PROPERTY RIGHTS AND PARLIAMENT IN INDUSTRIALIZING BRITAIN

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ABSTRACT

During Britain's industrialization, Parliament operated a forum where rights to land and resources could be reorganized. This venue enabled landholders and communities to exploit economic opportunities that could not be accommodated by the inflexible rights regime inherited from the past. In this essay, historical evidence, archival data, and statistical analysis demonstrate that Parliament increased the number of acts reorganizing property rights in response to increases in the demand for such acts. Tests with placebo groups confirm the robustness of this result. This evidence indicates that Parliament responded elastically to changes in the public's demand for reorganizing property rights. Parliament's efforts to adapt property rights to modern economic conditions may have accelerated Britain's economic ascent

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... laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths discovered and manners and opinions change, with the change of circumstances, institutions must advance also to keep pace with the times. We might as well require a man to wear still the coat which fitted him when a boy as civilized society to remain ever under the regimen of their barbarous ancestors.

Thomas Jefferson [1]

1. Introduction

Ronald Coase's seminal articles, "The Problem of Social Cost (1960)" and "The Lighthouse in Economics (1974)," examine property rights in nineteenth-century Britain. The British system, Coase contends, was flexible and efficient, a contention illustrated with examples from the common law of industrial torts and Parliament's policies towards lighthouses. A large literature follows Coase's lead and describes the common law's role regulating property rights, particularly rights to real estates, but little scholarship discusses Parliament's influence over rights to land and resources.

Recent research addresses that lacuna in the literature (Bogart and Richardson, 2008, 2009). Parliament played a pivotal role in the evolution of equitable estates, a property right superimposed above real estates and dictating who received revenues arising from land and resources. This essay extends that insight to the spectrum of legal arrangements regulating the cultivation of land, utilization of resources, and investment in infrastructure.

Addressing these issues requires understanding property rights in pre-industrial Britain. Britain's pre-industrial property-rights regime posed problems for people trying to reallocate resources towards more productive uses, particularly opportunities arising from technologies unanticipated in the distant past. Holders of equitable estates could neither mortgage, nor lease,

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[1]   Thomas Jefferson's letter to Samuel Kercheval, July 12, 1816. This quote is inscribed on the south-eastern interior wall of the Jefferson Memorial in Washington, DC.

nor sell much of the land under their control. Holders under many types of tenures could only transfer property to particular persons or members of a local community. Residents in common field villages often had to keep land in traditional uses. Residents could neither utilize resources in new ways, nor improve infrastructure, nor repackage rights without reaching agreements with all other parties possessing interests in a parcel, and such agreements could not, in most cases, be enforced by law, but could, in many instances, be challenged through courts.

Britain's pre-industrial property-rights system also inhibited localities from providing public goods, particularly those extending beyond the bounds of traditional communities or those necessitated by the expansion of commerce and cities. Communities lacked mechanisms for raising revenues and powers of eminent domain. Communities struggled to overcome free-riding, which inhibited the provision of public goods, and hold-outs, who withheld resources needed for public projects unless paid exorbitant sums. Market transactions might have alleviated these inefficiencies, but in most cases, the necessary transfers could not be consummated and the requisite contracts could not be enforced because of the restrictive nature of the rights regime, which valued tradition and stability above innovation and flexibility.

These problems persisted until Parliament embraced novel ideas concerning property and established procedures for processing petitions from groups hoping to reorganize rights to land and resources. These procedures enabled Parliament to review requests from individuals, families, and communities, and after considering the interests of all concerned and the general public, rewrite rules regarding the use of land and resources. Parliament enshrined these accords in three types of acts: estate, statutory authority, and enclosure. *Estate acts* altered the rights of individuals and families; eliminated restrictions on the uses to which property could be put; authorized the sale, mortgage, and leasing of land; and facilitated the enforcement of contracts.

Acts establishing *statutory authorities* created new organizations that built, operated, and maintained infrastructure and public services. Statutory authorities received new rights, such as the authority to collect tolls, levy taxes, issue debt, and purchase land. These rights superseded traditional rights, such as burgesses' right to travel throughout the realm free from tax and toll, which was enshrined in town charters and the Magna Carta. *Enclosure acts* disbanded collectively-managed common-field villages and assigned to individuals rights to particular pieces of property. Enclosure acts also shifted commonly-held agricultural land to new uses, such as the construction of housing and workshops near growing towns and cities. Acts of all three types embodied the public's desire to reorganize rights and to reallocate resources towards new uses.

A key question concerning Parliament's role in the property system is: did Parliament supply legislation that reorganized property rights elastically, in the sense that when the public's demand for legislation expanded, the quantity of legislation rose in response, while the cost remained reasonable and stable? Or, did Parliament supply legislation inelastically, indicating that the political system dictated the pace of reform, perhaps due to desires to extract economic rents, protect social classes, or restrain change?

This essay demonstrates that Parliament supplied property rights elastically. The demonstration begins with evidence describing Parliament's procedures for reorganizing rights. The evidence indicates that Parliament's process was rapid, affordable, and consensual. The demonstration continues with a series of statistical tests. The tests compare the annual number of acts that reorganized property rights with variables that influenced the public's desire to reorganize rights and Parliament's willingness to supply the requisite legislation. The public's demand depended upon the costs and benefits of reorganizing rights. The benefits of

reorganization depended on returns to constructing infrastructure, which varied with the cost of investment and the health of the economy. A good proxy for the former was the ex-post real interest rate. A good proxy for the latter was the volume of international trade.

Our statistical tests regress changes in the annual number of acts reorganizing property rights on changes in the volume of trade, the real interest rate, and an array of additional variables that influenced the public's desire to reorganize rights and Parliament's ability to pass the requisite legislation. Coefficients recovered from these regressions reflect short-term changes in legislative output caused by fluctuations in factors influencing the demand for reorganization and the supply of legislation. These regressions also account for econometric issues – such as non-stationarity and heterogeneity– that complicate the process of drawing inferences from time-series data. Additional robustness checks – including placebo groups and instrumental variables – allow clear conclusions to be drawn from the correlations in the data. The placebo groups consist of acts processed using the same procedures as acts reorganizing property rights, but which did not alter rights to land and resources. The instrumental variables consist of climatic conditions conducive to crop cultivation – as recorded in the width of tree rings – for Great Britain and its principal trading partners. These instrumental variables clearly demonstrate the direction of causation.

The rest of this essay elucidates our endeavor. Section 2 provides details about Parliament's process for reorganizing rights to land and resources. Section 3 describes the quantitative evidence that we analyze. Section 4 describes our statistical methods. Section 5 presents empirical results. Section 6 discusses the implications of our analysis. Parliament supplied legislation for reorganizing property rights elastically. When demand for reorganization rose, the quantity of legislation rose as well. When demand contracted, the quantity contracted.

Parliament's actions enabled Britain to reorganize property rights gradually and peacefully during the century following the Glorious Revolution. This reorganization could have contributed to Britain's economic growth and the onset of industrialization.

2. Acts that Reorganized Rights to Land and Resources

This section describes estate, statutory authority, and enclosures acts and Parliament's procedures for passing them. These three types of acts possessed a common theme: they relaxed constraints on the use of land and resources. They did this in varying ways. Some of these acts created new rights. Others altered or annulled old rights. Some created new organizations, such as turnpike trusts. Others disbanded existing organizations, including ancient entities, such as village councils and manorial courts.

3.1   Estates acts

Estate acts enabled holders of property to take some action prohibited by the rules under which they had inherited their land. Estate acts were necessary because the inheritance system limited estate holder's power over their property, particularly the ability to sell or lease land. These restrictions adhered to the wishes of the deceased (who bequeathed the property to their descendents) to protect the interests of dependents and heirs and to preserve a family's estate for future generations (English and Saville, 1983, pp. 19-21). This system of inheritance, known as strict settlement, solidified during the seventeenth century and prevailed until the nineteenth century. A settlement was a generic name for a property transaction and for the documents created in its consummation. While estimates vary, at the peak, at least one-quarter and as much as three-fourths of land in England was held through strict settlements (English and Saville, 1983, pp. 11-12, 30).

Three features of settlements generated a need for Parliamentary involvement. First, without an act of Parliament, holders of settled estates could only change the terms of the settlement when their heir came of age (i.e. reached the age of 21). Then, the holder and heir (typically father and son) could join forces and amend the settlement via the process of common recovery. Limited life spans meant that settlements could be changed only infrequently. A family might wait decades (or generations) for an heir to come of age and for the holder and heir to reach an agreement about restructuring the estate.

Second, settlements restricted the uses to which land could be put. Holders of a settled estate (who were just life tenants) could grant neither leases lasting beyond their lives nor leases from which they benefited at the expense of their heirs (such as leases in which tenants paid lump sums up front in return for concessions). Holders could seldom sell, swap, or mortgage property under their control. Holders could not alter property, even if they considered the alterations to be an improvement, without risking legal suits. The removal of trees, hedges, and buildings; the mining of minerals, quarries, and peat bogs; and the conversion of arable lands into pasture (or vice versa) could be considered waste, since these actions converted permanent resources into current income. All those who benefited from such actions could be liable for damages if dependents or heirs claimed to be harmed. Courts allowed sales, exchanges, mortgages, improvements, and long-term leases only if the settlement contained specific clauses authorizing such actions. Settlements written in the seventeenth and early eighteenth centuries seldom provided such powers, although as the eighteenth century progressed and as the law concerning settlements became increasingly sophisticated, settlements tended to provide broader powers.

Three, conducting transactions and enforcing contracts on settled land could be costly,

uncertain, and insecure. Settlements were long, complex documents, often unpunctuated and repetitious. Interpreting settlements required experience, skill, detailed knowledge of the document, and a large library of property laws, precedents, and legal texts estimated at 674 volumes in 1826 (English and Saville, 1983, p. 18). Settlements were not part of the public record. Copies of the deeds were usually held by the settlers, trustees, and lawyers. Settlements had to be consulted before taking out mortgages, drawing up leases, or completing sales, because if the settlement did not specifically authorize a transaction, the transaction could be voided. Ambiguities in settlements often deterred individuals from acting for fear that the transactions would be disputed (Bogart and Richardson 2009a).

Estate acts solved these problems. Estate acts facilitated the enforcement of contracts by clarifying permissible transactions and the rights of pertinent parties. Estate acts authorized actions previously prohibited by settlements such as the mortgaging of property, cutting of old-growth timber, and mining of ores and minerals. Estate acts authorized the sale and leasing of land. The authorization of sales and leases was one of the most significant economic effects of estate acts, since large tracts of English land were exposed to market forces.

3.2 Statutory Authority Acts

Statutory authority acts fostered the construction, improvement, and maintenance of infrastructure and social services. Statutory acts focused on particular topics. *Transportation acts* promoted roads, bridges, river navigation, ports, canals, and railways. *Urban improvement acts* provided for street paving, gas lighting, garbage collection, sewage extraction, water provision, and police protection. *Government building acts* fostered the construction of prisons, courthouses, and county administrative offices. *Poor relief acts* provided assistance for the poor and encouraged the construction of workhouses. *Court of small request acts* established legal

forums for adjudicating credit contracts valued at less than 40 shillings. *Lighthouse acts* authorized the construction of new lighthouses. The history of statutory authorities has been documented by several scholars.

Statutory authority acts were necessary because existing governmental entities—parishes, counties, boroughs, and sewer commissions—lacked appropriate fiscal devices and clear powers of eminent domain. River navigation provides an illustration. In the early seventeenth century, most tidal rivers were under the authority of Commissions of Sewers. Commissions could compel landowners to cleanse waterways and could tax land along riverbanks to pay for upkeep, but not tax individuals who traveled on the river or drank its waters and could not purchase land along a waterway or divert its course. These limitations kept sewer commissions from improving and extending navigable waterways (Willan 1964).

To encourage the improvement and expansion of infrastructure, Parliament passed statutory authority acts that established non-profit organizations whose trustees served without remuneration or for-profit corporations whose directors purchased shares and profited from their investments (Webb and Webb 1963). To these new organizations, statutory authority acts granted an array or rights. One was the right to levy user-fees and/or raise revenue through other means. A turnpike act, for example, authorized a trust operating a turnpike to levy tolls on road-users and claim labor (or the equivalent in taxes) from inhabitants along the road. The tolls marked a significant departure from the existing system, in which parishes paid for road improvements with local labor and property taxes, and in which individuals possessed the right of free passage. Trustees also received the right to issue debt and equity. The bonds were secured by the tolls. If interest payments fell into arrears, bondholders could seize toll revenues (Albert 1972).

Acts gave statutory authorities the right to purchase land along a route's right of way and legal procedures for doing so. Organizations initially negotiated with landowners. If the parties could not agree on a price for a plot of land, the organization could appeal to a commission that could compel the landowner to sell at a price that the commission determined to be fair and reasonable. These procedures provided the legal origin for modern laws concerning eminent domain.

3.3 Enclosure Acts

Enclosure acts reorganized rights to property, usually in open-field agricultural villages. At the beginning of the eighteenth century, approximately one-quarter of the arable land in England lay in such villages, where residents shared rights to communal assets, such as water, pasture, and woods. Villagers also shared rights in large open fields, which served as pasture during fallow periods and as cropland during the growing season. The cropland was divided among the residents, who possessed the right to grow grain on particular plots scattered throughout the fields and intermingled with those of their neighbors. Villagers managed these collective assets, such as the open arable fields, through village institutions, including customary laws and manorial courts.

The problems of open fields have long been studied by scholars.[2] Collective decision-making and communal rights impeded investments in improvements, the adoption of new techniques, and the conversion of land to new uses. Scattered plots wasted time and resources. Common pastures encouraged over-grazing and hindered breeding.

Parliamentary enclosure acts replaced collective ownership of common resources with individual ownership of particular plots of land, and replaced collective management through

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[2] For a sample of works see Tate (1967, 1978), Turner (1980, 1984), Wordie (1983), Allen (1992), Clark (1998, 2001), and Richardson (2005).

village institutions by individual management of personal estates. An enclosure act appointed a commission to devise the plan of enclosure and implement the terms of the act. The commission employed surveyors to draw a map of the village with its open fields and strips, tofts and crofts, waste and pasture, and other physical features. The surveyors recorded the holders of rights to all of these assets. At a series of public meetings, holders of land (and all other rights in the village) advanced claims as to what they should receive under the new arrangements. The commissioners decided on the validity of these claims. After they made their decisions, the surveyors created a map of the new village, displaying the new features, such as fields, roads, fences, and irrigation channels, and the owners of each.

3.4   The Process of Passing Acts

The passage of estate, statutory authority, and enclosure acts required time, resources, and expertise. Individuals and communities had to organize and submit proposals. Legislators had to review proposals and counterproposals from opposing interests. Clerks had to enscribe acts on parchment and ensure they contained language enforceable in courts.

Procedures for passing estate, statutory authority, and enclosure acts were standardized in the early 1700s and operated with minor adjustments through the late nineteenth century (Clifford 1968, Williams 1945). An estate act began with a petition from an individual or family desiring to change the rules regarding their estate. A statutory authority act also began with a petition, usually from a community stating a problem, such as insufficient road capacity, or an entrepreneur proposing a project, such as a canal or railway. An enclosure act began with a series of public meetings during which residents of a village debated the issue and drafted a petition signed by a sufficient share (typically four-fifths) possessing rights to the property under consideration.

Petitions could be submitted to either House of Parliament. A Parliamentary committee investigated the merits of a petition. In the Commons, committees consisted of members of Parliament (MPs) who had knowledge of the individuals or localities involved. In the Lords, committees consisted of Lords of Parliament (Peers) with knowledge of the issue at hand, although it was standard practice to let any peer participate if they desired to do so. If the committee deemed a petition appropriate, the petition became a bill that was read at least three times to the entire chamber and publicly disseminated, ensuring that all interested individuals learned of the legislation. During the readings and subsequent committee meetings, members could suggest amendments and pertinent parties could submit counterproposals. After the initial House approved the bill, it was sent to the other House, where it once again underwent public review. After passing both Houses, Parliament submitted the bill for royal assent. Then, the bill became law.

Repeated public notice ensured that individuals with vested interests knew about relevant legislation. Interested individuals often appeared before Parliament to support or oppose bills. Estate bills could be opposed by any beneficiary, creditor, or claimant of the estate. Opposition might come from immediate family members, distant relatives, trustees, bankers, or legal representatives. Enclosure bills could be opposed by anyone with rights to the lands under consideration or with interests in the village about to be reorganized. Opposition might come from tenants, small holders, or other parties who thought that they deserved more compensation for the rights that the legislation would extinguish. Statutory authority bills could be opposed by a broader range of persons, such as neighboring landowners, nearby towns, and rival operators. Opponents could air their grievances if called as witnesses by the committee. Opponents could also submit counter-petitions that amended the original legislation or offered alternative

proposals. Some bills aroused so much opposition that they failed to become acts. Others became law, but only after amendments appeased opposition.

The cost of proposing and opposing legislation appears to have been moderate and stable. Petitioners paid fees to the clerks of Parliament and officers of the Houses of Commons and Lords. Standing orders dictated the schedule of fees (Clifford 1968, pp. 716-751). The fees increased for longer bills with multiple provisions or when multiple parties were involved. On several occasions, Parliament debated the efficacy of the fee schedule. Leaders of the Commons advocated the fee-for-service approach on the grounds that fees encouraged clerks and officers to work diligently. In 1821, a select committee argued that fees should be retained because they "stimulate[d] the exertions of [officers] during periods of accumulated business (Clifford 1968, p. 741)." MPs and Peers received no direct compensation for introducing and advocating bills, but politicians may have been rewarded indirectly, by receiving electoral support, payments in kind, patronage, or side payments. Petitioners also paid lawyers or 'parliamentary agents' to prepare the paperwork and guide their bills through Parliament. Agents presented arguments, gathered evidence, and prepared witnesses for committee proceedings. Agents' fees amounted to 50 to 80 percent of the cost of obtaining an act (Great Britain, 1833).

The preponderance of material pertaining to petitions indicates that the process was accessible, affordable, and predictable. Whether the political process operated as advertised is, of course, a testable hypothesis. The subsequent sections of this essay describe the historical data and statistical methods needed to conduct such a test.

3. Data

The Parliamentary Archive maintains a computerized catalogue, *Portcullis,* which indicates the clerical title, calendar year, regal year, and parliamentary session for all acts passed

since the sixteenth century.[3] Clerks inscribed clerical titles on the exterior of a roll of parchment containing the full text of an act when Parliament reviewed the original legislation. The clerical title summarized the act, usually in a concise paragraph containing enough information for the clerks to identify the act and its principal provisions amidst thousands of similar pieces of parchment, without opening the rolls to read the full text.

Earlier papers explain processes for converting the clerical title of every act of Parliament into a vector of variables (Bogart and Richardson, 2006, 2009b).[4] Figure 1 plots the annual number of acts dealing with estates, statutory authorities, and enclosures from 1700 to 1830. Estate acts were the most common type of legislating altering property rights in the early 1700s. Statutory authority acts increased in number throughout the century. Enclosure acts became common from 1760 to 1820. The number of all of these acts varied greatly from year to year.

The top-half of Table 1 describes the series on estate acts. Row (a) refers to the series indicating the total number of estate acts passed each year. Rows (b) and (c) describe time series indicating the annual number of estate acts that authorized the sale or lease of property. Our analysis emphasizes estate acts authorizing sales and leases because these acts placed land long bound by the fetters of the past onto the market.

Rows (e) through (h) of Table 1 describe the data that serve as a comparison (or placebo) group for estate acts. Marriage acts permitted individuals to marry and/or divorce in contravention of secular and religious statutes. Naturalization acts provided foreign-born denizens with the rights of native-born citizens. Office acts appointed individuals to positions in the royal household, courts of law, executive agencies, and other positions that provided

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3   http://www.portcullis.parliament.uk. The clerical titles within Portcullis were first published in two nineteenth
     century compilations of Parliamentary legislation, *Statutes of the Realm* (Great Britain, 1800) and *Statutes at
     Large* (Great Britain, 1807), which were computerized during the 1990s.
4 Our quantitative compilation of acts builds on a large literature which counts and categorizes acts of Parliament.
See Langford (1991), Hoppit (1996), Hoppit and Innes (1997), and Innes (1997) for recent contributions.

government-funded livings. Important similarities existed between these marriage, naturalization, and office acts (collectively called non-estate private acts) and the estate acts examined in the top of the table. When processing all of these acts, Parliament followed common procedures. Similarities also existed in the clientele that requested these acts A key feature, however, distinguishes estate and non-estate private acts. The value of estate acts varied with economic conditions that influenced the costs and benefits of reorganizing rights to land. The value of marriage, naturalization, and office acts did not.

The top-half of Table 2 describes statutory authority acts. Row (a) indicates the annual number of statutory authority acts passed each year. Row (b) indicates the annual number of acts pertaining to transportation, principally roads, canals, harbors, rivers, bridges, and railways. Row (c) indicates the annual number of acts pertaining to urban improvements, principally the provision of water, sewers, market infrastructure, public buildings, gas lighting, garbage collection, church maintenance, courts of small request, poor relief, prison construction, and police protection. Columns (7) and (12) indicate whether the series are stationary, as determined by an Augmented Dickey-Fuller Test. While several series are non-stationary in levels, all of the series are stationary in differences.

The bottom-portion of Table 2 describes the placebo group for statutory authority acts: government finance acts. These acts dealt with national government expenditure and taxation. Most pertained to excise, customs, and land taxes; purchasing ships; provisioning of military forces, and constructing military fortifications. Like statutory authorities, these acts financed the provision of public goods, and their passage through Parliament required balancing local and broader interests. Unlike statutory authority acts, however, demand for these acts depended largely on the dictates of foreign affairs and little on the costs and benefits of reorganizing rights

to land and resources.

Table 3 describes enclosure acts. The last row of the table describes the placebo group, amendments to enclosure acts. Amendments serve as an illuminating comparison because their passage followed procedures identical to initial enclosure acts, but demand for amendments arose primarily after random instances when errors crept into original legislation during the long process of drafting and passing bills.

The accuracy of the data depicted in Tables 1 through 3 depends upon our ability to accurately determine the year in which acts passed. We can do that with confidence for years after 1762. For the early part of our sample period, a minor complication arises. A convention dated all acts passed by a session of Parliament as if they passed on the opening day of the session. This convention lingered from an earlier period when Parliament met infrequently at royal request and handled a limited volume of business in a short time period. After 1689, Parliament met annually. Sessions began in the fall, usually in the months of October, November, or December; lasted throughout the winter; and adjourned in the spring. These conventions complicate the dating of acts for the Parliaments of 1714-1715, 1751-1752, and 1760-1761. In these years, the monarch died, and/or Parliament opened late. In 1714, for example, Queen Anne died. George I assumed the throne. His ascension delayed the opening of Parliament until January of 1715. This parliament adjourned in the spring and another opened on schedule during the next fall. So, in the year 1715, the conventional dating method assigned the acts passed in two Parliamentary sessions – the winters 1714-15 and 1715-16 – to one calendar year, 1715. We correct for this confusion by assigning dummy variables to the years in which Parliament did not meet and the years in which Parliament met twice. In the example above, a

dummy is included for 1714, 1715, and 1716.[5]

Table 4 lists the right-hand-side variables in our regression analysis. Rows (a) and (b) refer to the key explanatory variables, the real interest rate and the volume of foreign trade. The real interest rate determined the cost of investment and rate of inter-temporal exchange, which were principal factors determining the returns from reorganizing property rights. Our real interest rate is the nominal interest rate, measured as the yield on long-term government bonds, known as 2½ % consols from Neal (1990), minus inflation, measured as a three-year moving average of the percentage change in Clark's (2001) consumer price index.[6] The volume of foreign trade was linked to aggregate economic activity, which was a principal determinant of revenues earned from improving infrastructure and reallocating resources towards more productive uses. The volume of trade also measured the health of the industrial and mercantile sectors relative to agriculture. Our measure of the volume of foreign trade, like most scholars, is the sum of the official value of imports plus exports (Mitchell, 1988). The official values reflect changes in the quantity of imports and exports weighted by a particular set of prices fixed at the outset of the eighteenth century. Rows (c) through (i) summarize the control variables including years when the monarch died, when a new prime minister assumed office, when Parliamentary elections occurred, when Britain was at war, when Britain suffered disease epidemics, and when Britain changed the structure of its land tax system. The land tax rate is in shillings per acre.

Rows (j) through (o) summarize indices of climatic conditions derived from timber growth rates. Tree rings are ideal instruments because they were driven by annual weather patterns which were clearly exogenous. Tree rings reveal year-to-year fluctuations in conditions

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[5] We have also corrected for this by assigning legislation to the years in which they appear to have been passed and by running all of our regressions only for the years of 1763 to 1830, for which we can precisely date all acts. Our conclusions remain robust regardless of the way in which we date acts from these idiosyncratic years.

[6] From 1700 to 1729, the dividend yield on Million Bank stock is used for the yield on long term government bonds. See Neal (1990) and Global Financial Data for more discussion of UK interest rates in the early eighteenth century.

conducive to cultivation, which had large effects on trade patterns and interest rates in an economy dominated by agriculture. Tree-ring indices exist for Britain and several of its largest trading partners. A series from Belgium reveals climatic conditions in the Low Countries, the agricultural lands adjoining the North Sea and English Channel, and the Rhine River basin. A series from the Southern French Alps reflects climatic conditions in the Mediterranean basin, particularly the productive and densely populated regions along the Rhone River and in Northern Italy. A series from Pomerania reflects climatic conditions in the grain exporting regions in Eastern Europe and near the Baltic Sea. A series from New York and Virginia reflect climatic conditions in England's American colonies, particularly the northern regions exporting foodstuffs, like fish and grain, and the southern colonies exporting cash crops, such as cotton and tobacco.

Graphing the data described in Tables 1 through 4 reveals correlations between the explanatory and dependent variables. A key correlation appears between changes in interest rates and changes in legislation reorganizing property rights. Figures 2 through 4 illustrate this correlation. For each figure, the top panel shows that the number of acts increased when the interest rate fell. The bottom panel shows that this correlation did not exist for the placebo groups. These patterns reveal a clear correlation between changes in the demand to reorganize property rights and changes in the number of reorganizations approved by Parliament. The next section describes statistical methods that yield clear interpretations of these correlations.

4. Methods

This section builds upon research which explores the public's demand and the political system's supply of property rights.[7] Formalizing this intuition yields equations that can be

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[7] Anderson and Hill (1975), Libecap (1989), Alston, Libecap, and Mueller (1999), and Alston and Mueller (2004).

estimated with clear interpretations and salutary statistical properties. An appendix completes the mathematical details of this exercise. This section explains what the estimating equation reveals about the patterns in the evidence.

The estimating equation is

$$(8) \qquad \Delta A_t = \sum_{i=1}^{I} \alpha_i \Delta x_{i,t-1} + \sum_{j=1}^{J} \beta_j \Delta z_{j,t-1} + \varepsilon_t$$

where ΔA_t is the change in the number of acts passed by Parliament from year $t-1$ to t. $\Delta x_{i,t-1}$ is the change from year $t-2$ to $t-1$ in the ith variable that affects returns from reorganizing property rights and thus shifts the demand for legislation. α_i is the coefficient on the ith demand-shift variable. $\Delta z_{j,t-1}$ is the change from $t-2$ to $t-1$ in the jth variable that alters Parliament's productivity and thus shifts the supply of legislation. β_j is the coefficient for the jth supply-shift variable. ε_t is an error term. Explanatory variables are lagged to capture the time necessary to respond to changing circumstances, prepare petitions, debate bills, and pass acts.

This specification is derived from a standard supply and demand model. In such a model, the effect of a shift in demand depends upon the elasticity of supply. If supply is inelastic, then shifts in demand have little (or no) impact on the equilibrium quantity, but a large impact on the equilibrium price. As the elasticity of supply increases, shifts in demand have a larger impact on quantity and smaller impact on price. The elasticity of supply is a key issue. The elasticity of supply indicates Parliament's response to constituents' requests. If supply was elastic, then when constituent's desired to reorganize property rights, Parliament allowed them to do so (as the documentary evidence indicates). If supply was inelastic, then Parliament based its decisions about reorganizing rights on concerns other than economic efficiency – concerns such as extracting economic rents, protecting social classes, or restraining modernization. In our model, determining the elasticity of supply involves the traditional hypothesis test for statistical

significance of α_i, the coefficients on the demand-shift variables $\Delta x_{i,t-1}$. If the null hypothesis that these coefficients equal zero can be rejected, then the supply curve cannot be perfectly inelastic. As the demand-shift coefficients α_i increase relative to the supply-shift coefficients β_j, the elasticity of supply increases.

This estimating equation arises because of the nature of the data. Data exists on the number of acts that Parliament approved each year, on factors that influenced Parliament's productivity, and on factors that influenced the public's demand for legislation. Data does not exist on the cost of passing acts, the way that effort put into the legislative process generated the supply of acts, and the exact nature of the relationship between macroeconomic variables and the aggregate demand for acts. This existing data and standard assumptions about human behavior and institutional organization illuminate short-run relationships between the dependent and explanatory variables in the vicinity of the equilibrium outcome.

Our estimation method is related to other papers in the literature which link the level of real interest rates with the number of enclosure or statutory authority acts in given year (Albert 1972; Crafts 1977). Our approach improves on this methodology by analyzing the correlation between *changes* in real interest rates or trade and *changes* in the number of property rights acts. Analyzing changes (a.k.a. first differences) in the data is sensible, because this is the specification that arises from a supply and demand model. Analyzing differences is also necessary, because much of the data that we analyze trends over time. Statistical phenomena frequently generate spurious correlations between trending time-series. Analyzing differences ensures the correlations that we detect arose for real rather than statistical reasons.

Earlier papers also failed to account for unobserved explanatory variables and the direction of causation. Our method accounts for both of these phenomena. We control for

unobserved explanatory variables using placebo groups. It is possible that our regressions do not control for an unobserved factor correlated with both an independent variable (such as the real interest rate) and the number of acts reorganizing rights to land and resources (our dependent variable). The exclusion of this unobserved variable might make it appear as if the real interest rate influenced the demand for acts, when in actuality, the excluded variable was the source of the correlation. Placebo groups indicate whether correlations existed between our independent variables and acts that did not reorganize rights to land and resources. If such correlations existed, then our regressions may reveal spurious, rather than real, relationships.

Our estimation method determines the direction of causation using instrumental variables. Our instruments are tree ring measurements from Great Britain and its major trading partners. Tree-ring measurements reveal variations in climate conducive to cultivation that are obviously exogenous and highly correlated with the volume of commerce. When this instrument is used to identify the effects of trade on statutory authority acts in a standard two-stage least-squares specification, the main results change little, indicating that the regressions identify a causal link between short-run changes in economic conditions and property rights legislation.

5. Results

This section presents results from the methods described in the preceding section. Table 5 examines estate acts. Columns (1) through (4) regress the year-to-year change in the annual number of estate acts authorizing the sale or lease of land on year-to-year changes in the key explanatory variables, the real interest rate and the volume of international trade. The regressions span the 124 years for which we have data suitable for statistical analysis. The initial year, 1705, lies close to the point where Parliament formalized procedures for processing acts regarding

property rights. The final year, 1830, lies close to the nationwide reform of Parliamentary elections and procedures enshrined in the Great Reform Act of 1832. The standard errors are calculated using the Newey-West procedure for estimating a heteroskedastic and autocorrelation consistent covariance matrix. All the variables are stationary in differences.

The table explores the temporal relationship between the explanatory and dependent variables. Column (1) lags the explanatory variables by one year. Column (2) lags the explanatory variables by two years. Column (4) includes both lags. The results reveal significant correlations for the real interest rate for both the first and second lags, with the second being stronger. Column (4) reports the sum of the coefficients for the change in the real interest rate lagged one and two years. The sum of this distributed lag (-0.51) is statistically significant, as is the F-test on the regression as a whole, indicating that estate holders and Parliament reacted to the changes in the real rate of interest over a period of two years. Columns (3) and (4) add control variables including years of elections, years in which the prime minister changed, years in which the monarch died, changes in the real land tax rate, changes in the tax code, changes in the onset and end of epidemics, and changes in the incidence of war. This spectrum of control variables improves the fit of the regression, but does not alter the results.

An array of checks demonstrates the robustness of these regressions to a wide range of alternative specifications. Neither the signs nor the significance levels of the coefficients change when the endpoints of the analysis change by up to two decades. The signs and significance levels are also invariant to the inclusion of additional explanatory variables such as year-to-year changes in the level of population, industrial production, and Parliamentary majorities. Granger causality tests indicate that changes in economic conditions precede changes in legislative outcomes, while changes in legislative outcomes did not preceded changes in economic

variables. The results are consistent with our earlier findings: changes in the real interest rate

Granger-cause changes in sale and lease acts.[8]

Columns (5) through (9) strengthen our results by replacing the dependent variables with

placebos. The placebos include marriage, naturalization, office, and all non-estate private acts.

The placebos resembled estate acts in many dimensions, but the placebos did not alter property

rights. In all of the placebo tests, the dependent variable is uncorrelated with the real interest rate.

This result has two important implications. First, the real interest rate influenced the passage of

estate acts through demand-side channels, since if interest rates influenced the way in which

Parliament supplied acts, then changes in interest rates should be correlated with changes in all

types of acts, including non-estate private acts. Second, excluded explanatory variables did not

drive the results in Columns (1) through (4). If they did, then the same patterns should appear in

(5) through (9).

Table 6 replicates these results for the years 1763 to 1830, which span the generations

during which the Industrial Revolution began, spread, and accelerated. The years also span the

period for which all acts are accurately dated and other statistical series pose the fewest

problems. Columns (1) through (3) and (6) through (10) demonstrate that the relationship

between real interest rates and the number of acts reorganizing rights to land holds for this key

period and for the cleanest data. Column (4) shows that these results hold when the dependent

variable is limited to only acts that authorized sales of strictly-settled land. Column (5) shows

that these results hold when the dependent variable is limited to acts that authorized the lease of

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[8] The Granger causality tests are based on a vector auto regression (VAR) model with equations for the number of acts, the real interest rate, and the volume of trade. The equations include three lages of each endogenous variable. All test statistics, such as the likelihood ratio statistic, indicate the lag length should be 3. The p-value for the Chi-square statistic on changes in the real interest rate is less than 0.01 indicating strong statistical significance. The VAR model also reveals that changes in sale and lease acts do not Granger cause changes in trade or real interest rates (the p-values are 0.86 and 0.14 respectively). Variation in acts is correlated with lags but not leads of our explanatory variables.

strictly-settled lands.

Table 7 presents results for statutory authorities. Column (1) regresses the change in the number of statutory authority acts on changes in the real interest rate and the volume of trade. Column (2) adds control variables. Column (3) includes explanatory variables lagged both one and two years. Column (4) restricts the sample to the years between 1763 and 1830. Column (5) restricts the analysis to statutory authorities dealing with transportation (i.e. roads, canals, harbors, rivers, bridges, and railways). Column (6) restricts the analysis to statutory authorities related to the improvement of urban infrastructure and provision of urban services (i.e. the provision of water, sewers, market infrastructure, public buildings, gas lighting, garbage collection, church maintenance, courts of small request, poor relief, prison construction, and police protection). The results reveal a strong statistical correlation between economic conditions that influenced the value of statutory authorities and the number of statutory authorities passed by Parliament. In (1) through (4), the magnitude of the coefficients on our demand shift variables averages a little more than -1.0 for the change in the real interest rate and a little more than 1.0 for the change in trade. The standard errors on those variables average about 0.36 and 0.34 respectively. The small size of the standard errors relative to the magnitudes indicates that the coefficients are measured precisely. Column (8) examines the placebo group: changes in the number of government finance acts. The placebo is uncorrelated with changes in real interest rates and the volume of trade. This indicates that omitted variables cannot account for the observed relationship between statutory authority acts, real interest rates, and the volume of trade. A Granger test indicates that causation ran from changes in the volume of trade and rate of interest to the number of statutory authority acts.[9]

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[9] The Granger causality test comes from a three-variable VAR model. The tests indicates that changes in trade and real interest rates Granger caused changes in statutory authority acts (p-values of 0.09 and 0.01 respectively). In

23

Table 8 examines enclosure acts. Columns (1) through (3) illuminate the correlation between enclosures and interest rates. The reaction to changes in the real rate appears to have occurred over a period of two years. Column (4) examines the placebo group, acts amending enclosure acts. The placebo appears uncorrelated with the real interest rate, which suggests that the variation in the number of enclosure acts was not driven by unobserved factors that altered the costs of creating acts.

So far, our results illuminate correlations between changes in the quantity of legislation, changes in the volume of trade, and changes in the real interest rates. The direction of causation appears to be from economic conditions to legislative outcomes, but the results cannot rule out all potential counter hypotheses. We address this issue with the method of instrumental variables. The instruments are tree-ring measurements for Britain and its major trading partners. Tree rings are an ideal instrument because they were clearly exogenous. Tree rings reflected climatic conditions conducive to agriculture. Agriculture formed the foundation of the early modern economy. The size of harvests influenced the volume of trade and rate of interest. Thus, tree rings reveal exogenous variation in our explanatory variables. This variation can be used to identify the direction of causation.

Our analysis focuses on statutory authority acts, where clear results arise, probably because trade consisted largely of agricultural products and statutory authorities primarily financed improvements in transportation. In Table 8, column (2) reports results from a two-stage least squares (2SLS) regression of the change in statutory authority acts in year t on the change in trade in t-1. The second stage includes all the control variables in t-2 but it excludes tree ring measurements. The first stage includes the change in tree ring measurements for the UK in the

contract, changes in statutory authority acts did not Granger cause changes in trade or real interest rates (p-value of 0.86 and 0.52 respectively).

24

years t-2, t-3, and t-4 and all the control variables in t-2. The estimated effect of a change in trade on the change in statutory authority acts is positive and statistically significant at the 10% level. The coefficient is 1.76 which is larger than the estimate in the comparable ordinary least squares (OLS) model. The hypothesis that the coefficient on trade in the 2SLS model is equal to the coefficient in the OLS model cannot be rejected. This indicates that our OLS model is an accurate assessment of the effect of trade on statutory authority acts.

Table 8's bottom panel shows that tree ring measurements are valid instruments. The lagged values for UK tree ring measurements are jointly significant in the first stage at the 10% level. Ideally, the F-statistic would be larger, avoiding a weak instruments problem, but the estimate seems sensible, given that many factors influenced the volume of trade and that climatic conditions influenced the economy with variable and extended lags. The over-identification test confirms our intuition that tree ring measurements were exogenous.

Column (3) reports results from an expanded set of tree-ring measurements including Britain's major trading partners: France, the Spanish Netherlands (modern day Belgium), Silesia (modern day Poland), Virginia, and New York. The results indicate that exogenous changes in trade had a positive and significant effect on the number of statutory authorities. The hypothesis of equality between the OLS and 2SLS coefficients cannot be rejected. Concerns arise with the first-stage of this regression. While adding additional instruments improves the fit of the first-stage (the R-square in the first stage increase from 0.14 to 0.31), the F-statistic falls, and the instruments no longer appear jointly significant. This appearance, however, occurs because we do not account for differences in the length of time that climatic shocks in various countries affected English trade. Controlling for these lags alleviates the problem, but imposes additional assumptions. We opted to report results with fewer assumptions.

Columns (4) and (5) use the change in the real interest rates as the endogenous variable. The results resemble those for the volume of trade. The second-stage regressions indicate that our OLS regressions had little bias. Changes in real interest rates caused changes in statutory authorities. The first-stage regression indicates that tree rings are a valid instrument – tree rings pass both the goodness-of-fit and over-identification tests.

Column (6) reports results from a 2SLS model which includes both the change in real interest rates and trade as endogenous variables. The results resemble the previous regressions. A positive correlation exists between the volume of trade and the quantity of legislation. A negative correlation exists between the real interest rate and the quantity of legislation. Causation runs from changes in economic conditions to changes in the quantity of legislation.

A series of historical examples strengthen our arguments concerning causality. The first is Lancashire's turnpike building boom. During the 1760s and 1770s, technological innovations dramatically lowered the cost of spinning yarn and dramatically increased the production of cotton cloth. The city of Manchester was the center of this industrial revolution. In 1780, few improved roads linked Manchester to the textile towns emerging in its vicinity. During the next decade, localities and entrepreneurs sought to improve the road network. They could not do so without reorganizing property rights. So, a steady stream of turnpike bills appeared before Parliament. Most of the bills came in the years following surges in the textile production. In 1792, for instance, the revolution in France and a blockade of French ports reduced competition for English manufactures. English imports of raw cotton rose and exports of finish cloth surged. In the following year, 1793, Parliament received a surge in turnpike proposals from the Lancashire textile region exceeding all of the acts proposed in the previous ten years combined. Within a few months, Parliament passed all of the acts.

A second example comes from London's expansion during the eighteenth and nineteenth centuries, when London became the richest and one of the largest cities in the world. This expansion required agricultural land on the city's periphery to be converted to residential and industrial uses. Existing property rights, however, prevented some of this land from being redeveloped. Prohibitions on selling land and signing long-term leases deterred development. Developers feared that they would not be able to reap the returns from investments and that successful building projects would be held-up after the fact. To solve these property-rights problems, holders of equitable estates sought Parliamentary assistance. Landholders did this more often when interest rates fell and profits from development rose.

This connection is particularly clear during the 1750s and 1760s, when the Seven Years War and harvest failures pushed interest rates to prohibitive levels. Spikes in interest rates coincided with declines in the number of estate acts. In 1761, for example, because of the exorbitant yield on government bonds, private lending virtually ceased (Belcher, Cottrell, and Sheppard 1979, p. 186). During the next three years, landholders on London's periphery sought few acts for reorganizing rights. In 1765, however, the yield on government bonds dropped to around 3.25%. A building boom ensued. During the next three years, land holders sought large numbers of acts reorganizing rights to estates on London's periphery.

The texts of these acts prove particularly illuminating. Consider George Forster Tuffnell. In 1766, Tuffnell held property in Islington and Holborn, just outside the city. From Parliament, Tuffnell obtained an act that declared

> "From the great increase of buildings which have lately been in the Parish of
> Islington…(Tuffnel) had a fair prospect and opportunity by granting building
> leases to make a considerable improvement and to increase the yearly
> income…But Tuffnell is, by the terms of the will, disabled from making and
> granting leases of any part of the said premises to any persons so as to encourage

them to make such improvements, without the aid and authority of Parliament."[10]
So, Parliament altered the terms of Tuffnell's estate, allowing him to sign 99-year building leases, which provided a contractual condition conducive to development.

How responsive was Parliament to changes in the demand for acts reorganizing rights? A few calculations reveal the answer to this inquiry. The sum of the coefficients for the real interest rate in Tables (5), (7), and (8) are -0.51, -1.14, and -2.07. Multiplying those coefficients with the standard error of the yearly difference in real interest rates (4.9) indicates that a one standard deviation decline coincided with an increase of 2.5 in the yearly difference in estate acts, an increase of 5.6 for statutory authority acts, and an increase of 10.1 for enclosure acts. Thus, a one standard deviation change in the yearly difference in interest rates explains approximately 35% (~2.5/7.2) of a standard deviation change in the yearly difference in estate acts, 29% (~5.6/19.4) of a standard deviation change for statutory authority acts, and 73% (~10.1/13.8) of a standard deviation change for enclosure acts. Similarly, the standard deviation of the yearly difference in trade is 4.66. The sum of the coefficients on trade in table 7 is 0.99. The product of those numbers is 4.6. Thus, a one standard deviation change in the yearly difference in trade explains 24% of a standard deviation change for statutory authority acts. Short-run fluctuations in trade explain around 19% of the variation in transportation acts and 25% of the variation in urban acts.

In sum, changes in real interest rates and the volume of trade explain much of the annual fluctuation in estate, statutory authority, and enclosure acts. Parliament accommodated the public's demand for legislation reforming property rights for families and communities. These acts comprised the preponderance of the local legislation passed by the national legislature. The following section concludes by considering how and why Parliament reorganized property rights and whether it influenced Britain's economic expansion.

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[10] See Private Act 6 George III c.45.

6. Discussion

At the opening of the eighteenth century, Parliament established a forum for reorganizing rights to land and resources. This venue enabled individuals, families, and communities to exploit opportunities that could not be accommodated by the inflexible rights regime inherited from England's past. The process was rapid, affordable, and consensual. The forum operated elastically. When returns from reorganizing rights rose, the public requested and Parliament passed larger numbers of acts. Reorganizing rights in this way was a principal occupation of Parliament during the century preceding industrialization. From 1700 to 1830, estate, statutory authority, and enclosure acts comprised more than half of all legislation passed by Parliament

These acts probably contributed to Britain's economic ascent. The acts loosened constraints on investment inherent in Britain's medieval landholding system, which could not accommodate modern economic opportunities. Parliament's impact appears to have increased during the eighteenth and nineteenth centuries, as the constraints inherent in the property-rights system became increasingly binding. Relaxing these constraints was probably a necessary condition for English economic development. Entrepreneurs, landowners, and localities would have forgone investment opportunities without alterations in their property rights.

Statutory authorities played a large role in the urbanization and commercialization of the English economy. Statutory authorities provided fresh water, removed garbage, aided the indigent, operated forums for dispute resolution, and financed police forces. These services were essential for enabling large populations to live in small areas. Statutory authorities established a high-volume, long-distance transportation network. Canal companies enabled coal to reach emerging manufacturing centers. Harbor-improvements increased the number and draft of ships which could load and unload, facilitating the expansion of maritime commerce. Turnpikes

reduced freight charges and travel times by widening, resurfacing, and maintaining thoroughfares (Bogart, 2005).

Estate acts – particularly those authorizing the sale and lease of land – exposed land to the invisible hand. Freeing resources from the shackles of the past loosened constraints on landowners, facilitated the reallocation of physical and financial assets to new and lucrative uses, and enabled the exploitation of opportunities arising in a dynamic economy. The lowering of transaction costs enhanced efficiency and encouraged investment (Bogart and Richardson 2009). The benefits of estate acts extended beyond the persons and property involved. Estate acts established precedents. Knowledge of what Parliament would decide when confronted with a case helped to resolve disputes within families, to safeguard the interests of investors, to determine the distribution of rents within ongoing business arrangements, and to prevent the holding-up of new projects by those seeking an inordinate share of the profits. The development of institutions solving such problems has long been considered to be one of the principal institutional innovations underlying modern capitalist economies (Williamson 1985).

Why did Parliament establish such institutions when it did? The proximate answer is the Glorious Revolution of 1688, after which Britain became a constitutional monarchy, and the political system changed in fundamental ways. Parliamentary supremacy triggered transcendent political and intellectual developments. The Bill of Rights in 1689 (and subsequent legislation) encouraged the expansion of legislative activity. Parliament began meeting on a predictable, annual schedule. Parliament began setting its own agenda. Parliament established a permanent bureaucracy and procedures for processing petitions. Streamlined procedures reduced the cost of submitting bills and increased the predictability of passage. A cadre of professional solicitors and clerks emerged to help petitions through the Parliamentary process. By the 1720s, capacity

expanded to the point where the legislative process could effectively accommodate almost any demand for legislation reorganizing property rights.

The political system that solidified at that time internalized a balance of political power between landowning, mercantile, courtly, and aristocratic interests. That balance enabled individuals interested in economic development to pass acts restructuring property rights and promoting economic progress. Political stability ensured that those acts would not be overturned by the ascension of new regimes, via either violent revolution or Parliamentary election. Parliament's decisions became the law of the land.

The security of property rights was not absolute. Parliament often amended ancient economic rights, if it felt that doing so contributed to the common good. Parliament felt free to alter rights regarding resources that could be put to more productive uses. Rights to property were secure, in other words, as long as property was used efficiently. Parliament did not, however, expropriate rights to land and resources without compensation. Individuals received remuneration for the rights that they lost. Remuneration typically left all parties as well off as before. Parliament, in other words, provided security for income derived from rights to property, but not security for the rights themselves. Rights typically defined who could use a piece of property, what they could employ the property for, when they could employ the property, and who would share in the resulting benefits. These rights were pliable. These rights could be altered by common consent and political decisions. This flexibility of rights enabled society's institutional foundations to adapt to new conditions and emerging opportunities.

The emergence of Britain's system for reorganizing property rights coincided with an intellectual revolution called the Enlightenment. The essence of the Enlightenment was the notion that natural laws could be identified and harnessed for the betterment of society (Mokyr

2002, 2009; Mokyr and Nye 2007). Enlightened English thinkers such as John Locke wrote repeatedly about the appropriate role for government. In December 1689, Locke published his magnum opus, *Two Treatise of Government*. The second treatise focused on the concepts of property and legislature. Locke wrote that property should be used industriously and rationally. Rights to property formed the foundation for civil society. These rights existed by consent of the citizenry. That consent formed the law of the land (Locke, Second Treatise on Government, Chapter V, On Property, Sections 34 and 35). Locke's concepts of property rights, civil government, and consent of the governed informed the individuals who reformed Britain's political system in the late-seventeenth and early-eighteenth century. These reforms allowed all citizens (not just the King and his appointees) to utilize forms of petitions previously employed for the reorganization of royal estates, appointments to royal offices, and the assignment of rights to aristocratic estates and chartered towns. The principal modification of the old form was the addition of clauses indicating that the acts would enhance the wealth of the realm and enable individuals and communities to prosper. These clauses provide textual evidence that Enlightenment ideals influenced estate, enclosure, and statutory authority acts.

Britain's system for reorganizing property rights appears to be unique among European nations. In other nations, inflexible property-rights regimes prevented entrepreneurs from exploiting emerging opportunities. In France, for example, the sclerotic landholding system impeded the construction of infrastructure, such as canals, even when returns from their operation would have substantially exceeded construction costs (Rosenthal, 1992). The principal problem involved establishing rights of way. Local groups who opposed projects (or hoped for a larger share of the profits) could perpetually delay construction by repeatedly suing in slow and inefficient courts. Only after its revolution did France simplify procedures for establishing rights

of way. Britain established procedures for establishing rights of way more than a century before France and other countries on the continent. Britain created these procedures at the same time that Parliament established procedures for passing estate, statutory authority, and enclosure acts.

We close by reemphasizing how our findings expand Coase's insights into Parliament and property rights in industrializing Britain (Coase 1974). Coase argued that in a world with transaction costs, some distributions of property rights promote efficiency. Other distributions trap people in poverty. Parliament and common law courts understood this principle, and strove to assign rights in a way which maximized the wealth of the realm. The evidence presented in this essay shows that Parliament operated in this way since the early 1700s, a century and a half before the era studied by Coase.

Appendix: Derivation of Estimating Equation

This section elucidates how to interpret patterns in the evidence. The exercise begins with intuition standard among social scientists. Private parties desired Parliament to pass acts. Their desires fluctuated as the value of acts fluctuated. Economic conditions which altered the net benefits of reorganizing rights propagated those fluctuations. Social scientists summarize such relationships with an inverse demand function.

$$(1) \qquad p_d = F(q_d, X)$$

In this equation, p_d indicates the maximum amount that the public would expend to secure the passage of a certain quantity of legislation, q_d. X indicates the array of economic factors that influenced the net benefits of legislation. $X = \{x_1, x_2, ..., x_I\}$, where x_i represents the ith factor. To keep the notation clear, assume $0 < \partial F / \partial x_i < \infty \quad \forall \ i = 1, ..., I$. Since F represents demand, $\partial F / \partial q < 0$.

The number of acts depended upon the time, effort, and resources that the legislature and bureaucracy expended in the approval process as well as political factors that influenced legislative productivity. The number of acts passed also depended upon the lawyers, lobbyists, and peripheral personnel that supplicants employed to prepare and advance their petitions. Petitioners had numerous routes for bringing bills before the Houses of Lords and Commons. Petitioners could choose among numerous lawyers that prepared petitions and approach any MP. We summarize this process with a supply function.

$$(2) \qquad p_s = G(q_s, Z)$$

p_s indicates the costs of passing a quantity of legislation, q_s, during a particular year. Z indicates the array of factors influencing the supply of legislation during that year. Symbolically, $Z = \{z_1, z_2, ..., z_J\}$, where z_i represents the jth factor. To keep the notation clear, assume

34

$\partial G/\partial z_j > 0$ $\forall$ $j = 1,...,J$. In the short run, increasing the quantity of acts required more intensive employment of factors with diminishing returns and rising costs. So, $\partial G/\partial q \geq 0$.

The interaction of supply and demand determines the quantity of acts that Parliament passes. This equilibrium occurs when the demand price, p_d, equals the supply price, p_s, plus some markup, m.

(3) $p_d = p_s + m$

If the markup exceeds zero, then someone in the act-passing process (either lobbyists, opponents of the legislation, or MPs) were able to extract some of the surplus generated by the legislation, and the equilibrium occurs at the intersection of the supply and marginal revenue curves. If the markup equals zero, then the act-passing process was completely competitive, and the equilibrium occurs at the intersection of the demand and supply curves.

Substituting Equations (1) and (2) into Equation (3) reveals the number of acts passed in equilibrium.

(4) $F(q^*, X^*) - G(q^*, Z^*) = m$

Here, the asterisk superscript indicates quantities of variables in equilibrium. Rewriting the equilibrium condition emphasizes the implicit relationship between the equilibrium values of the variables.

(5) $H(q^*, X^*, Z^*) \equiv F(q^*, X^*) - G(q^*, Z^*) = m$

The implicit function theorem describes the relationship between the function, H, the equilibrium level of quantity demanded, q^*, and the variables that shift supply and demand, X and Z.

(6) $q^* = Q(X^*, Z^*)$

(6') $\dfrac{\partial q^*}{\partial x_i} = (-1)\dfrac{\partial H(q^*, X^*, Z^*)/\partial x_i}{\partial H(q^*, X^*, Z^*)/\partial q_*} = \dfrac{-\partial F(q^*, X^*)/\partial x_i}{\partial F(q^*, X^*)/\partial q^* - \partial G(q^*, Z^*)/\partial q^*}$

$$(6'') \quad \frac{\partial q^*}{\partial z_i} = (-1)\frac{\partial H(q^*, X^*, Z^*)/\partial z_i}{\partial H(q^*, X^*, Z^*)/\partial q^*} = \frac{-\partial G(q^*, Z^*)/\partial z_i}{\partial F(q^*, X^*)/\partial q^* - \partial G(q^*, Z^*)/\partial q^*}$$

The total differential of (6) provides a linear approximation of the relationship in the neighborhood of the equilibrium.

$$(7) \quad Dq^* = DQ(X^*, Z^*) = \sum_{i=1}^{I} \frac{\partial q^*}{\partial x_i} dx_i + \sum_{j=1}^{J} \frac{\partial q^*}{\partial z_j} dz_j$$

This relationship can be estimated with the data described in the body of the essay. The change in the quantity of acts, Dq^*, is the change in the number of acts passed from year $t-1$ to year t. The changes in the independent variables, dx_i and dz_j, are changes in variables that influence demand and supply from year to year. The estimating equation is

$$(8) \quad \Delta A_t = \sum_{i=1}^{I} \alpha_i \Delta x_{i,t-1} + \sum_{j=1}^{J} \beta_j \Delta z_{j,t-1} + \varepsilon_t$$

where ΔA_t is the change in the number of acts from $t-1$ to t. $\Delta x_{i,t-1}$ is the change in the ith demand shift variable from $t-2$ to $t-1$. α_i is an estimate of $\partial q_* / \partial x_i$. $\Delta z_{j,t-1}$ is the change in the jth supply shift variable from $t-2$ to $t-1$. β_j is an estimate of $\partial q_* / \partial z_j$. ε_t is an error term.

Our estimates of $\partial q^* / \partial x_i$ and $\partial q^* / \partial z_j$ do not allow us to recover the parameters of the underlying supply and demand curves, F and G. However, proposition 1 indicates how the estimates enable us to characterize the shape of the supply curve.

Proposition 1. If $\partial q_* / \partial x_i \neq 0$ for some i, then $\partial G(q_*, Z_*) / \partial q_* < \infty$.

Proof. This is a proof by contraposition. Assume $\partial G(q_*, Z_*) / \partial q_* = \infty$. Then,
$$\frac{\partial q_*}{\partial x_i} = \frac{-\partial F(q_*, X_*)/\partial x_i}{\partial F(q_*, X_*)/\partial q_* - \infty} = 0 \quad \forall \ i = 1,\dots,I \quad \text{because} \quad \partial F(q_*, X_*)/\partial q < 0 \text{ and}$$
$$\partial F(q_*, X_*)/\partial x_i < \infty.$$

Proposition 1 indicates that if the quantity of acts fluctuated in response to fluctuations of one (or

more) of the factors that influenced the demand for acts, then the supply curve for acts was not

perfectly inelastic. Determining whether α_i, our estimate of $\partial q_*/\partial x_i$ differ from zero involves the

traditional hypothesis test for statistical significance.

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Table 1: Estate and Other Private Acts, Summary Statistics

		Δ Rights		Series in levels				Series in differences			
		Land	Personal	Avg	SD	Min	Max	Avg	SD	Min	Max
	Type of Acts	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Estate Acts										
(a)	All Estates	All	Some	21.7	8.4	0	45	-0.2	9.6	-21	30
(b)	Estates that authorizes sales	All	Some	11.2	5.0	0	29	-0.1	5.7	-15	15
(c)	Estates that authorizes leases	All	Some	3.7	3.1	0	24	0.0	3.1	-12	16
(d)	Estates that authorizes sales or leases	All	Some	14.8	6.8	0	39	-0.1	7.2	-17	17
	Placebo Group **Non-Estate Private Acts**										
(e)	Marriage	No	All	1.6	2.0	0	10	0.1	2.2	-9	7
(f)	Naturalization	No	All	7.7	6.2	0	36	0.0	6.9	-25	20
(g)	Office	No	All	0.4	0.7	0	4	0.0	1.0	-4	3
(h)	Sum (Marriage, Naturalization, Office)	No	All	12.1	7.9	0	47	0.1	9.3	-34	26

Notes: Column (1) indicates acts that changed rights to land and resources, marked "All" for acts that did and "no" for acts that did not. Column (2) indicates acts that altered personal rights, marked "All" for acts that did, and "some" if the act sometimes affected personal rights. Columns (3) through (6) describe the statistical properties of the original series. Columns (7) through (10) describe the statistical properties of the series in differences, i.e. where the observation in year t-1 is subtracted from the observation in year t. Columns (3) and (7) indicate the average. Columns (4) and (8) indicate the standard deviation. Columns (5) and (9) indicate the minimum value. Columns (6) and (10) indicate the maximum value.

Table 2: Statutory Authority and Finance Acts, Summary Statistics

		Δ Rights To Land	Provide I & S	Series in levels					Series in differences				
				Avg	SD	Min	Max	Stat?	Avg	SD	Min	Max	Stat?
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Statutory Authority Acts												
(a)	All	All	All	50.8	41.4	0	187	No	1.0	19.4	-53	68	Yes
(b)	Transportation Only	All	All	37.2	29.1	0	126	No	0.7	14.3	-37	56	Yes
(c)	Urban Only	All	All	9.8	10.8	0	53	Yes	0.2	6.9	-22	26	Yes
	Placebo Group												
(d)	Govt. Finance Acts	None	Some	24.5	23.0	0	94	Yes	0.2	16.5	-87	54	Yes

Notes: Column (1) indicates acts that changed rights to land and resources, marked "All" for acts that did and "none" for acts that did not. Column (2) indicates whether the acts authorized the provision of infrastructure or services, marked "All" for acts that did and "some" for categories in which some acts authorized infrastructure and services. Columns (3) through (7) describe the statistical properties of the original series. Columns (8) through (12) describe the statistical properties of the series in differences, i.e. where the observation in year t-1 is subtracted from the observation in year t. Columns (3) and (8) indicate the average. Columns (4) and (9) indicate the standard deviation. Columns (5) and (10) indicate the minimum value. Columns (6) and (11) indicate the maximum value. Columns (7) and (12) indicate whether the series is stationary, indicated "yes," or whether the series is non-stationary, indicated "no." An augmented Dickey-Fuller test is used to determine whether the series possesses a unit root.

Table 3: Enclosure Acts and Amendments, Summary Statistics

		Δ Rights To Land	Correct Error	Series in levels					Series in differences				
				Avg	SD	Min	Max	Stat?	Avg	SD	Min	Max	Stat?
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(a)	Enclosure Acts	All	None	32.1	35.1	0	136	No	0.2	13.8	-49	37	Yes
(b)	Enclosure Amendments	Some	All	0.2	0.7	0	5	Yes	0	1.1	-5	5	Yes

Notes: Column (1) indicates acts that changed rights to land and resources, marked "all" for acts that did and "some" for categories in which some acts changed rights to land and resources while other acts did not. Column (2) indicates whether the acts amended or corrected earlier acts changing rights to land and resources, marked "all" for acts that did and "none" for acts that did not. Columns (3) through (7) describe the statistical properties of the original series. Columns (8) through (12) describe the statistical properties of the series in differences, i.e. where the observation in year t-1 is subtracted from the observation in year t. Columns (3) and (8) indicate the average. Columns (4) and (9) indicate the standard deviation. Columns (5) and (10) indicate the minimum value. Columns (6) and (11) indicate the maximum value. Columns (7) and (12) indicate whether the series is stationary, indicated "yes," or whether the series is non-stationary, indicated "no." An augmented Dickey-Fuller test is used to determine whether the series possesses a unit root.

Table 4: Explanatory Variables, Summary Statistics

		Series in Differences				Description	Sources
		Avg	SD	Min	Max		
		(1)	(2)	(3)	(4)	(5)	(6)
(a)	Interest Rate, Real	-0.1	4.9	-15.1	12.9	Yield on 2½ % consols minus inflation.	Neal (1990) and Clark (2001)
(b)	Foreign Trade, Volume	738	4665	-24200	18300	Sum exports plus imports at official prices.	Mitchell (1988)
(c)	Election Year	0	0.6	-1	1	Indicator for years with elections.	H.HS (1993) and Evans (2001)
(d)	Monarch Dies	0	0.3	-1	1	Indicator for years in which monarch dies.	H.HS (1993) and Evans (2001)
(e)	Prime Minister Changes	0	0.5	-1	1	Indicator for years in which PM changes.	H.HS (1993) and Evans (2001)
(f)	Epidemic Mortality	0	0.3	-1	1	Indicator for years with epidemic mortality.	H.HS (1993) and Evans (2001)
(g)	Land Tax Rate, Real	0	0.5	-2.1	2.0	Tax rate in shillings per acre.	H.HS (1993) and Evans (2001)
(h)	Tax Code Change	0	0.1	-1.	1	Indicator for year when tax code changes.	H.HS (1993) and Evans (2001)
(i)	War Years	0	0.3	-1	1	Indicator for years when Britain fights wars.	Rodger (2004), H.HS (1993), and Evans (2001)
(j)	Tree Ring Belgium	11.6	258.0	-1040	1190	Index. 0 equals no growth. 1000 is average.	Hoffsummer (1986)
(k)	Tree Ring England	2.5	177.1	-468	496	Index. 0 equals no growth. 1000 is average.	Baillie (1986)
(l)	Tree Ring French Alps	-4.0	282.0	-871	867	Index. 0 equals no growth. 1000 is average.	Tessier (1995)
(m)	Tree Ring Pomerania	0.1	16.7	-63	61	Index. 0 equals no growth. 1000 is average.	Wazny (1986)
(n)	Tree Ring New York	1.45	187.4	-495	493	Index. 0 equals no growth. 1000 is average.	Cook (1995)
(o)	Tree Ring Virginia	1.4	196.2	-479	550	Index. 0 equals no growth. 1000 is average.	Cook (1994)

Notes: Definitions for Columns (1) through (4) identical to definitions for Columns (8) through (11) in Table 3. All of these differenced series are stationary. H.HS (1993) refers to the texts by Holmes (1993) and Holmes and Szechi (1993).

Table 5: Estate Acts, 1705-1830, Regression Results

	Δ Estate Acts				Δ Non-Estate Private Acts				
	Sales + Leases (1)	Sales + Leases (2)	Sales + Leases (3)	Sales + Leases (4)	Marriage (5)	Naturalize (6)	Office (7)	All (8)	All (9)
Δ Real interest rate t-1	**-0.22** [0.11]			-0.11 [0.13]					-0.28 [0.32]
Δ Real interest rate t-2		**-0.34** [0.10]	**-0.39** [0.11]	**-0.40** [0.12]	-0.03 [0.04]	0.11 [0.17]	0.02 [0.02]	-0.01 [0.22]	0.08 [0.27]
Δ Trade t-1	-0.03 [0.12]			-0.22 [0.14]					0.01 [0.14]
Δ Trade t-2		-0.09 [0.17]	-0.07 [0.16]	-0.10 [0.16]	0.04 [0.08]	-0.15 [0.20]	-0.01 [0.01]	0.09 [0.28]	-0.06 [0.28]
Control Variables?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
#Observations	124	124	124	124	124	124	124	124	124
F-test (deg. freedom)	(2,113)	(2,113)	(9,106)	(11,104)	(9,106)	(9,106)	(9,106)	(9,106)	(11,104)
F-test statistic	313	360	528	2945	19	53	13378	149	162
Sum coefficients on Δ real interest rate t-1 and t-2 (p-value)				**-0.51** (0.002)					-0.2 (0.37)
Sum coefficients on Δ trade t-1 and t-2 (p-value)				-0.32 (0.23)					-0.05 (0.90)

Notes: **Bold face** indicates significant at the 5% level. *Italic* indicates significance at the 10% level. Standard errors calculated using the Newey-West procedure with 3 lags. Control variables include year of election, monarch dies, prime minister changes, epidemic mortality, land tax rate real, tax code change, and war years.

Table 6: Estate Acts, 1765-1830, Regression Results

	Δ Estate Acts					Δ Non-Estate Private Acts				
	Sales + Leases	Sales + Leases	Sales + Leases	Sales	Leases	Marriage	Naturalize	Office	All	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ Real interest rate t-1	**-0.32**		*-0.21*	-0.02	*-0.19*					-0.46
	[0.13]		[0.12]	[0.09]	[0.11]					[0.50]
Δ Real interest rate t-2		**-0.39**	**-0.43**	**-0.34**	-0.09	-0.06	-0.01	0.01	-0.12	0.05
		[0.17]	[0.16]	[0.14]	[0.08]	[0.08]	[0.38]	[0.03]	[0.48]	[0.58]
Δ Trade t-1	-0.05		**-0.29**	-0.14	**-0.15**					0.07
	[0.12]		[0.14]	[0.11]	[0.06]					[0.15]
Δ Trade t-2		-0.02	-0.06	-0.15	**0.09**	0.03	-0.20	0.00	-0.18	-0.13
		[0.13]	[0.12]	[0.11]	[0.04]	[0.08]	[0.22]	[0.01]	[0.31]	[0.31]
Control Variables?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
#Observations	66	66	66	66	66	66	66	66	66	66
F-test (deg. freedom)	(2,64)	(9,57)	(11,55)	(11,55)	(11,55)	(9,57)	(9,57)	(9,57)	(9,57)	(11,55)
F-test statistic	3	7	8	3	5	3	2	1	1	2
Sum coefficients on Δ real interest rate t-1 and t-2			**-0.64**	**-0.36**	*-0.28*					-0.41
(p-value)			(0.003)	(0.01)	(0.06)					(0.23)
Sum coefficients on Δ trade t-1 and t-2			-0.35	-0.29	-0.06					-0.06
(p-value)			(0.15)	(0.16)	(0.48)					(0.88)

Notes: **Bold face** indicates significant at the 5% level. *Italic* indicates significance at the 10% level. Standard errors calculated using the Newey-West procedure with 3 lags. Control variables include year of election, monarch dies, prime minister changes, epidemic mortality, land tax rate real, tax code change, and war years.

Table 7: Statutory Authority Acts Regression Results

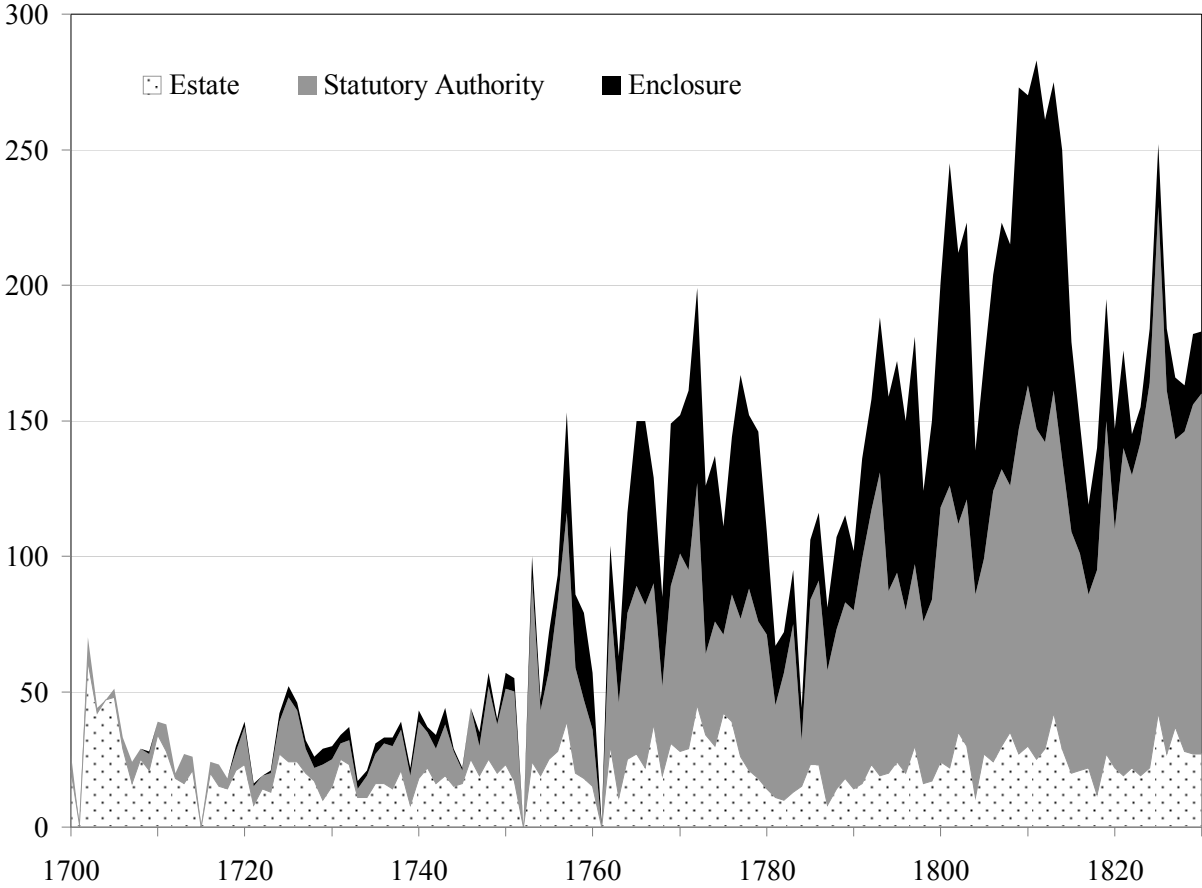|	Δ Statutory Authority Acts							Δ Finance
	All	All	All	All	Transport	Urban	All	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Real interest rate t-1	**-1.00**	**-1.03**	**-1.00**	**-1.20**	**-0.56**	*-0.27*	**-0.87**	-0.03
	[0.33]	[0.31]	[0.34]	[0.45]	[0.20]	[0.14]	[0.26]	[0.33]
Δ Real interest rate t-2			-0.14					
			[0.35]					
Δ Trade t-1	**1.03**	**1.03**	**1.01**	**1.12**	**0.58**	**0.37**	**1.08**	0.64
	[0.36]	[0.31]	[0.35]	[0.34]	[0.24]	[0.11]	[0.39]	[0.53]
Δ Trade t-2			-0.02					
			[0.32]					
Control variables?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	124	124	124	66	124	124	120	120
F-test (deg freedom)	(2,113)	(9,106)	(11,104)	(9,57)	(9,106)	(9,106)	(9,102)	(9,102)
F-test statistic	117	169	1237	8	255	482	169	26
Sum coefficients on Δ real interest rate t-1 and t-2			**-1.14**					
(p-value)			(0.001)					
Sum coefficients on Δ trade t-1 and t-2			*0.99*					
(p-value)			(0.10)					

Notes: **Bold face** indicates significant at the 5% level. *Italic* indicates significance at the 10% level. Standard errors calculated using the Newey-West procedure with 2 lags. Control variables include years of election, monarch dies, prime minister changes, epidemic mortality, land tax rate real, tax code change, and war.

Table 8: Enclosure Acts Regression Results

	Δ Enclosure Acts			Δ Amendments
	(1)	(2)	(3)	(4)
Δ Real interest rate t-1	**-1.02**	**-1.04**	**-0.81**	0.01
	[0.28]	[0.27]	[0.29]	[0.03]
Δ Real interest rate t-2			**-1.26**	
			[0.50]	
Δ Trade t-1	0.45	0.43	0.26	-0.04
	[0.32]	[0.34]	[0.32]	[0.04]
Δ Trade t-2			0.04	
			[0.35]	
Control variables?	No	Yes	Yes	Yes
# Observations	66	66	66	66
F-test (deg freedom)	(2,64)	(9,57)	(11,55)	(9,57)
F-test statistic	11	7	8	1
Sum coefficients on Δ real interest rate t-1 and t-2			**-2.07**	
(p-value)			(0.00)	
Sum coefficients on Δ trade t-1 and t-2			0.30	
(p-value)			(0.61)	

Bold face indicates significant at the 5% level. *Italic* indicates significance at the 10% level. Standard errors calculated using the Newey-West procedure with 2 lags. Control variables include years of election, monarch dies, prime minister changes, epidemic mortality, land tax rate real, tax code change, and war years.

Table 8: Statutory Authority Acts OLS and 2SLS Results

	OLS (1)	2SLS (2)	2SLS (3)	OLS (4)	2SLS (5)	2SLS (6)
Δ Real interest rate t-1				**-1.12** [0.38]	**-1.54** [0.68]	*-1.28* [0.75]
Δ Trade t-1	**1.00** [0.35]	*1.76* [0.96]	**1.42** [0.67]			*1.20* [0.66]
Control variables?	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	124	124	124	124	124	124
F-test statistic first stage (p-value)		2.45 (0.07)	1.38 (0.16)		1.79 (0.04)	1.47 (0.05)
Over-id Stat (p-value)		0.96 (0.62)	19.01 (0.33)		21.40 (0.21)	17.23 (0.37)
Regions with Treering		UK	NY, VA, FR, BEL, POL, UK		NY, VA, FR, BEL, POL, UK	NY, VA, FR, BEL, POL, UK
Number of lags for Treering data		3	3		3	3

Notes: **Bold face** indicates significant at the 5% level. *Italic* indicates significance at the 10% level. Robust standard errors are reported.

Figure 1: Number of Acts Reorganizing Property Rights, 1700 to 1830.

Sources: see text.

Figure 2: Relationship between Real Interest Rate, Estate Acts, and Placebo Group

$y = -0.2676x + 0.1765$
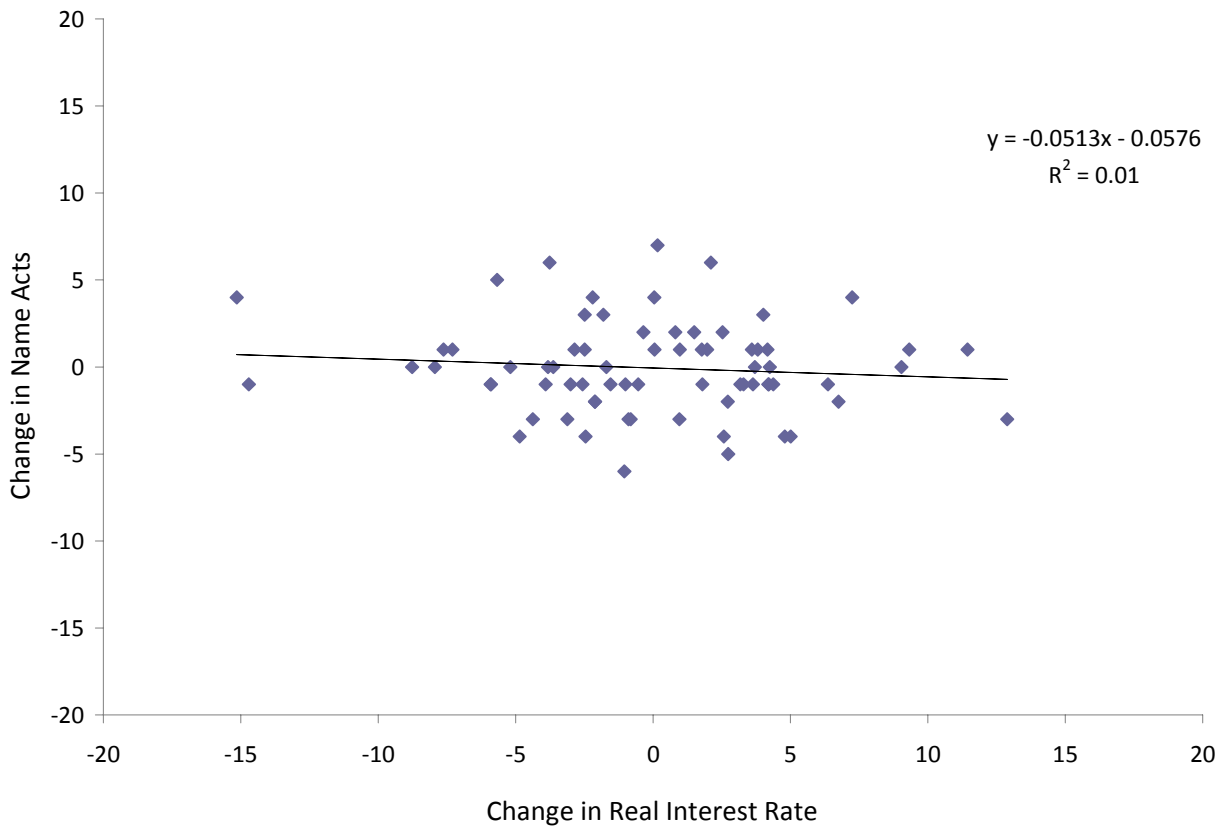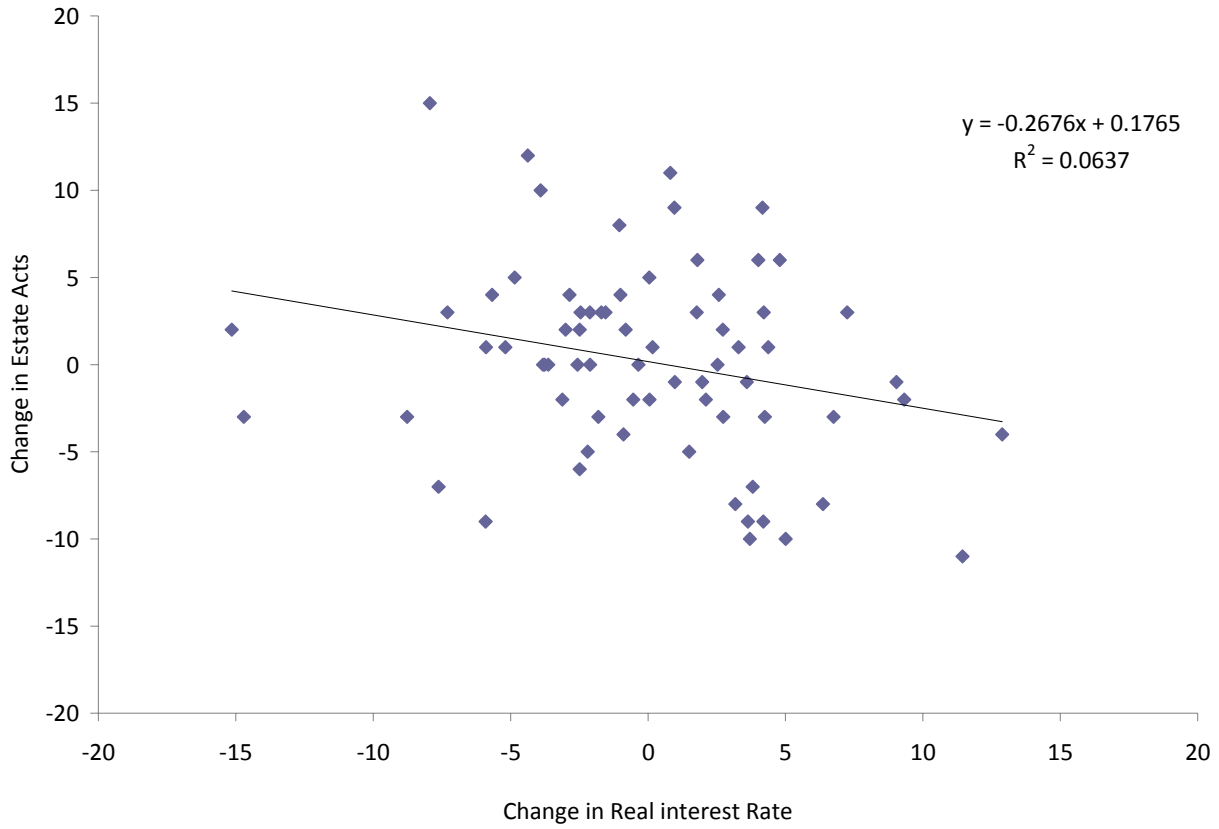$R^2 = 0.0637$

$y = -0.0513x - 0.0576$
$R^2 = 0.01$

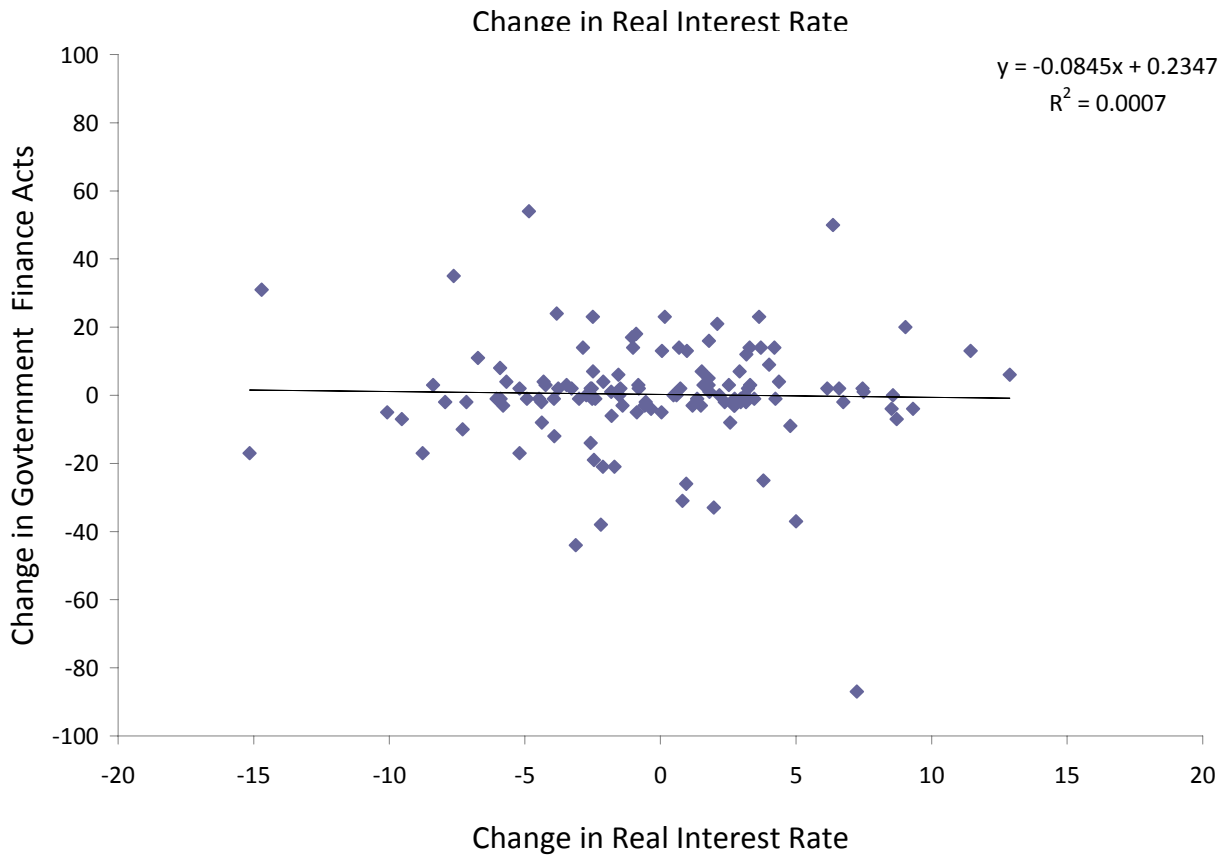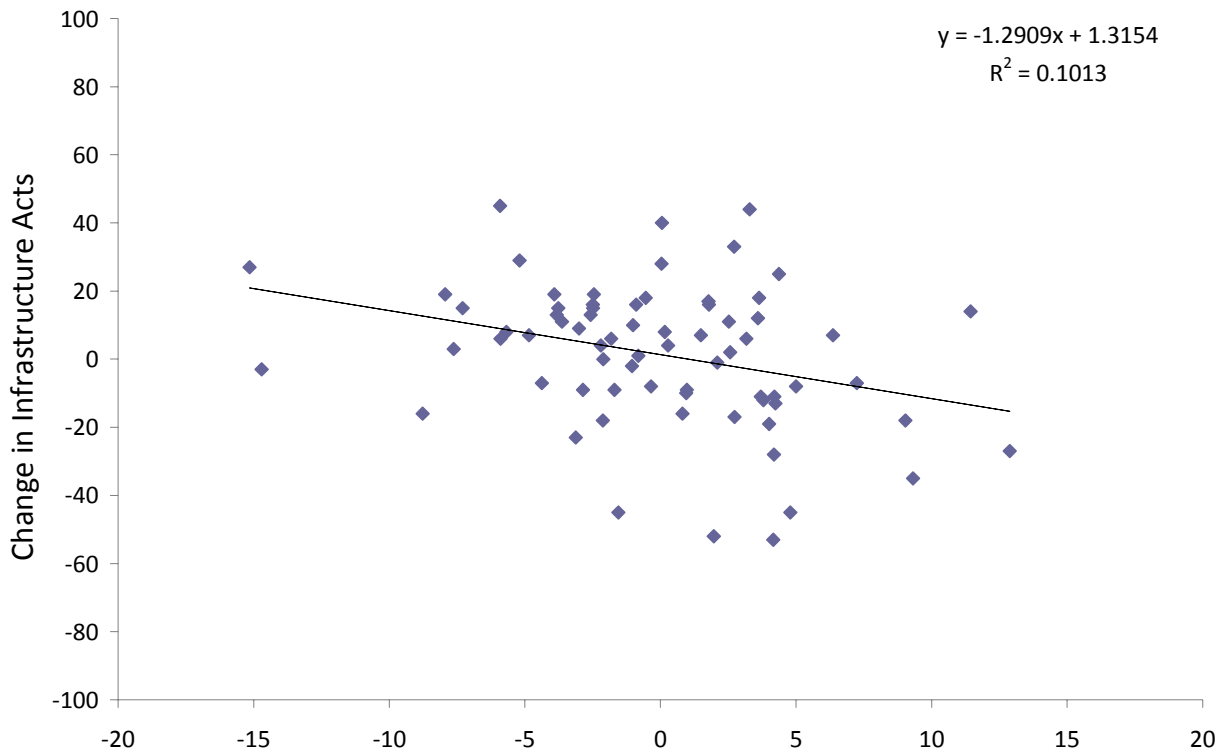Figure 3: Relationship Between Real Interest Rate, Statutory Authority Acts, and Placebo Group

Figure 4: Relationship Between Real Interest Rate, Enclosure Acts, and Placebo Group