ships is 0.0165, which implies that shipping capacity increased by an average of 1.65 percent per year. The investment rate is larger averaging 12% per year, but the exit rate is also large averaging 10.35%. Regarding ports, the size of

[20]To summarize, the deficit ratio is close to 0 in years of peace, and large and positive in years of war. Naval capacity increased for both the British and the French. The share of Indian land under EIC control increased discontinuously from zero in 1757 to 0.4 by the 1820s.

the active network grew by an average of 1.55%, and 2.1 new ports were added each year on average. Note all the main variables in the analysis are stationary. The share of Indian territory and the naval capacity control variables are the exception.

Table 5: Summary Statistics

	Mean	Stand. Dev.	Min.	Max
Net investment rate shipping capacity	0.0165	0.0962	-0.1786	0.3207
Investment rate shipping capacity	0.1201	0.0846	0	0.4018
Exit rate shipping capacity	0.1035	0.0644	0	0.2896
Exit rate due to depreciation or accid.	0.0379	0.0334	0	0.1567
Net investment rate ships $>$ 399 tons	0.0230	0.1061	-0.3581	0.3210
Net investment rate ships excluding New Company	0.0162	0.0934	-0.1869	0.3207
Net investment rate port network	0.0155	0.1164	-0.4285	1
Investment rate port network	0.1054	0.1344	0	1
Exit rate port network	0.0898	0.0749	0	0.4285
New ports	2.1000	2.0880	0	13
Elections changing the majority party	0.0941	0.2928	0	1
Elections mandated by law	0.0941	0.2928	0	1
Elections mandated and changing the maj. party	0.0235	0.1520	0	1
New monarchs	0.0470	0.2123	0	1
New monarchs deaths	0.0411	0.1992	0	1
War with Euro. power	0.4470	0.4986	0	1
Deficit ratio	0.2194	0.3752	-0.2631	1.9243
Yearly log difference in sales	0.0112	0.3295	-1.5780	1.0879
Ln EIC sales - Ln EIC shipping capacity	3.8389	0.4445	1.9029	4.6261
Ln EIC sales - Ln EIC port capacity	-1.101	0.475	-1.819	0.429
Share of Indian land controlled by EIC	0.0917	0.1213	0	0.4140
French naval capacity in logs	4.1356	0.4009	3.0910	4.8283
British naval capacity in logs	4.6882	0.2213	3.912	5.037
N				170

Sources: see text.

6 Results

Specifications analyzing the net investment rate in shipping capacity are shown in table 6. Newey West Standard Errors are reported to address potential heteroscedasticity and auto correlation in the error term.[21] Model 1 shows results for government changes without

[21]I use four lags following the convention $\#lags = .75N^{1/3}$. The estimates are similar are similar using robust standard errors. Results are available upon request.

any controls. Elections changing the majority party and new monarchs have a negative and significant effect on the net investment rate in shipping capacity. Model 2 adds the log difference in sales, the log ratio of sales to capacity, and the exit rate of ships due to depreciation or accidents. Net investment in shipping is found to increase with sales growth and a high ratio of sales to capacity. Both of these patterns are expected, as changes in trade conditions should affect investment. Also as expected a higher depreciation rate for ships reduces net investment. The main finding in model 2 is that elections changing the party and new monarchs continue to have negative and significant effects, although the coefficient on new monarchs is smaller.

Model 3 in table 6 is the full specification. It adds the controls and indicators for each monarch and each party that had a majority in the Commons. The coefficient for new monarchs is reduced and becomes statistically insignificant. Unreported specifications show that the negative effects of new monarchs is conflated with differences between monarchs captured by their indicator variables. The coefficient for elections changing parties remains negative and significant even with the additional variables added. The estimates imply a reduction in the net investment rate of 0.045, which is close to 0.5 standard deviations in the outcome variable. By comparison a one standard deviation increase in sales growth increases the net investment rate by 0.033, or 0.34 standard deviations. Thus elections changing the majority party had larger effects than a typical shock to trade conditions.

Table 6: Baseline Regression for Net Investment Rate in Shipping

Variable	Model 1 Coefficient (Stand. Err.)	Model 2 Coefficient (Stand. Err.)	Model 3 Coefficient (Stand. Err.)	Monarch or Party indicator	Coefficient (Stand. Err.)
Elections changing majority party t	-0.0484	-0.0459	-0.0453	Charles II	0.0884
	(0.0178)***	(0.0137)***	(0.0206)***		(0.0471)*
New Monarchs t	-0.0835	-0.0392	-0.0161	James II	0.1748
	(0.0252)***	(0.0173)***	(0.0265)		(0.0459)***
Log difference in sales t		0.0993	0.0995	William	0.1378
		(0.0180)***	(0.0204)***		(0.0390)***
Ln (Sales t-1 /Shipping Cap. t-1)		0.0417	0.0625	Anne	0.0068
		(0.0159)***	(0.0227)***		(0.0497)
Exit rate due to depreciation or accid. t		-0.7505	-0.9310	George I	0.0228
		(0.2149)***	(0.2534)***		(0.0261)
War with Euro. power t			-0.0051	George III	0.0138
			(0.0223)		(0.0421)
Deficit ratio t			0.0435	George IV	-0.0411
			(0.0292)		(0.0583)
French naval capacity in logs t			0.0007	William IV	-0.0802
			(0.0284)		(0.0640)
British naval capacity in logs t			0.0906	Court	0.0102
			(0.0511)*		(0.0420)
Share of Indian land controlled by EIC t			0.3347	Tory	-0.0860
			(0.2274)		(0.0342)**
				North group	-0.0282
					(0.0401)
				Pitt group	-0.0360
					(0.0314)
				Addington group	-0.0989
					(0.0335)**
				Grenville group	-0.0245
					(0.0437)
				New Tory	-0.0723
					(0.0419)*
				New Whig	-0.0780
					(0.0565)
N	170	170			170
F-stat	7.36	13.38			14.19

Notes: Newey West standard errors with 4 lags are reported. *, **, *** indicates significance at the 10%, 5%, and 1%.

The coefficients on the monarch and majority party indicators are in the right columns.

The omitted monarch is George II reigning from 1727 to 1760 and the omitted majority party is the Whigs governing from 1715 to 1774 and some years earlier. The results show net investment rates could differ depending on the government. To assess the magnitudes, I calculate differences in average net investment moving from a monarch or majority party to its successor. On average the effect of changing from monarch n to monarch $n+1$ was to increase or decrease net investment rates by an average of 0.05 or 0.52 standard deviations. Moving from Whig majorities to Tory majorities, which occurred often from 1688 to 1715, lowered net investment rates by 0.9 standard deviations. The effects of majorities parties are less in the late 18th century. Starting with the switch from the Whigs to Lord North's coalition, the effect of changing from majority party n to majority party $n+1$ was to increase or decrease net investment by an average of 0.037 or 0.39 standard deviations.

Concerning the control variables, only British naval capacity has a significant effect. Outside of factors related to sales, it was mainly government changes and the identity of governments that influenced net investment rates in EIC shipping.

The robustness of the estimates for government changes are examined in table 7. The model in (1) studies effects from elections mandated by law and new monarchs from deaths. The model also includes the monarch and majority party indicators and the other control variables. These additional coefficients are not reported to save space. Mandated elections and new monarchs from deaths are both negative and significant at the 10% level. The model in (2) includes mandated elections that also changed the majority party. Its coefficient is negative and significant. These findings are important because they suggest omitted variables, like unobservable shocks to the EIC's trade, cannot explain the estimated relationship between government changes and net investment rates in shipping.

The other specifications in table 7 address different samples of ships. The dependent variable in (3) is the net investment rate dropping private ships and those associated with the New East India Company. While the standard errors are larger, the estimated effects of

government changes are very similar to model (3) in table 6. The dependent variable in (4) is the net investment rate in ships greater than 399 tons. The results are again similar to the baseline model, indicating that differing ship sizes do not significantly affect the results.

Table 7: Robustness Regressions for Net Investment Rate in Shipping

	(1)	(2)	(3)	(4)
	Coefficient	Coefficient	Coefficient	Coefficient
Variable	(Stand. Err.)	(Stand. Err.)	(Stand. Err.)	(Stand. Err.)
New monarchs from deaths t	-0.0423	-0.0403		
	(0.0232)*	(0.0224)*		
Elections mandated by law t	-0.0288			
	(0.0149)*			
Elections mandated and changed majority party t		-0.0387		
		(0.0204)*		
New monarchs t			-0.0067	-0.0232
			(0.0321)	(0.0294)
Elections changing majority party t			-0.0430	-0.0492
			(0.0241)*	(0.0281)*
Log difference in sales t	0.1021	0.1010	0.0837	0.0772
	(0.0204)***	(0.0205)***	(0.225)***	(0.0378)**
Ln (EIC Sales/ EIC Shipping Cap.) t-1	0.0694	0.0678	0.0469	0.0475
	(0.0235)***	(0.0238)***	(0.0235)**	(0.0275)*
Exit rate due to depreciation or accid. t	-0.9176	-0.9114	-0.8402	-0.9973
	(0.2420)***	(0.2493)***	(0.2817)***	(0.2885)**
Controls for war, deficits, naval cap.,				
and Indian land	Yes	Yes	Yes	Yes
Monarch and party indicator variables	Yes	Yes	Yes	Yes
Drop New Company and private ships	No	No	Yes	No
Ships $>$ 399 tons only	No	No	No	Yes
N	170	170	170	170
F-stat	13.77	13.83	12.92	12.60

Notes: Newey West standard errors with 4 lags are reported. *, **, *** indicates significance at 10%, 5%, and 1% level.

Table 8 provides more insights with specifications analyzing the investment and exit rates of shipping tonnage. In column (1) elections changing the majority party are shown to lower investment rates, but new monarchs have little effect. Column (2) repeats this model for the exit rate in shipping. Here elections raise the exit rate, but not significantly. These finding are important because they show the EIC responded to elections changing parties by

reducing its additions to shipping tonnage, not by retiring shipping tonnage earlier. Column (3) examines the dynamics in investment by including an indicator for elections that will change the majority party in the upcoming year $(t+1)$, in the year prior $(t-1)$, and in the current year (t). The coefficient for the upcoming year is -0.056, suggesting a negative anticipation effect from elections changing the majority party. Combining the anticipation effect with the current year effect implies that elections changing the majority party reduced investment rates by 0.095, or 1.12 standard deviations.

Table 8: Models for Investment and Exit rates of Shipping Capacity

	(1)	(2)	(3)
	invest rate	exit rate	invest rate
	Coefficient	Coefficient	Coefficient
Variable	(Stand. Err.)	(Stand. Err.)	(Stand. Err.)
Elections changing the majority party t+1			-0.0562
			(0.0194)***
Elections changing the majority party t	-0.0368	0.0202	-0.0389
	(0.0189)*	(0.0181)	(0.0209)*
Elections changing the majority party t-1			-0.0111
			(0.0227)
New monarchs t+1			-0.0041
			(0.0217)
New monarchs t	0.0040	0.0084	0.0035
	(0.0250)	(0.0136)	(0.0308)
New monarchs t-1			0.0017
			(0.0328)
Log difference in sales t	0.0897	-0.0097	0.0803
	(0.0166)***	(0.0095)	(0.0157)***
Log difference in sales t-1			0.0091
			(0.0325)
Ln (EIC Sales/ EIC Shipping Cap.) t-1	0.0781	0.0155	0.0687
	(0.0204)***	(0.0188)	(0.0303)*
Exit rate due to depreciation or accid. t	0.2429	1.1740	0.3012
	(0.2176)	(0.1380)***	(0.2280)
Monarch and party indicator variables	Yes	Yes	Yes
Controls for war, deficits, naval cap. and Indian land	Yes	Yes	Yes
N	170	170	169
F-stat	53.08	22.69	43.26

Notes: Newey West standard errors with 4 lags are reported. *, **, *** indicates significance at 10%, 5%, and 1% level.

6.1 Port Network Results

The analysis of active ports complements the analysis of shipping capacity. The results of the baseline model are reported in table 9. Note that to address time delays in observing decisions on ports, the government change, sales growth, and depreciation rate variables are all lagged by one year. I also lag the relative port capacity to sales variable to two years. Model (1) shows that new monarchs and elections changing the majority party have a negative and significant effect on the net investment rate in active ports without any other variables. In model (2), variables for sales, capacity, and depreciation are added. New monarchs is now insignificant, but elections changing the majority party remains significant. Model (3) is the full specification. Here an election changing the party is estimated to lower the net investment rate in ports by 0.096 or 0.8 standard deviations. By comparison, a one standard deviation increase in sales growth increases the net investment rate in ports by only 0.34 standard deviations.

The results in table 9 also show that the identity of governments mattered for net investment in active ports (see the far right column). In magnitudes, the effect of changing from monarch n to monarch $n+1$ was to increase or decrease net investment rates in ports by an average of 0.073 or 0.63 standard deviations. The effect of changing from majority party n to majority party $n+1$ starting with the switch from the Whigs to North's coalition was to increase or decrease net investment by an average of 0.089 or 0.77 standard deviations.

The specifications in table 10 analyze investment rates and exit rates of active ports separately. In columns (1) and (2) elections changing the majority party have a negative and significant effect on the investment rate in active ports and a positive and significant effect on the exit rate of active ports. These findings suggest the EIC reduced the expansion of its port network and let ports fall into disuse in response to elections changing the party.[22]

[22]Note that the investment and exit rates can equal zero and so I also estimate a Tobit model with a lower bound of zero. The results are similar for elections and available upon request.

Table 9: Baseline Regression for Net Investment rate in Active Ports

Variable	Model 1 Coefficient (Stand. Err.)	Model 2 Coefficient (Stand. Err.)	Model 3 Coefficient (Stand. Err.)	Monarch or Party indicator	Coefficient (Stand. Err.)
Elections changing majority party t-1	-0.0658	-0.0636	-0.0960	Charles II	0.0139
	(0.0306)**	(0.0284)**	(0.0374)**		(0.0809)
New Monarchs t-1	-0.0793	-0.0280	0.0419	James II	0.1385
	(0.0374)**	(0.0405)	(0.0491)		(0.0928)
Log difference in sales t-1		0.0721	0.1228	William	0.1572
		(0.0950)	(0.1016)		(0.0907)*
Ln (EIC Sales/ EIC Port Cap.) t-2		0.0286	0.1786	Anne	0.0660
		(0.0259)	(0.0384)***		(0.0946)
Exit rate due to depreciation or accid. t-1		-0.9678	-1.1148	George I	0.0363
		(0.4298)**	(0.5520)**		(0.0429)
War with Euro. power t-1			0.0750	George III	-0.0818
			(0.0345)**		(0.0636)
Deficit ratio t-1			0.0103	George IV	-0.1721
			(0.0455)		(0.0899)*
French naval capacity in logs t-1			0.0783	Willliam IV	-0.2853
			(0.0535)		(0.1180)**
British naval capacity in logs t-1			0.0662	Court	-0.1069
			(0.1201)*		(0.0950)
Share of Indian land controlled by EIC t-1			0.3442	Tory	-0.0700
			(0.3901)		(0.0791)
				North group	-0.0239
					(0.0446)
				Pitt group	-0.1666
					(0.0544)***
				Addington group	-0.2507
					(0.0795)***
				Grenville group	-0.1695
					(0.0837)**
				New Tory	-0.1780
					(0.0859)**
				New Whig	0.0178
					(0.1228)
N	170	170			170
F-stat	4.22	3.71			11.22

Notes: Newey West standard errors with 4 lags are reported. *, **, *** indicates significance at 10%, 5%, and 1% level.

Specification (3) in table 10 is particularly interesting because it analyzes the creation of new trading posts. Recall that new ports were visited for the first time by EIC's ships in a given year. Thus it represents the first time the English and locals traded. In column (3) a negative binomial model is used to study new ports because it is a count variable. The estimates show that new ports decreased in years with elections changing the majority party. In magnitudes, such elections reduced the number of new ports by 0.34 standard deviations. Notably few other variables predict new ports. Sales growth and existing port capacity have no clear effect. The coefficients for the majority party and monarch indicators are not shown to save space. Those estimates show that new ports were significantly lower under the Court party compared to the Whigs, but otherwise there were few differences. Thus the creation of new trading posts was largely driven by unobserved factors, but elections and the identity of parties played a role.

Table 10: Models for investment and exit rates in active ports and new ports

	(1)	(2)	(3)
	invest rate	exit rate	new ports
	OLS	OLS	Neg. Bin.
	Coefficient	Coefficient	Coefficient
Variable	(Stand. Err.)	(Stand. Err.)	(Stand. Err.)
Elections changing the majority party t-1	-0.0585	0.0374	-0.6731
	(0.0283)**	(0.0181)**	(0.2670)**
New monarchs t-1	0.0420	0.0001	0.2895
	(0.0327)	(0.0257)	(0.3296)
Log difference in sales t-1	0.0243	-0.0984	-0.0767
	(0.0870)	(0.0213)***	(0.2049)
Ln (EIC Sales/ EIC Port Cap.) t-2	0.0834	-0.0952	0.0501
	(0.0379)**	(0.0237)***	(0.2350)
Exit rate due to depreciation or accid. t-1	-0.6900	0.4247	1.2907
	(0.4598)	(0.1460)***	(2.2186)
Monarch and party indicator variables	Yes	Yes	Yes
Controls for war, deficits, navies, and land	Yes	Yes	Yes
N	170	170	170
F-stat/Pseudo R-square	41.29	12.05	0.098

Notes:Newey West standard errors with 4 lags are reported in columns (1) and (2). Robust standard errors are reported in column (3). *, **, *** indicates statistical significance at the 10%, 5%, and 1% level.

7 Re-examining the 17th century

As a final exercise, I re-examine the EIC's investment in shipping and port capacity in the 17th century. This period is useful to study because there were four major regime changes. First, there was the Civil War in 1642, which pitted the monarchy against parliament. Second, the monarchy was abolished in 1649 following the execution of Charles I. Third, the monarchy was restored in 1660 following the death of Oliver Cromwell, who served as Lord Protector during the Interregnum. Fourth, there was the Glorious Revolution of 1688, in which the monarchy was transferred from James II to King William following the invasion from the Dutch. If my general argument is correct then one would expect the EIC's shipping and port capacity to decline in the wake of these four events.

Figure 4 plots the EIC's shipping capacity and the number of active ports from 1620 to 1700. Shipping capacity declines after the beginning of the Civil War, and it declines substantially following the abolition of the monarchy. The size of the EIC's active port network also declines substantially following the Civil War and especially after the abolition of the monarchy. Consistent with these figures, directors of the EIC considered stopping their business in these years. In 1652, Company agents in India were told to begin winding up their affairs because the EIC's trade was under such stress from interlopers taking advantage of the political chaos (Scott 1912, p. 122).

Continuing in time, the EIC's shipping and port capacity rose in the late 1650s in large part because it was re-created as a joint stock company under a new charter from Oliver Cromwell. However, both capacity measures declined once again when the monarchy was restored in 1660. The immediate effect of the Restoration was a series of losses for the EIC. It had made loans to Cromwell's government that were canceled, and its recent charter was also nullified. It could not easily predict how the new monarchy would set policy. Fortunately, for the EIC it found Charles II to be fairly hospitable, especially after it made many loans

Figure 4: EIC shipping and port capacity surrounding major political changes, 1620-1700

to his government (Bogart 2017).

The final regime change of the 17th century, the Glorious Revolution, led to a similar decline in shipping and port capacity. This makes sense because the EIC was closely connected to the previous monarch James II and interlopers were strongly represented in the parliament that followed the Revolution. The EIC barely survived the challenges of the 1690s, and was forced to make loans and pay extraordinary taxes to the new King William.

8 Conclusion

This paper argues that governments and government changes had large effects on the EIC's investment. The proposed mechanism is through differences in policy risk and uncertainty. The historical background reveals how the monarch and leading party in the Commons sometimes changed policies concerning the EIC's monopoly, its contribution to government finance, and its affairs in India. Often these policy changes went against the interests of the EIC. To examine the effects of governments empirically, this paper uses new time series on EIC shipping and port capacity from 1601 to 1833. In the main specification, net investment rates are regressed on indicators for governments in power and government changes. Net investment rates are found to be lower in years when elections changed the ma-

jority party in the House of Commons. Investments rates are also affected by the monarch and majority party in power. These findings are further supported by the decline in shipping and port capacity following the major regime changes of the 17th century.

The paper offers lessons beyond the EIC. For economic history it illustrates a different approach to studying policy risks. It treats policy risks as constantly evolving and sometimes uncertain due to changing governments and political circumstances. Studying how corporations and other actors responded to political shocks and government changes can reveal more about the dynamics of growth in many historical contexts.

This paper also contributes to the broader literature on uncertainty and investment. It is novel in analyzing the same investment activity for 170 years. It shows the relevance of policy risk and uncertainty over the long-run, especially for companies involved in prominent partnerships with government.

References

1. Abel, A. B. and J. C. Eberly (1994), "A unified model of investment under uncertainty", American Economic Review, 84(5), 1369-1384.

2. Acemoglu, Daron, Simon Johnson, and James Robinson. "The rise of Europe: Atlantic trade, institutional change, and economic growth." American economic review (2005): 546-579.

3. Alesina, Alberto, and Roberto Perotti. "Income distribution, political instability, and investment." European economic review 40.6 (1996): 1203-1228.

4. Baker, Scott R., Nicholas Bloom, and Steven J. Davis. "Measuring economic policy uncertainty." The Quarterly Journal of Economics 131.4 (2016): 1593-1636.

5. Bloom, Nicholas. "The impact of uncertainty shocks." Econometrica 77.3 (2009): 623-685.

6. Bloom, Nick, Stephen Bond, and John Van Reenen. "Uncertainty and investment dynamics." The Review of Economic Studies 74.2 (2007): 391-415.

7. Bogart, Dan. "Party connections, interest groups, and the slow diffusion of infrastructure: Evidence from Britain's first transport revolution." The Economic Journal (forthcoming).

8. Bogart, Dan. "The East Indian Monopoly and the Transition from Limited Access in England, 1600-1813," in Lamoreaux, Naomi and John Wallis, eds. Organizations, Civil Society, and the Roots of Development, University of Chicago Press, 2017.

9. Bond, Stephen R., and Domenico Lombardi. "To buy or not to buy? Uncertainty, irreversibility, and heterogeneous investment dynamics in Italian company data." IMF Staff Papers (2006): 375-400.

10. Bowen, Huw V. The Business of Empire: The East India Company and Imperial Britain, 1756–1833. Cambridge University Press, 2005.

11. Bowen,H. (2007). East India Company: Trade and Domestic Financial Statistics, 1755-1838. [data collection]. UK Data Service. SN: 5690, http://doi.org/10.5255/UKDA-SN-5690-1

12. Broadberry, Stephen N., Bruce MS Campbell, Alexander Dr Klein, Mark Overton, and Bas van Leeuwen. "British economic growth: 1270-1870." Working Paper, 2011.

13. Caballero, Ricardo J. "On the sign of the investment-uncertainty relationship." The American Economic Review (1991): 279-288.

14. Carlos, Ann M., and Stephen Nicholas. ""Giants of an Earlier Capitalism": The Chartered Trading Companies as Modern Multinationals." Business history review 62.03 (1988): 398-419.

15. Carruth, Alan, Andy Dickerson, and Andrew Henley. "What do we know about investment under uncertainty?." Journal of Economic Surveys 14.2 (2000): 119-154.

16. Chaudhuri, Kirti N. The English East India Company: The Study of an Early Joint-Stock Company 1600-1640. Frank Cass, 1965.

17. Chaudhuri, Kirti N. The Trading World of Asia and the English East India Company: 1660-1760. Cambridge University Press, 1978.

18. Chaudhuri, K. N. "The English East India Company's Shipping (c.1660-1760)." In Bruijn, Jaap R., and Femme S. Gaastra, eds. Ships, sailors and spices: East India Companies and their shipping in the 16th, 17th and 18th centuries. Vol. 20. Amsterdam: Neha, 1993.

19. Cox, Gary W. "Was the Glorious Revolution a constitutional watershed?." The Journal of Economic History 72.03 (2012): 567-600.

20. Cruickshanks, Eveline, Stuart Handley, and David Hayton. The History of Parliament: The House of Commons, 1690-1715. Cambridge University Press, 2002.

21. Dari-Mattiacci, Giuseppe, Oscar Gelderblom, Joost Jonker, and Enrico C. Perotti. "The emergence of the corporate form." Amsterdam Law School Research Paper (2014).

22. De Vries, Jan. Connecting Europe and Asia: a quantitative analysis of the Cape-route trade, 1497 – 1795 .In D.O.Flynn, A.Giráldez and R.Von Glahn (eds.), Global Connections and Monetary History, 1470 – 1800 . Aldershot: Ashgate, 2003.

23. De Vries, Jan. "The limits of globalization in the early modern world." The Economic History Review 63.3 (2010): 710-733.

24. Desai, Tripta. The East India Company : a brief survey from 1599 to 1857. New Delhi, 1984.

25. Dincecco, Mark. Political Transformations and Public Finances: Europe, 1650–1913. Cambridge University Press, 2011.

26. Dixit, Avinash K. and Robert Pindyk. Investment under uncertainty. Princeton university press, 1994.

27. Erikson, Emily. Between Monopoly and Free Trade. Princeton University Press, 2014.

28. Evans, Eric J. The forging of the modern state: early industrial Britain, 1783-1870. Routledge, 2014.

29. Farrington, Anthony. Catalog of East India Company Ships' Journals and Logs, 1600-1834. London: British Library, 1999.

30. Feng, Yi. "Political freedom, political instability, and policy uncertainty: A study of political institutions and private investment in developing countries." International Studies Quarterly 45.2 (2001): 271-294.

31. Fernández-Villaverde, J., Guerrón-Quintana, P., Kuester, K., & Rubio-Ramírez, J. Fiscal volatility shocks and economic activity. The American Economic Review, 105(11) (2015): 3352-3384.

32. Fisher, Michael H. The politics of the British annexation of India, 1757-1857. Oxford University Press India, 1994.

33. Fuss, Catherine, and Philip Vermeulen. "Firms' investment decisions in response to demand and price uncertainty." Applied Economics 40.18 (2008): 2337-2351.

34. Gelderblom, Oscar, Abe De Jong, and Joost Jonker. "The Formative Years of the Modern Corporation: The Dutch East India Company VOC, 1602–1623." The Journal of Economic History 73.04 (2013): 1050-1076.

35. Guasch, J. Luis. Granting and renegotiating infrastructure concessions: doing it right. World Bank Publications, 2004.

36. Gulen, Huseyin, and Mihai Ion. "Policy uncertainty and corporate investment." Review of Financial Studies 29.3 (2016): 523-564.

37. Hackman, Rowan. Ships of the East India Company. World Ship Society, 2001.

38. Handley, Kyle, and Nuno Limao. "Trade and investment under policy uncertainty: theory and firm evidence." American Economic Journal: Economic Policy 7.4 (2015): 189-222.

39. Hejeebu, Santhi. "Contract enforcement in the English East India company." The Journal of Economic History 65.02 (2005): 496-523.

40. Henisz, Witold J. "The institutional environment for infrastructure investment." Industrial and corporate change 11.2 (2002): 355-389.

41. Hill, R. Charters Relating to the East India Company from 1600 to 1761, Government Press, 1887.

42. Holmes, Geoffrey S. The making of a great power: late Stuart and early Georgian Britain, 1660-1722. London and New York: Longman, 1993.

43. Holmes, Geoffrey S., and Daniel Szechi. The age of oligarchy: pre-industrial Britain, 1722-1783. London: Longman, 1993.

44. Horwitz, Henry. "The East India trade, the politicians, and the constitution: 1689-1702." The Journal of British Studies 17.02 (1978): 1-18.

45. Jha, Saumitra. "Financial Asset Holdings and Political Attitudes: Evidence from Revolutionary England." The Quarterly Journal of Economics (2015).

46. Julio, Brandon, and Youngsuk Yook. "Political uncertainty and corporate investment cycles." The Journal of Finance 67.1 (2012): 45-83.

47. Krishna, Bal. Commercial Relations Between India and England 1601-1757. Krishna Press, 2007.

48. Laffont, Jean-Jacques. Regulation and development. Cambridge University Press, 2005.

49. Lawson, Philip. The East India Company: A History. Routledge, 1994.

50. Leahy, J. and Whited, T., "The Effects of Uncertainty on Investment: Some Stylized Facts", Journal of Money Credit and Banking (1996) 28, 64–83.

51. Mc Donald, R. and D. Siegel (1986), "The value of waiting to invest", Quarterly Journal of Economics, 101, 707-728.

52. Modelski, George, and William R. Thompson. Seapower in global politics, 1494–1993. Springer, 1988.

53. Newberry, David M. Privatization, restructuring, and regulation of network utilities. Vol. 2. MIT press, 2002.

54. North, Douglass C., and Barry R. Weingast. "Constitutions and commitment: the evolution of institutions governing public choice in seventeenth-century England." The journal of economic history 49.04 (1989): 803-832.

55. Persson, Torsten, and Guido Enrico Tabellini. Political economics: explaining economic policy. MIT press, 2002.

56. Philips, Cyril Henry. The East India Company 1784-1834. Read Books Ltd, 2013.

57. Rei, Claudia. "The organization of Eastern merchant empires." Explorations in Economic History 48.1 (2011): 116-135.

58. Robins, Nick. The corporation that changed the world: how the East India Company shaped the modern multinational. London: Pluto Press, 2006.

59. Rodrick, Dani. "Policy uncertainty and private investment in developing countries." Journal of Development Economics 36.2 (1991): 229-242.

60. Scott, W. R. The Constitution and Finance of English, Scottish, and Irish. Joint-Stock Companies to 1720. Cambridge University Press, 1912.

61. Solar, Peter M. "Opening to the East: Shipping Between Europe and Asia, 1770–1830." The Journal of Economic History 73.03 (2013): 625-661.

62. Stein, Luke, and Elizabeth Stone. "The effect of uncertainty on investment: evidence from equity options." Working paper 2013.

63. Stern, Philip J. The Company-State: Corporate Sovereignty and the Early Modern Foundations of the British Empire in India. Oxford: Oxford University Press, 2011.

64. Sutherland, Lucy Stuart. The East India Company in eighteenth-century politics. Clarendon Press, 1962.

65. Sutton, Jean. Lords of the East: The East India Company and Its Ships. London: Conway Maritime Press, 1981.

66. Svensson, Jakob. "Investment, property rights and political instability: Theory and evidence." European Economic Review 42.7 (1998): 1317-1341.

67. Watson, Ian Bruce. Foundation for empire: English private trade in India, 1659-1760. New Delhi: Vikas, 1980.

68. Webster, Tony. The twilight of the East India Company: the evolution of Anglo-Asian commerce and politics, 1790-1860. London: Boydell Press, 2009.

9 Appendices

9.1 Theoretical appendix I: Investment and extraction risks

Government extraction of EIC profits is related to the commitment problem, well known in the theoretical literature.[23] The idea is that absent effective constraints, rulers have an incentive to extract profits from firms. Extraction undermines incentives for investment because the more a firm invests, the more profits it generates, and the more is extracted by the ruler. This section first presents a simple model of the commitment problem and policy risk. The next section incorporates policy uncertainty.

Consider a three period model. In period 1, the EIC decides on the number of ships s to hire and send to Asia for trade. In period 2 the monarch decides whether to renegotiate

[23]See Persson and Tabellini (2002, ch. 12) for a review of the literature on commitment problems.

the charter, and if so, how much to demand in payments e from the EIC. If there is no renegotiation in period 2, then in period 3 the EIC orders its s ships to return to England with cargo and it earns $\pi(s)$ profits, where $\pi(\cdot)$ is the profit function. With no renegotiation, the monarch extracts nothing from the EIC but it gets $u(g)$ where $u(\cdot)$ is the monarch's utility function from money and g is the monarch's ordinary tax revenue. If there is renegotiation in period 2, then the EIC decides whether to return its ships with their cargo. If the ships return the EIC earns $\pi(s) - e$ in profits. If ships do not return, the EIC dumps the cargo in the sea and earns zero profits (dumping can be relaxed). If the EIC returns its cargo, then the monarch gets $u(g + e) - f$ in utility, where f is the monarch's cost of renegotiating the charter. One component of f is the loss in reputation from violating the EIC's privileges. In the future firms will not invest as much and the monarch will lose revenues. Offsetting the reputation loss there may be political gains because the EIC was a controversial company. One could also think of structural components coming from the strength of checks and balances. For example, the cost of renegotiation f will be higher if the monarch has to spend much time and resources convincing parliament or the courts that it has the right to act. Lastly, note that if the EIC dumps its cargo in the sea, the monarch gets $u(g) - f$ in utility and it extracts nothing. But it still suffers the costs of renegotiating.

A few assumptions simplify the analysis. The profit function $\pi(\cdot)$ is assumed to be continuous and differentiable in s. It achieves its maximum at s^{max}, which is the number of ships the EIC would choose if there was no threat of extraction. I also assume that the utility $u(\cdot)$ is increasing and concave in g and e . The monarch always likes more money, but at a diminishing marginal utility. I also assume that if the monarch's expected utility from renegotiating and extracting is the same as not renegotiating, then it prefers not to renegotiate. This implies ties favor honoring the charter.

The model is solved using backward induction. Suppose in period 3 there has been no renegotiation and the EIC has hired s ships. The EIC will return its ships and earn $\pi(s)$.

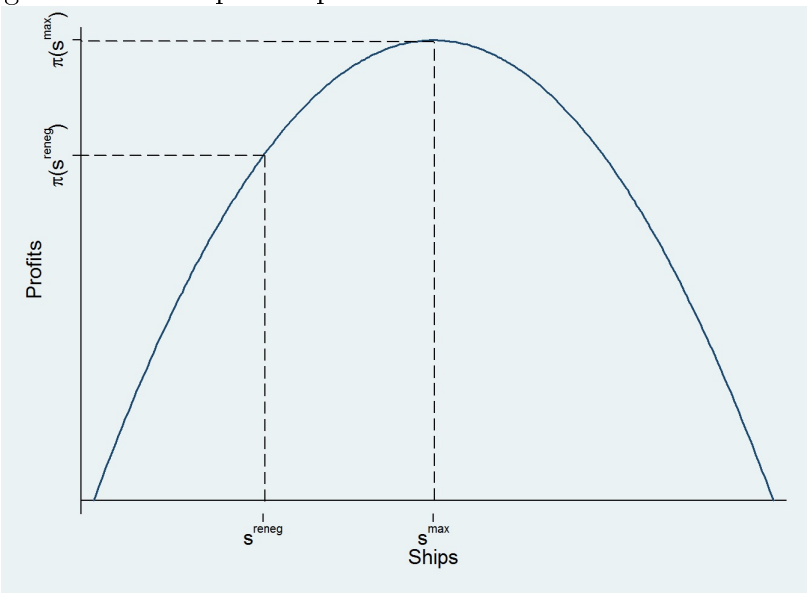
There is no reason to dump. If there is renegotiation the EIC returns its cargo only if $\pi(s) - e \geq 0$. If $\pi(s) - e < 0$ it is better to dump and earn zero profits.

In period 2, suppose the monarch decides to renegotiate. The monarch's utility will be $u(g + e) - f$, which implies it will demand $e^* = \pi(s)$ in payments. Demanding less than $\pi(s)$ will lower the monarch's utility. Demanding more than $\pi(s)$ will lead to dumping and a zero payment for the monarch. The monarch will choose to renegotiate in period 2 if its utility from renegotiating is strictly higher than not, or $u(g+\pi(s)) - f > u(g)$. Notice there is a minimum number of ships at or below which the monarch will not renegotiate. Let the minimum number s^{reneg} be defined by the equation $u(g + \pi(s^{reneg})) - f = u(g)$.

Turning to period 1, the EIC chooses its optimal shipping capacity s^*. The EIC will choose a capacity such that $s^* \leq s^{reneg}$ because otherwise it expects the monarch to demand $e^* = \pi(s)$ in payments and the EIC earns zero profits. There are two potential outcomes depending on the maximal capacity s^{max} under no threat of extraction. If $s^{max} < s^{reneg}$ then the EIC will choose $s = s^{max}$ because at any other capacity it earns lower profits by definition. If $s^{max} \geq s^{reneg}$ then the EIC will choose $s = s^{reneg}$ because it expects the monarch will not renegotiate and that it will earn profits $\pi(s^{reneg})$. The choice of ships is illustrated in figure 5 when $s^{max} \geq s^{reneg}$. The EIC invests in fewer ships and earns lower profits than if they faced no threat of extraction. If f or g increases then s^{reneg} will shift to the right in figure 7.[24] In other words, increasing the monarch's tax revenue g and the costs of renegotiation f raises the minimum number of ships at or below which the monarch will not renegotiate. Lower f or g has the opposite effect.

[24]The reason is that $\partial s^{reneg}/\partial f > 0$ and $\partial s^{reneg}/\partial g > 0$. To see this let $I = u(g + \pi(s^{reneg})) - f - u(g)$. By the implicit function theorem, $\partial s/\partial f = \frac{-\partial I}{\partial f}/\frac{\partial I}{\partial s} = 1/[\frac{\partial u(g+\pi)}{\partial \pi} + \frac{\partial \pi(g)}{\partial s}]$. The denominator is positive because $u(\cdot)$ is increasing in profits and $\pi(\cdot)$ is increasing in ships if $s \leq s^{max}$. Similarly $\partial s/\partial g = \frac{-\partial I}{\partial g}/\frac{\partial I}{\partial s} = [\frac{-\partial u(g+\pi)}{\partial g} + \frac{\partial u(g)}{\partial g}]/[\frac{\partial u(g+\pi)}{\partial \pi} + \frac{\partial \pi(g)}{\partial s}]$. The numerator is positive because of the concavity of $u(\cdot)$. The denominator is positive as before.

Figure 5: EIC ships and profits under the threat of extraction



9.2 Theoretical appendix II: Investment under Policy Uncertainty

The following theoretical framework illustrates the EIC's decision whether and how much to invest under policy uncertainty.[25] I focus on uncertainty over the costs of renegotiation, f, but there could also be uncertainty about the monarch's tax revenues g which will produce similar results. Suppose that in period 1 the EIC has an opportunity to hire ships and it believes with probability p the renegotiation cost will be f^l and with probability $1-p$ the cost will be f^h, where $f^l < f^h$. Intermediate values of p like 0.5 are meant to capture the most uncertainty. The reason is that in period 2 the probability p becomes 0 or 1 and the variance disappears. Supposing that the EIC knew the monarch's costs with certainty its optimal number of ships would be s^l when $f = f^l$ and s^h when $f = f^h$. In each case it earns just enough profits not to be extracted. To simplify the notation let the EIC's profits under certainty be denoted π^l and π^h, corresponding to $\pi(s^l)$ and $\pi(s^h)$.

It can be shown that if the EIC hires ships in period 1 it will choose either s^l or s^h.[26] If it

[25] See McDonald and Siegel (1986), Caballero (1991), Rodrick (1991), Dixit and Pindyck (1994), Abel and Eberly (1994), and Bloom et. al. (2007) for theoretical models on investment and uncertainty.

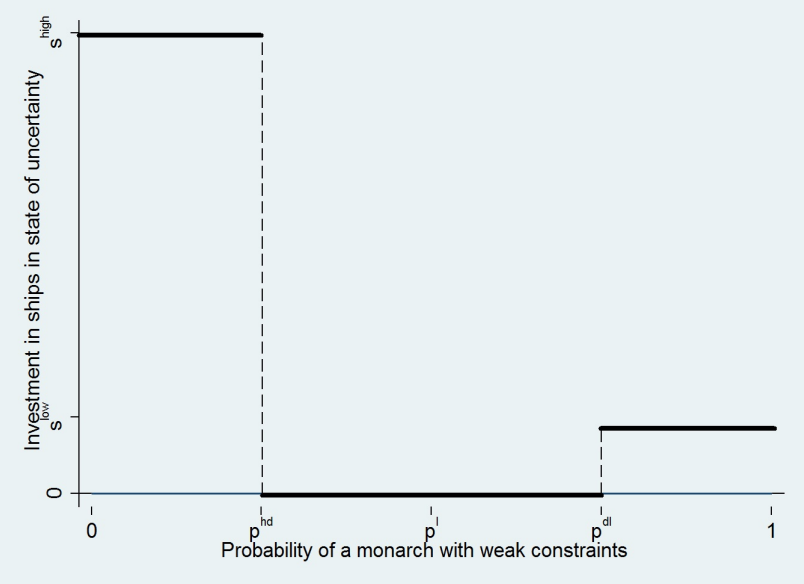
[26] The expected profits are π^l if $0 < s \leq s^l$,$(1-p)\pi^h$ if $s^l < s \leq s^h$, and 0 if $s^h < s$. Thus they are maximized at two ship choices: s^l or s^h

chooses s^l it earns π^l no matter what happens. If it chooses s^h it earns π^h with probability $1-p$ and zero with probability p because all its profits get extracted when the renegotiation costs are low. Deciding between these two choices the EIC will hire s^l ships if $\pi^l \leq (1-p)\pi^h$ and otherwise it will hire s^h ships. Rearranging terms implies it will hire s^l if the probability p exceeds some threshold $p^l = 1 - \frac{\pi^l}{\pi^h}$. Fewer ships are preferable if the probability of the bad state (low renegotiation costs) exceeds the relative difference between high and low profits.

The EIC also has the choice to delay in period 1, learn the costs of the monarch, and then hire ships in period 2. At that point the EIC will choose its optimal number of ships s^l when $f = f^l$ and s^h when $f = f^h$. From the perspective of period 1, the option value of delaying investment is the discounted expected profits that the EIC will receive, or $\beta p\pi^l + \beta(1-p)\pi^h$, where β is the time discount factor. Notice there is an assumption here that the EIC has the same investment opportunity in period 2. It is also assumed that investment is irreversible so that if ships are hired in period 1, they cannot be scrapped at full value and hired again in period 2. Both of these assumptions appear reasonable as the EIC was a monopoly and its sailings were largely irreversible. The qualification is that ships could be redeployed at some loss in profits.

Drawing on the theory of investment under uncertainty, the EIC will choose to hire ships in period 1 if the expected profits at that time exceed the option value from delaying. As its expected profits in period 1 depend on p, π^l , and π^h there are two different scenarios. In scenario 1, $p \geq p^l$ and the EIC's expected profits are π^l because it never gets extracted. It can be shown that the expected profits π^l are higher than the option value of delaying $\beta p\pi^l + \beta(1-p)\pi^h$ if and only if the probability p exceeds some threshold $p^{dl} = \frac{\beta\pi^h - \pi^l}{\beta\pi^h - \beta\pi^l}$. I refer to the threshold as p^{dl} because it marks the probability at which the EIC shifts from delaying to hiring s^l in period 1. Notice that p^{dl} rises with higher values of β. Delaying becomes more attractive with greater patience all else equal. In scenario 2, $p < p^l$ and the EIC's expected profits are $(1-p)\pi^h$. The expected profits are higher than the option value

Figure 6: Investment in EIC ships under uncertainty

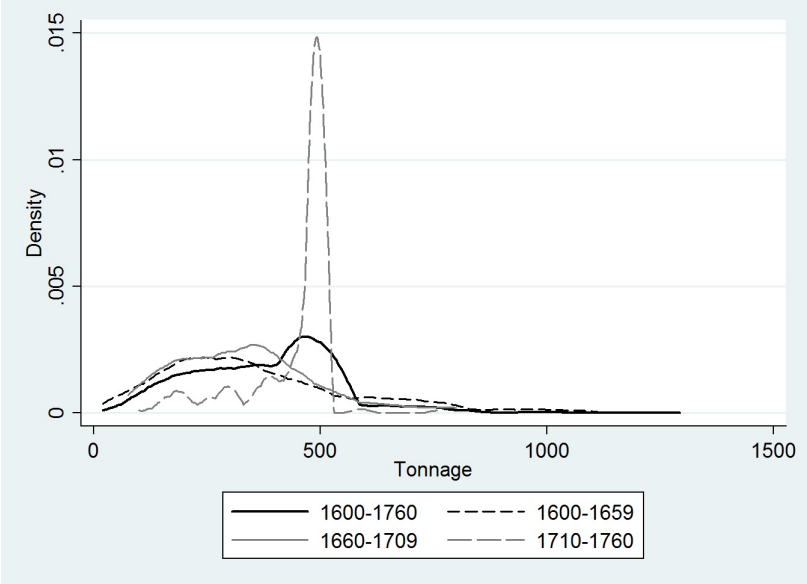


if and only if $p < p^{hd} = \frac{(1-\beta)\pi^h}{(1-\beta)\pi^h - \beta\pi^l}$. Here the threshold probability for delaying as opposed to investing in more ships increases with higher values of β.

Fixing the values of π^l and π^h there are different investment outcomes in period 1 across two or three regions for the probability. The three region case occurs when the EIC is sufficiently patient that delaying becomes an optimal strategy. Otherwise it always invests low or high numbers of ships in period 1.[27] Figure 6 illustrates the three region case. For probabilities $p < p^{hd}$ the EIC will invest in the higher number of ships in period 1. Going with more ships is preferable because the bad state (low renegotiation costs) is unlikely. For $p^{hd} < p < p^{dl}$ the EIC does not invest in period 1 and delays its decision to period 2. The level of uncertainty is high, so there is value in delaying. For $p \geq p^{dl}$ the EIC invests in low numbers of ships in period 1 because the bad state is likely.

[27] There is a third region if $p^{dl} > p^l$. After rearranging, this occurs when $\frac{\pi^l \pi^h}{2\pi^h \pi^l - (\pi^l)^2} < \beta$ or when patience is high.

Figure 7: Kernel Density for Tonnage of EIC ships



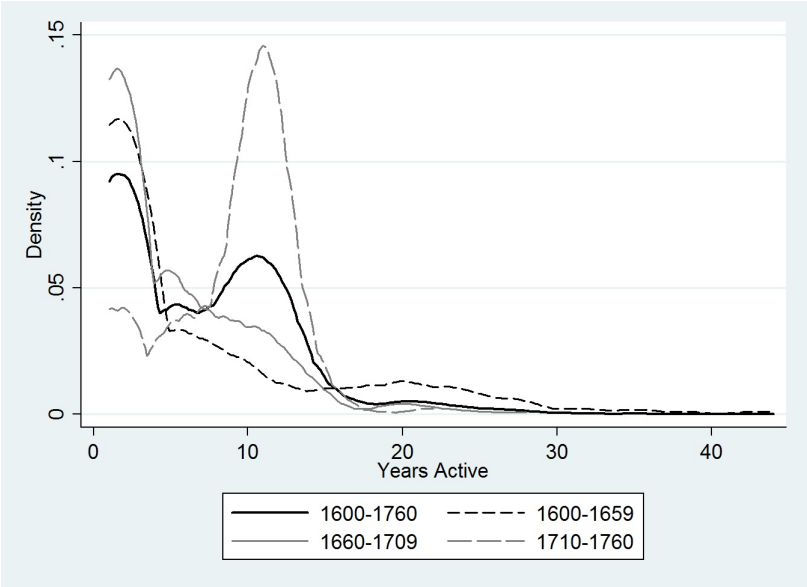
Source: see text.

9.3 Figures for key Variables

The following graphs show kernel density estimates for the tonnage and years of activity for EIC ships prior to 1760. Tonnage varies a lot across ships over the period from 1600 to 1710, but much less (around 499 tons) from 1710 to 1760. There are two reasons. One is that ships became larger on average over time. Second, there was a requirement to employ a chaplain on ships over 500 tons and many EIC ships were registered just under 500 to avoid this regulation. The size of ships is significant because larger ships are more specific to the Asian trade as most coastal and Atlantic ships were under 300 tons.

There are two peaks in the distribution of years active around 1 year and 11 years. After 1710, the number of one-year ships falls and most average 11 active years. Ships active for only one year were different from most other ships as they generally had lower tonnage. Some ships were also sent to Asia with the intention of never returning and are likely to be one-year ships because non-returning ships do not reoccur in the data.

Figure 8: Kernel Density Estimates for Years of Activity EIC ships



Source: see text.