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A Macrohistory of Legal Evolution and Coevolution: Property, Procedure, and Contract in Pre-Industrial English Caselaw*

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Abstract

We provide a quantitative macrohistory of the evolution and coevolution of three fundamental elements of English caselaw: property, contract, and procedure. Our dataset is derived from a comprehensive corpus of reports on pre-1765 English court cases. Leveraging existing topic-model estimates, we construct annual time series of attention to each of the three legal domains and estimate a structural VAR. Property and procedure are affected for decades by their own shocks. Procedure and property coevolve. In contrast, contract adjusts quickly to its own shocks and does not coevolve with the other two areas of law. We identify the episodes and events outside the legal system that correspond to systemic shocks. Edward Coke was a shock to procedure. The commercial revolution raised attention to contract. The Glorious Revolution, interestingly, did not lead to elevated attention to property issues, but the Civil War and Interregnum did. The evolution of contract, while relatively autonomous from the internal dynamics of the legal system, was, of the three legal domains, least autonomous from society.

Keywords: Legal coevolution, caselaw, legal history, pre-industrial England, time series, machine-learning

JEL Classifications: C80, C32, K00, N43, P10, O17

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1. Introduction

The history of English law is predominantly a history of caselaw, evolving over many centuries via decisions in vast numbers of cases shepherded through the legal system by strict and meticulous procedure. From the middle-ages on, this was the process by which the English legal profession developed core ideas in property and contract law. These ideas have become foundational elements of the institutional landscape of many modern capitalist societies. Before the Industrial Revolution, at least, legislation or abstract jurisprudence played only a minor role.[1]

The central aim of this paper is to develop a quantitative macrohistory of this process of legal evolution, focusing on developments in three fundamental areas of English caselaw: procedure, property, and contract. We do this by applying vector-autoregressive (VAR) analysis to a novel time-series dataset generated on the basis of prior topic-model estimates. Specifically, existing topic-model estimates, which provide a machine-learning digest of a large corpus of late medieval and early modern legal texts, facilitate the construction of time series of the attention that the legal system paid to each of procedure, contract, and property over the years 1552-1764. VAR applied to these time series then provides parsimonious empirical results, offering insight into the coevolutionary development of the three aspects of caselaw.

This paper makes two main contributions to the literature. The first is substantive: we generate an entirely new set of quantitative insights into the history of English law and the nature of England's early legal development. In particular, we provide a characterization of the coevolutionary development of three fundamental areas of law, showing, for example, how much development in one area spurred or hindered development in other areas. In addition, we are able to distinguish periods of normal legal development from those times affected by large 'shocks', where idiosyncratic events occurring outside the court system, within the society more generally, had a powerful effect on legal development. As a consequence, we add directly to the stock of observations on decisive events in the development of English law and legal institutions.

Our second contribution is methodological: we demonstrate how VAR analysis applied to data generated via topic modeling can be productively employed to construct a quantitative macrohistory of legal evolution and coevolution using an approach that is relevant to the social sciences more generally. VAR has been used extensively to study recent historical events, such as changes in oil prices (Kilian 2009, Baumeister and Kilian 2016). But apart from a small set of notable contributions, it has been little used to study history before the Industrial Revolution, and certainly not legal history.[2] This is undoubtedly because the data requirements of VAR analysis are quite demanding and legal-historical data have thus far not been readily available. Topic-modeling of texts addresses this problem by facilitating the creation of new quantitative measures, thereby enabling the application of VAR to investigate legal macrohistory.

[1] Baker (2019) details developments in English law from the very earliest times. For an overview of literature on law and economic development in the industrial era, see Cornish et al. (2019: 6-10).

[2] For the exceptions, see Eckstein et al. (1984), Pedersen et al. (2021), Edvinsson (2017), Weisdorf and Sharp (2009), Møller and Sharp (2014), Nicolini (2007), Crafts and Mills (2009), and Wells and Wills (2000).

Our central results may be summarized as follows. First, we find that external shocks, such as those emanating from legislation, lead to above-normal attention to an area of law for many years, suggesting that unforeseen legal developments originating outside normal court processes cause many subsequent adjustments by the courts. This adjustment process takes longest for procedure, a result consistent with standard views of the rigidities inherent in the old common-law system. We also find that procedure and property coevolve: the development of caselaw and legal ideas on procedure helps to solve problems in the area of property while changes in procedure heighten attention to property issues, an indication that property law adjusts to fit procedures. In contrast, contract law reacts quickly to external shocks and does not coevolve with the two other areas of law.

Second, our use of VAR helps us to pinpoint the years when large external shocks affected the workings of the legal system. Our estimates reveal dozens of such episodes. For example, we clearly detect an effect attributable to Edward Coke: an innovating lawyer is a shock to the system. Coke's influence particularly coincides with heightened attention to procedure. Similarly, our estimates reveal that uncharacteristically strong development in property law occurred early in the reign of Elizabeth (1558-1603) when real-property issues that had been left dangling by her predecessors were addressed by the courts. So pronounced are the episodes during Elizabeth's reign that much of the overall development of caselaw on property occurred during this time. In contrast, the large shocks to contract occur much later, especially in the period from 1665 to 1684. This is a time when commercialization of the economy was proceeding apace and the custom of merchants was being applied by judges to a much wider domain.

Third, our VAR methodology provides new comparative insights into the development of English property law during the two great revolutionary episodes of the 17th century: the Civil War-Interregnum era and the Glorious Revolution. Interestingly, in the raw data produced by topic-modeling, these two periods look very similar with respect to attention to property: neither period evidences an elevated attention to property. However, our analysis also reveals that those data are produced by very different configurations of circumstances. Attention to property from 1640 to 1654 reflects large positive shocks to property but also a lingering effect of very large past and current shocks to procedure, which depress attention to property. These cancel out in the raw data. During 1685-1700, in contrast, there are no lingering effects of shocks to procedure and no significant shocks to property. Thus, in the earlier era, external events caused the courts to pay increased attention to property issues, while in the later era there is no sign of any unusual external events spurring attention to property law. This observation has relevance to the debates on when the most critical developments occurred in England in the 17th century (North and Weingast 1989, Clark 2007, McCloskey 2010, Acemoglu and Robinson 2012, Ogilvie and Carus 2014, Murrell 2017, Hodgson 2017).

Lastly, as a byproduct of our core analysis, we are able to add insights into the question of the degree of autonomy of legal processes. This is an old question, with many answers that often depend on the specific definition of autonomy (Tomlins 2007). The main insight generated by our

empirical investigation is that the internal dynamics of the legal system explain much more of the development of caselaw on property and procedure than that on contract. For contract, the buffeting of unusual events outside the normal functioning of the system of litigation is much more important. Contract development, then, in comparison with property and procedure, is relatively more autonomous from the internal dynamics of the legal system, but relatively less autonomous from society.

The rest of the paper is organized as follows. Section 2 provides a thumbnail of English legal history for those readers unversed in important details. Section 3 describes the steps taken in the construction of our time-series data, generated on the basis of prior topic-model estimates by Grajzl and Murrell (2021a, 2021b). Section 4 describes our implementation of VAR. Section 5 presents and discusses our results. The final section concludes with a broader reflection on our findings.

2. Background on Early English Legal History

In this section we offer a brief overview of selected aspects of early English legal history intended for readers with limited prior knowledge of the subject.[3] We highlight especially those historical features and developments that are most relevant to the activity of the courts.

2.1. The Courts

By the mid-13th century, the common law of the realm, administered in the royal courts, was a "fully fledged juristic entity" (Baker 2019: 34) operated by specialist practitioners who soon acquired a powerful social status. Distinguished from other venues for dispute resolution, the royal courts relied on an efficient process, provided a written record, and, importantly, offered enforcement backed by the king. The central common-law courts, located in Westminster, were the King's (or Queen's) Bench, the Court of the Common Pleas, and the Court of the Exchequer. The courts were not organized in modern-day hierarchies, but functioned both as courts of first instance and courts of appeal. To facilitate access to royal justice outside of London, the judges of the central courts travelled around the country and held assize sessions. Cases presenting difficult legal issues in the assizes were sometimes reserved for later hearing in the central courts in London.

Equity, a distinct and complementary area of law, was administered in Chancery and presided over by the Lord Chancellor, the head of the legal system and a servant of the Crown. Over time equity acquired jurisdiction over many important legal matters, including trusts of land and mortgages. Because Chancery was willing to hear cases for which prior judgment had already been given at common-law, the relationship between equity and the common-law courts was not always amicable. But the jurisdictional conflicts subsided after the early 17th century, by which time all judges were chosen from the same pool of candidates, all steeped in the common-law.

Gradually, the three highest common-law courts and Chancery acquired jurisdiction over the overwhelming majority of legal matters. Admiralty and the ecclesiastical courts lost most of their jurisdictions as the 17th century proceeded. The Court of Star Chamber, which had gained much

[3] Elements of this section draw on portions of Section 2 in Grajzl and Murrell (2021c).

authority in the 16th century, was abolished in 1641. In contrast to property, contract, and torts cases, the adjudication of criminal cases usually started and ended in the localities, meaning that our database of cases includes relatively few criminal trials: only a small set of criminal cases featuring especially important questions of law were debated in the central courts.

2.2. Legal Procedure

The procedural framework of the common-law from its early beginnings to the mid-19th century was based on a system of writs, a strict and rigid scheme of elaborate rules that defined the ways in which a complaint could be brought to court. With time, legal practitioners invented a broad range of formulae that prescribed the forms of legal action.

An emphasis on reasoning about points of law and judgments arose in the 15th and 16th centuries. The structure of procedures tended to focus the attention of a trial or hearing on only one disputed issue, which then became the focus of the court's deliberations. This increased the importance of knowing and referring to past judicial decisions made in similar cases. Therefore an emphasis on precedent-based reasoning emerged gradually as legal procedures took their distinctive common-law form, becoming a central feature of the English legal tradition.

The heavily formulaic, procedure-infused culture of the common-law courts and the limited set of remedies that they provided revealed the need for an alternative system of justice. Equity, as administered in Chancery, relied on comparatively simpler rules, used an inquisitorial procedure, and provided remedies such as decrees and injunctions that were not available under common-law. Lord Chancellors and their assistant judges were nevertheless common-law-trained lawyers. Thus, in the 17th century and onwards, Chancery cases were regularly reported on and precedent became as important in equity as at common-law.

2.3. Law of Property and Contract

Early common law was to a great extent the law of real-property, grounded in a feudal understanding of land tenure, with the King at the apex of the structure of obligations and rights. Thus, both landlords and their tenants became dependent on royal justice as the system gradually moved to sets of arrangements where the tenant was de facto owner of the land (Baker 2019: 257).

An abiding concern of the law of real property was the ability of tenants/landowners to control ownership after they died. Restrictions on disposition via wills, rules on perpetuities, law and custom on inheritance, and the Crown's need to collect revenues from feudal tenure arrangements all interacted to produce centuries of litigation over ownership. Practicing lawyers played a large part in the creation of new property arrangements, constructed with the aim of determining ownership at death and the by-passing of feudal dues. The process was shaped by both the courts, via caselaw, and the King in Parliament, via legislation, attempting to mold property law.

In the seventeenth century, property law was greatly influenced by the attempts of the new gentry to preserve their family estates.[4] Perhaps the most significant development was the distinctively English law on uses, that is, the separation of legal title to a property from beneficial ownership of the same property. Chancery, in particular, gradually shaped the interest of the beneficiary into a new set of property rights. A complex set of inheritance arrangements, known as strict settlement, were one consequence. Thus trusts became hugely important in property law, foreshadowing the modern corporation (Morley 2016). At the same time, the mortgaging of real property emerged as a popular approach to securing loans.

Legal action for breach of an agreement was initially possible under a wide range of formulae, each of which had its own shortcomings. Via a tortuous route, across many centuries, the courts made an action in assumpsit the standard approach to recover damages.[5] After an internecine struggle, the common-law courts eventually settled on using this type of action to channel litigation for the recovery of debts. The critical decision was Slade's case in 1602, but the whole first half of the 17th century saw the development of much caselaw on the use of assumpsit. There were critical repercussions in the latter half of that century on the use of bills of exchange and promissory notes, which were spreading far beyond the London merchant community as the whole society became increasingly commercialized. The latter part of the 17th century and the early 18th century saw much litigation connected to these early forms of paper money.

Actions in assumpsit often led to a determination of the facts by a jury, in a era when perjuring witnesses were available for hire. This problem became more critical after the abolishment of the Court of Star Chamber, which could administer more draconian punishments than could the common-law courts. To address the resulting concerns, the 1677 Statute of Frauds ruled that certain contracts had to be in writing to be enforceable. Litigation was then generated by practicing lawyers attempting to avoid the strictures of that Statute.

With spreading commercialization, and the demise of the old merchant courts, the custom of merchants (i.e., the law merchant) was increasingly being used as a basis for decisions on commercial matters. Custom, subject to rigorous qualifications, had always been part of the common-law, but the common-law courts seemed to become much more receptive to the custom of merchants as the 17th century proceeded. This process continued into the 18th century. In addition, equity courts were developing their own doctrine of contract performance, addressing matters that common-law would not. By virtue of its comparatively greater flexibility and by taking evidence from the contracting parties, equity was better able to consider the intentions of the parties and the idiosyncratic circumstances surrounding an agreement. Equity also had access to remedies other than damages, such as specific performance.

In sum, our data covers a time period in which the law on procedure, property, and contract were undergoing large-scale development, mainly via the decisions made in the four central courts.

[4] The gentry were a class of landowners, many of whom had acquired land during the Reformation, and were becoming much wealthier through their own industry and the improving economic fortunes of the English countryside.
[5] The term 'assumpsit' referred to the promise made in undertaking to do something.

With the solidification of precedent, these decisions provided the caselaw that would constitute the vast majority of the law of procedure, property, and contract as England entered the Industrial Revolution. The internal dynamics of the system of litigation and adjudication created the relevant law, but this system was affected by shocks that were outside its normal operations: there was the occasional statute, the judge who went beyond the normal in reshaping an area of law, political strife, and the continuing economic development that brought a wider set of the population into activities that were within the ambit of the law.

3. Measuring the Attention to Property, Contract, and Procedure in Early English Caselaw

3.1. Topic Model Estimates as a Source of Data

Our measures of attention to property, contract, and procedure in pre-industrial English caselaw are derived from the estimates of Grajzl and Murrell (2021a, 2021b; henceforth GM). They draw on the English Reports (Renton 1900-1932; ER, in brief) to assemble a corpus of 52,949 reports on cases heard before 1765. The ER cover a selection of cases considered by the superior courts. Reporters were especially eager to provide a record of cases that highlighted unsettled or novel aspects of law, that is, cases that led to legal development. By such means, the ER became the record of court cases that the English legal profession has used as its authoritative source for late medieval and early modern legal precedent. Thus, even though the ER are certainly not representative of the universe of all court cases adjudicated in the pertinent era, the ER provide unique insight into the nature of pre-18th-century English caselaw development. No comprehensive exploration of late medieval and early modern English legal history can be conducted without use of the ER. At the same time, no other legal-historical corpus of comparable breadth and depth has been preserved for the pre-18th-century period.

GM first carefully pre-processed the corpus.[6] To characterize the development of English caselaw and its associated legal ideas prior to 1765, GM then use the corpus as the data to estimate a 100-topic structural topic model (STM; Roberts et al. 2014, 2016).[7] Topic modeling is an unsupervised machine-learning algorithm that exploits patterns in the co-occurrence of word-use across documents to identify topics (Blei 2012). One can think of topics as providing the chapters of a legal digest, with each chapter capturing one part of the information contained in the corpus. Importantly, the topics themselves are exclusively the product of estimation; they are not the result of an attempt to fit cases into pre-existing categories.

The corpus used by GM spans more than two centuries. During that time, the English language certainly changed. Nevertheless, topic modeling provides an appropriate approach for generating a digest of the corresponding corpus. First and foremost, the system of writs and bills, which determined how legal action could be commenced in court, enforced continuity and relative

[6] See Grajzl and Murrell (2021a, Appendix B) for details.

[7] Section 3 in Grajzl and Murrell (2021a) provides a detailed justification of the decision to estimate a model with precisely 100 topics. In a nutshell, a model with 100 topics fits the data well and no alternative models clearly dominates the 100-topic model on the basis of scores on average semantic coherence and exclusivity.

stability in the use of legal language. Second, topic modeling identifies topics based on co-appearance of words in documents. Especially notable changes in the substantive meaning of words would therefore be reflected in the estimates through the assignment of the distinct meanings to distinct topics.[8] Third, in pre-processing the corpus, GM standardized the English orthography, eliminated Law French reports, and translated Latin. Therefore, the steps taken in the assembly of the corpus and the features of topic modeling directly address the nuances of changing language.

Upon estimating the model, GM provided an interpretation of the substance of each estimated topic—the chapter name. They show that the 100 estimated topics are readily interpretable. The generation of topic names uses two pieces of information. First, since topics are probability distributions over the corpus vocabulary, clues are provided by the words (or rather their stems) that are most used by the topic.[9] For example one topic in GM is characterized by keywords such as 'judgement', 'error', 'writ', 'erratum', 'erron', 'supersedea', 'revers', 'recogniz', 'record', 'transcript'. Therefore, the case reports prominently featuring this topic use terms for the formal procedural steps that must be followed to address various errors of fact or law that arise in court decisions.

The second piece of information used to generate topic names is an examination of the reports of cases that feature a topic highly.[10] For instance, in one top document for the topic considered in the previous paragraph, there is the statement that: "If a judgment be below for the plaintiff, and a writ of error is brought and the judgment reversed, yet, if the record will warrant it, the Court ought to give a new judgment for the plaintiff; but if the judgment be erroneous and against the plaintiff in the merits, that ought to be reversed, and a new judgment given for the defendant" (Anonymous, 7 Modern 2, 87 ER 1056). GM name this topic Writs of Error, a very important aspect of procedural law, both in the time under study and now.[11] Of course, this is just one example of 100 topics.[12]

[8] For instance, 'patent' in the context of an early topic named Royal Patents & Tenures (see Grajzl and Murrell 2021a, Appendix E) pertains to the monarch's granting of an appointment, e.g. "A scire facias was brought to reverse a patent, in which the case was; King Charles the Second, anno 12, of his reign, grants the office of searcher to Martin, durante beneplacito…" (Rex v Kemp, Skinner 446, 90 ER 198). But 'patent' in a case featuring prominently a comparatively more recent topic named Publishing & Copyright (see Grajzl and Murrell 2021a, Appendix E) is related narrowly to publishing, e.g. "In action upon the statute against the defendant for printing and publishing an almanack, to their damage; special verdict finds that the usage of printing hath been regulated by the King, &c. and that he by patent granted them the sole printing of almanacks, and of the Common-Prayer Books…" (Corporation of Stationers v Seymor, 3 Keble 792, 84 ER 1015). Here, the GM-estimated topic model clearly differentiates between the nuances of meaning by identifying two distinct topics.

[9] Topic modeling generates a matrix whose individual entries are the expected probability of the use of any single word by every topic.

[10] GM find that examining the top 40 documents is sometimes required.

[11] Topic names are capitalized in order to distinguish them clearly.

[12] For a detailed elaboration on the naming of each of the 100 topics, see Grajzl and Murrell (2021a, Appendix E). We rename GM's Interacting in Court as Decisional Logic, prompted by scrutiny of the case-reports that most use this topic.

3.2. Generating the Time Series of Attention to Property, Contract, and Procedure

STM estimates the proportion of each of the 100 topics within each of the 52,949 reports. The year of each reported case is known, as is the length of the report in words. We use these three pieces of information to calculate the relative attention to each of the 100 topics for every year between 1552 and 1764. We focus on relative as opposed to total attention (as measured, for example, with total word count) because during the period of our focus the number of reports included in the ER varies considerably (see Figure 1 in Grajzl and Murrell 2021a). In the time period covered by our data, case reporting was haphazard and an activity that was not commissioned by the courts.[13] A measure of relative attention is therefore arguably better suited for capturing fundamental changes in emphases on specific sets of legal ideas than a measure of total attention would be: total attention would be sensitive to variability in the raw count of available reports.

To compute our measures of relative attention (henceforth attention, in short), for each topic in every year we compute a weighted average of the prevalence of the topic within reports on cases heard in that year, using as weights the lengths of the reports as measured by the number of words.[14] The resultant data comprise 100 time series of the average yearly attention paid to topics during the period 1552-1764.

In this paper we focus on those 55 topics that clearly capture elements of property, contract, and procedure, respectively. We assigned topics to these three themes manually, based on our own knowledge of the topics.[15] The themes that we use here aggregate elements of the classification introduced by GM. For example, to reflect our focus on the broad notions of contract and property, we subsumed several topics classified under debt by GM into our contract theme. Similarly, our property theme encompasses both real property and personal property topics as defined by GM. Given that each of the GM-estimated topics pertains to a readily interpretable set of ideas and concepts, the aggregation of topics into themes by the further application of any automated approach (e.g. factor analysis or clustering) would not provide any advantages over our manual approach.[16] Table 1 lists the topics falling into each of these three themes and provides summary information on topic attention.

Given the interconnected nature of law, it is not surprising that some topics lie close to the boundaries between themes. For example, topics stressing pleading, a key procedural vehicle for case adjudication in late medieval and early modern English law, can feature prominently in the

[13] See Grajzl and Murrell (2021a, Appendix A). 1552 is the year after which the number of available case reports stabilizes in the double digits, and 1764 was chosen by GM as one that marked the end of the pre-industrial era.

[14] For the civil-war years 1643, 1644, and 1645, the yearly number of case reports drops below 20. For those years, the values of the series were imputed using linear interpolation.

[15] See Gennaro and Ash (2022) for an analogous approach to construction of broader themes (categories) on the basis of estimated topics.

[16] Similarly, re-estimation of a topic model featuring a smaller number of topics from the outset would have undoubtedly yielded inferior results: standard model-fit metrics for the GM-estimated topic model clearly show that the estimated number of topics must be appropriately large in order to produce exclusive and coherent topics, (See Grajzl and Murrell 2021a: Sec. 3).

context of procedure (e.g. Correct Pleas), contract (e.g. Pleadings on Debt), and property (e.g. Elizabethan Land Cases). However, it is clear that in the first context, the emphasis on pleading is central to procedural issues, while in the latter two contexts pleading is used merely as a tool to elucidate the substantive legal issue. There are also examples of topics that are less clear-cut with regard to classification. Mortgages, for instance, entail a transfer of interest in real-property and the corresponding topic is therefore assigned to the property theme in the present paper. Mortgages, however, also facilitate debt contracts and are therefore quite close to the contract theme. We have verified that all of our key qualitative findings are robust to slightly modified definitions of our property, contract, and procedure themes.

Our property theme includes 24 topics, contract 14, and procedure 17. The attention paid to each of the three themes in a given year is then the sum of the yearly weighted topic proportions for the topics comprising the particular theme.[17] This yields the three time series that capture the temporal evolution of the yearly attention to property, contract, and procedure between 1552 and 1764. These time series are the variables that we employ in our VAR. Figure 1 plots the three time series, each comprising 213 observations, together with the trend computed using the Hodrick-Prescott filter. Table 2 provides descriptive statistics, while appendix Figures A1, A2, and A3 present timelines of each of the 55 topics.

3.3. Attention as Legal Development

To this point, we have referred to the topic and theme timelines as indicating the degree of relative attention that the courts paid each year to the various areas of law. The use of the term 'attention' is implied immediately by the process used to generate the data. The attention directed by the courts to a particular issue is obviously an interesting piece of information in itself, and all the analysis in this paper applies even if readers are not willing to go beyond this interpretation of the data.

However, there is also a deeper interpretation of what the time series of attention convey about the world. To produce that interpretation, GM developed a stylized model of the diffusion of legal ideas and used examples from legal history. GM argue that the attention paid to a topic in any given year reflects the amount of change in adherence to the corresponding legal ideas in that year. Hence, each value of the time series captures the intensity of yearly development of the pertinent area of law.[18]

The series shown in Figure 1 are thus informative of macro-temporal developments in the three core areas of English law from the late medieval era to the onset of the Industrial Revolution. Periods when a series has an increasing trend are times when the legal system enters a period of

[17] This approach is algebraically equivalent to first summing the prevalences of pertinent topics in each document in the relevant year and then computing a weighted average of the resultant prevalences across documents using as weights the number of words in a report.

[18] In contrast, the cumulative sum of the time series up to a specific year—cumulative attention—captures the total development by that year of the applicable legal ideas. Conceptually, these notions exactly correspond to the distinction in epidemiological models between the incidence of new infections and the cumulative number of infections.

intense legal development in the pertinent area of law. Times when a series peaks are eras of especially vigorous legal development. Episodes when a series trends downward are times when the pertinent law is becoming relatively settled. Thus, lack of attention to a specific area of law does not imply that the relevant law is not a fixture of the legal system. Given the nature of the ER, a legal doctrine that is thoroughly accepted will not garner as much attention as one that is undergoing lively development. In the remainder of the paper, we use the terms 'attention to' an area of law and 'development of' an area of law interchangeably.

3.4. The Development of Procedure, Contract, and Property

Although there are many narratives of the development of English law, together with treatises upon landmark cases and treatises upon those treatises, we know of no previous work that contains the type of information presented in Figures 1, A1, A2, and A3. Even without the VAR analysis, they provide their own narrative of the progress of English caselaw.

The 17 time series for procedure appear in Figure A1. The most prominent era of development in procedure was from 1610 to 1660. Developments in many areas contribute (Figure A1), with attention to rulings and judgments particularly prominent (Coke's Procedural Rulings, Procedural Rulings on Actions, Rendering Judgment, Decisional Logic). A lesser focus on procedure appears in the early 18th century, reflecting in part an increase in review procedures (Motions, Reviewing Local Orders, Court Petitions, and Equity Appeals). Notably, the overall attention to procedure is rapidly declining by the mid-18th century, indicating that by the time of the Industrial Revolution, many of the core ideas on the functioning of the courts had been largely settled (Grajzl and Murrell 2021b).

Figure 1 captures the yearly variation in the proportion of the total corpus accounted for by each of the three themes. Attention to property accounts for nearly half of the overall attention of the corpus in the last quarter of the 16th-century. This reflects the fact that land issues were the predominant focus of early common law. Not surprisingly several of the topics that are important in this era have a medieval ring to them, such as Manorial Tenures, Tree Law, and Common Land Disputes. But Uses are prominent and developments in these had very large effects on later law, while other prominent issues are timeless in their applicability (Transfer of Ownership Rights, Competing Land Claims, and Timing of Property Rights). The relative overall attention to property decreases as the importance of feudal law wanes. But later there are some newly prominent, more modern, issues such as Mortgages and Implementing Trusts. The 18th century prominence of Estate Tail and Marriage Settlement suggests that developing methods of keeping the old, landed estates intact was still an important concern.

The temporal development of contracting contrasts with that of procedure and property. Here developments are more pronounced in the 18th than in the 16th century (Figure 1). Slade's case settled a crucial issue, but, as our timelines suggest, also precipitated a large amount of litigation on Assumpsit in the first half of the 17th century (Figure A3). The rise in attention to contract in the third quarter of the 17th century reflects the increasing importance of finance and debt, as seen in the timelines of Pleadings on Debt, Repaying Debt, Claims from Financial Instruments, and

Negotiable Bills & Notes. The overall attention to contracting matters tends to decrease from the last quarter of the 17th century onwards. Figure 1 thus indicates that many legal ideas pertaining to contract had already gained widespread acceptance by the start of the Industrial Revolution. However, multiple areas, such as Negotiable Bills & Notes, Executable Purchase Agreements, Contract Interpretation & Validity, and Bankruptcy continue to exhibit very active development even after 1750 (Figure A3). Thus, the years immediately before the industrial era saw the intensification of legal development pertinent to multiple contracting domains.

4. The Empirical Approach: Modeling Legal Evolution and Coevolution

We study the behavior of the vector $\boldsymbol{y}_t \equiv (proc_t, prop_t, contr_t)'$, where $proc_t$, $prop_t$, and $contr_t$ are the time series of (relative) attention to procedure, property, and contract in year *t*, constructed following the steps outlined in the previous section. What might be called the 'normal' operations of the court system make $\boldsymbol{y}_t$ a function of $\boldsymbol{y}_{t-1}, \boldsymbol{y}_{t-2}$, ... only. This function reflects the fact that a change in one area of caselaw in time *t* might change the amount of attention to all areas of law in time *t*+1 and later because, for example, problems are either created or solved in all areas of law by the initial change.

But $\boldsymbol{y}_t$ is affected by more than the lagged values of all areas of law. There are shocks that occur outside the normal operations of the court system, which produce one-time, idiosyncratic or 'abnormal' changes in $\boldsymbol{y}_t$. For example, the court system might exhibit unusual behavior because of an important political event (civil war), or Parliament passing legislation (Statute of Frauds), or because a particularly innovative judge brings very new ideas (Lord Nottingham on trusts).

Given this structure, vector autoregressions (VAR) can be used to study the empirics of the system. VAR can produce particularly incisive results in historical studies because it is able to differentiate between the normal and the unusual, and tell us about the empirical relevance of both. Once the VAR is estimated, the analysis of the responses of the caselaw variables to shocks conveys the structure of the normal operations of the legal system, that is, how shocks in one area propagate to all areas of law. In contrast, estimates of shocks themselves show when a specific area of law has been unusually affected by some idiosyncratic event outside the court system. Those estimated shocks provide information about which events might have been decisive in caselaw development, increasing our stock of knowledge about historical junctures.

In any practical VAR application there is always the question of which data to use, that is whether or not to transform the original data in some way (e.g. a logarithmic function or differencing). In the current case, measures of the attention to procedure, property, and contract in year *t* are exactly appropriate. As noted above, the attention measures derived from topic-modeling are proxies for the intensity of caselaw development at a particular time. In any area of law, caselaw development is a cumulative process in which one year's progress provides the flow of new legal investment that can foster next year's progress in many areas of law. This is precisely a VAR structure. Moreover, our interest lies in examining the interaction over time of our caselaw variables, as opposed to exploring their long-run or short-run equilibrium relationships. We

therefore employ a standard VAR with all variables in levels, an approach that is fully appropriate even if some variables are non-stationary (Kilian and Lütkepohl 2017).

We postulate the following structural VAR model:

$$\mathbf{A}\boldsymbol{y}_t = \boldsymbol{\Gamma}_0 + \sum_{i=1}^{5} \boldsymbol{\Gamma}_i \boldsymbol{y}_{t-i} + \boldsymbol{\varepsilon}_t, \quad (1)$$

where $\boldsymbol{y}_t \equiv (proc_t, prop_t, contr_t)'$ is defined above. $\boldsymbol{\Gamma}_0$ is a 3×1 column vector of constants. $\mathbf{A}$ is a 3×3 nonsingular matrix of coefficients. $\boldsymbol{\Gamma}_i$, $i \in \{1,2,3,4,5\}$, are 3×3 matrices of coefficients. $\boldsymbol{\varepsilon}_t$ is a 3×1 column vector of serially and mutually uncorrelated structural shocks. The choice of the model with five lags was made on the basis of standard lag length criteria and tests (see, e.g., Kilian and Lütkepohl 2017). As we clarify in Section 5.5, we have verified that all of our findings are robust to a doubling of the lag length.

For identification, we rely on short-run restrictions, a cornerstone of the VAR approach in macroeconomics (see, e.g., Christiano et al. 1999, Ramey 2016, Kilian 2009). We therefore theorize about which shocks may, and more importantly which may not, contemporaneously affect which variables, as implied by the off-diagonal elements of matrix $\mathbf{A}$. We base our argument on two core characteristics of the early English legal system.

First, in the pre-industrial era, procedure was the bedrock of the administration of royal justice with litigation unfolding within the strict confines of the system of writs. Mastery of the procedural aspects of the functioning of the courts was a key to successful client representation: innovations in procedure would need to be promptly absorbed by legal professionals who were ruling on or litigating issues of substantive law. Adherence to current procedure was a precondition for all successful activity in the courts, and innovative use of new procedures would immediately provide a competitive edge for lawyers pursuing substantive issues. In contrast, innovations in substantive law would have affected attention to procedure only with a lag, since those innovations would only enter the deliberations of the courts if existing procedures were used as the basis of litigation: a jolt to property or contract would not be sufficient to change the foundations of court process within one year. Thus, only shocks in attention to procedure exert a contemporaneous effect on attention to all three areas of law.

Second, contractual relationships inherently presuppose the existence of some form of exchangeable property, but not vice versa. Thus, with the unanticipated emergence of new legally recognized forms of property, economic agents and their lawyers could immediately seek ways of facilitating the contractual exchange of such property. In contrast, unpredicted changes in legally sanctioned forms of contracting would not immediately reconfigure property forms: new possibilities for contracting only lead to new forms of property, and litigation on that property, after economic agents and their lawyers have had time to construct novel forms of property that are derived from contracting innovations.

Chang and Smith (2019) provide a more general argument that is consistent with our specific approach to identification. They argue that doctrines that have a larger number of effects on other areas are the most difficult to change. Therefore, given the centrality of procedure in pre-industrial

English law, legal actors would have been most resistant to changing this particular legal domain. Similarly, property was much more connected with other areas of law, particularly procedure, than was contract: changes in contract would be easier to bring about within a given time span because there were fewer ramifications for the rest of the legal system.

These types of identification arguments are standard in the VAR literature. They are necessary to both pinpoint the structural shocks as implied by the model (estimates of $\boldsymbol{\varepsilon}_t$) and identify the effects of the structural shocks on the variables in the system. The corresponding estimates are a fundamental contribution that VAR analysis can generally make to historical studies. In our example, the $\boldsymbol{\varepsilon}_t$ indicate the timing of events outside the court system that produce changes in the law: the wars, legislation, politics, and personalities that move the society onto new trajectories.

Given this theorizing, $\mathbf{A}$ in (1) is lower-triangular. Then, $\mathbf{A}^{-1}$ has a recursive structure and the errors from the reduced-form VAR can be expressed as $\mathbf{e}_t = \mathbf{A}^{-1}\boldsymbol{\varepsilon}_t$, where

$$\mathbf{e}_t \equiv \begin{bmatrix} e_t^{proc} \\ e_t^{prop} \\ e_t^{contr} \end{bmatrix} = \begin{bmatrix} \tilde{a}_{11} & 0 & 0 \\ \tilde{a}_{21} & \tilde{a}_{22} & 0 \\ \tilde{a}_{31} & \tilde{a}_{32} & \tilde{a}_{33} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{proc} \\ \varepsilon_t^{prop} \\ \varepsilon_t^{contr} \end{bmatrix}. \tag{2}$$

Then the reduced-form VAR is:

$$\boldsymbol{y}_t = \mathbf{A}^{-1}\boldsymbol{\Gamma}_0 + \mathbf{A}^{-1}\sum_{i=1}^{5}\boldsymbol{\Gamma}_i\boldsymbol{y}_{t-i} + \mathbf{e}_t. \tag{3}$$

This reduced form can be consistently estimated using ordinary-least-squares, applied to each equation separately. Then the reduced-form VAR estimates in combination with (2) provide an estimate of the structural VAR representation of the model, including estimates of the $\boldsymbol{\varepsilon}_t$.

5. Characterizing Pre-Industrial Legal Evolution and Coevolution

To characterize the dynamics of legal evolution in pre-industrial England, we focus on three core sets of results. Section 5.1 presents impulse-response analysis, exploring the impact that structural shocks have on the normal dynamics of the legal system. In Section 5.2, we discuss the incidence of specific shocks, pinpointing those times when forces external to the functioning of the court system were most important in affecting the overall dynamics of legal evolution. In Section 5.3, we provide a historical decomposition of the effect of structural shocks, thus providing evidence of the cumulative effect on all three series at a particular time of current and past shocks in each individual series. Since all three of these analyses provide some evidence on the relative autonomy of legal development in each of the three legal domains, we summarize this evidence in Section 5.4. Section 5.5 reports the results of various robustness checks.

5.1. Evidence on the Impact and Propagation of Shocks

We examine how attention to procedure, property, and contract responds to structural innovations. Innovations are modeled as one-standard-deviation structural shocks that increase attention to the pertinent legal domain. We estimate impulse-response functions (IRFs) over 30

years, together with one-standard-error bias-corrected confidence intervals computed using Kilian's (1998) bootstrap method.

Figure 2 summarizes the results. The effects of procedure, property, and contract each occupy one column of that matrix of sub-figures. Similarly the rows, in the same order, show the area of law that is affected by the shocks. For legibility, each element of Figure 2 uses a different scale to display the response magnitude.

The estimated effects of shocks in a legal domain on developments in the same legal domain are captured in the diagonal components of Figure 2. All three variables exhibit an initial rise in attention followed by above-normal attention that gradually declines. These patterns suggest that external shocks, such as legislation, do not immediately solve all problems in the area of law to which they apply, but rather cause heightened attention to that area of law for an extended time. The three legal domains, however, differ notably in the speed of their reaction times. After a contract shock, attention to contract falls very quickly, within two years, and then decreases further to the pre-shock level within a decade. A property shock has a larger initial effect and attention to property remains at an elevated level even after three decades. Attention to procedure increases by the largest amount initially and then declines most gradually. When forced by circumstance to adjust its procedures, the system adjusts very slowly.

The estimated effects of shocks in one legal domain on other legal domains are captured in the off-diagonal components of Figure 2. Shocks occurring in one area of law could have three types of effects on other areas. Legal development in one area could mean that adjustments, and therefore heightened attention, is required in another area. Or, legal development in one area could mean that problems are solved in another area, leading to less attention. These two effects result from legal complementarities. But there are also substitution effects: with scarcity of time and resources, the courts might pay less attention to some areas because of heightened attention to others.

Unexpected surges in attention to contractual issues result in short-lived, small declines in attention to both procedure and property. These small effects suggest crowding-out given the short length of time that it takes procedure and property to return to normal levels. The effect of procedure and property shocks on attention to contract are very similar. The interactions of contract with the two other areas of law are therefore easily characterized as crowding-out effects, suggesting that developments in contract were not tightly tied to developments in procedure and property.[19]

The interaction between procedure and property is of a different character, suggesting stronger complementarities between these two areas of law. Attention to property falls when there is a positive shock to procedure, but falls by a much greater amount than in the four cross-effects that

[19] We should emphasize here that this empirical exercise probably has little to say about how the general legal reasoning developed in one area of law affected the general legal reasoning in other areas. Such general reasoning is not likely to make its presence felt in an analysis that primarily captures short-term interactions between different legal domains. The current analysis is more likely to capture the effect of specific problems or solutions in one area causing problems or providing solutions in other areas.

involve contract. And the attention to property remains depressed for a rather long time period. This suggests that the development of caselaw and legal ideas on procedure helps to solve problems in the area of property. For example, in the 17th-century, procedural innovations by an ingenious Chancery practitioner introduced the possibility of the transfer of land without the livery ceremony and the intrusive registration required by statutory law (Baker 2019: 324-325). Because the procedural logistics of real-property transfer had been a focus of the courts in many disputes in the earlier era, attention to law on property could decrease following this shock in procedure.

An unanticipated increase in attention to property causes a small and transitory increase in the attention to procedure. This indicates that shocks to property had ramifications for procedures, requiring the courts to consider how changing procedures could help adjustment to new property arrangements. Innovations in the law of uses and trusts provide a historical example consistent with this result. A trust as a form of property arose so that landowners could avoid certain obligations arising from feudal land law. But trusts initially exposed the landowner to the risk of possible misdeeds by the trustee. To counter this, procedural developments in Chancery helped to make the arrangements more secure for landowners. These included new procedures for discovery, including the use of documentary evidence and sworn testimony (see, e.g., Morley 2016: 2153). Thus, following a shock in attention to property, attention to procedure increased in the ensuing time periods.

5.2. Evidence on the Historical Incidence of Different Shocks

Figure 3 plots the temporal path of the structural residuals (or shocks) implied by the estimated model. For greater clarity, the structural residuals have been averaged over five-year periods. Shocks to all the series become less pronounced over time. The average absolute value of shocks to property is 60% greater in the period up to 1660 than in the period after that. (The year 1660 conveniently divides our series into halves while marking the restoration of the monarchy, a very significant event in English history.) The corresponding number for procedure is 52%, and for contract 34%. This indicates that unusual demands on the legal system from pressing social and political events progressively declined in the two centuries before the industrial revolution, especially in the case of property and procedure. One way to view the overall trends in shocks, displayed in Figure 3, is that, over time, the flow of litigation presented fewer new issues that could not be handled conveniently within the normal operations of the legal system administered by the courts. Notably, this is less true of contract than for the other two areas of the law.

Figure 3 also allows us to identify those very specific times when the legal system was affected by abnormally large shocks that disturbed its normal routines, providing insights into episodes of 'abnormal history', that is, episodes that are in need of explanation outside the model. In what follows, we comment on three illustrative cases, one in each area of caselaw.

A series of repeated positive shocks in attention to procedure is detectable between 1605 and 1619. This is the era of Edward Coke, for many "the most important" among the "Makers of English Law" (Holdsworth 1938: 113). During his tenure as the Chief Justice of the Common Pleas (1606-1613) and the King's Bench (1613-1616), Coke fundamentally shaped the evolution of legal

thought via his rulings and arguments. At the same time, he radically transformed the practice of case reporting, emphasizing legal theorizing more strongly and thereby introducing jurisprudence more explicitly into the reports. While his decisions and reports touched upon many areas of law, Coke was particularly known for his reverence for and attention to common-law procedure. His discourses and analyses stressed "the lore and the office procedure: the fundamental rules, the understandings which surround those rules, and the routines and formalities which must be negotiated" (Boyer 1998: 64). This specific example shows that such shocks can arise from the actions of a highly unusual individual—indeed a world historical figure—operating within the judiciary. The unusual surge in attention to procedure between 1605 and 1619 is probably best interpreted as reflecting the idiosyncratic influence of one of the preeminent figures of English law.

Repeated positive shocks to property occurred between 1560 and 1574, soon after Elizabeth's ascent to the throne. At that point, the courts began to address a variety of real-property issues that had been left unattended by the chaos of the previous 30 years, in particular in the areas of uses and the testamentary transfer of land. Henry VIII's Statutes of Uses (1535), Enrolments (1536) and Wills (1540), for example, "wrought changes in jurisprudence which went far beyond the effective restoration of lost revenue" and "the side-effects of the legislation on conveyancing and [land] settlements", having effects lasting for many years (Baker 2019: 278). Indeed, the next segment of especially notable recurrent positive shocks in attention to property, between 1610 and 1624, can be readily interpreted as reflecting a variety of unforeseen legal developments that arose from the same underlying source—Henry VIII's legislation and subsequent caselaw. During this later time, practicing lawyers industriously promoted trusts as a means of circumventing the existing law that restricted how land could be transferred within families, one such restriction being rules on perpetuities (Baker 2019: 307-324). The latter practice, which had the collateral effects of precluding the sale of land for repayment of debts and causing intra-family tensions, was especially disdained by the courts, with Coke in 1613 viewing the practice as "a monstrous brood carved out of mere invention, and never known to the ancient sages of the law" (Baker 2019: 307). At the same time, legal practitioners exploited statutory loopholes in order to transfer land in a swifter manner. Thus, strong social forces can also lead to periods of abnormal legal development, in this case the desire of the land-owning class to sidestep the rigidities of inheritance law and the rule of perpetuities.

Our last example of abnormal history is on the recurring positive contract shocks between 1665 and 1684. During those years and the immediately preceding ones, the economy experienced dramatic change. Colonial trade was increasing the importance of the merchant class; an increase in rural textile production was stimulating internal trade; the market in land grew as those hit hard by the Civil War were forced to sell; a spreading financial sector was embracing negotiable instruments. All of these would have generated extra demand for improved commercial law. In reaction, the courts made the custom of merchants relevant to more and more situations, solidifying its use in legal reasoning during the second half of the 17th century. These economic changes coincided with politico-economic ones that also required the courts to pay attention to contractual

matters. Markets for Crown debt expanded but had a poor underpinning in legal infrastructure, which needed to be addressed. Developments in contract law earlier in the century had led to increasing problems of perjury in litigation on oral agreements, which was made harder to punish by the abolishment of the Star Chamber in 1641. This was addressed in the 1677 Statute of Frauds, whose stringent requirements led to much subsequent litigation. The positive contract shocks of 1665-1684 would have reflected all of these circumstances. Thus, the largest series of shocks on contract probably reflects a confluence of social, economic, and political forces within a rapidly commercializing nation, many elements of which had been set in motion by the enormous changes consequent on the Civil War and Interregnum.

5.3. Evidence on the Cumulative Importance of Different Shocks

Figures 4-6 display historical decompositions, portraying the cumulative effects of past and present shocks on the attention paid by the courts to each of the three legal domains at each point in time. These decompositions combine the information in the IRFs (Figure 2) and in the individual shock estimates (Figure 3), but reveal information that is not transparent from the two individual figures. If, for example, there is a long sequence of positive shocks to one series, then this would have a larger effect on other series than would the effect of a single shock that is depicted in the IRFs. Such information is critical in understanding the flow of history. Looking at some raw data, one might ask the question: Why didn't the law on X receive much attention during some era, given that X was presenting such contentious issues then? Historical decompositions might give the answer that the raw data on X reflects a dampening effect of earlier developments in other areas of law, not a lack of overall concern about X.

A central finding that readily emerges is that the dynamics of contract and procedure are largely a product of their own individual shocks (see Figures 4 and 6). Shocks to procedure are never an especially important determinant of fluctuations in attention to contract. Shocks to property do not account for any noticeable amount of the fluctuation in the attention to contract, except in the second half of the 16th century. Similarly, neither shocks to property nor shocks to contract account for much fluctuation in attention to procedure, with two small exceptions. In the 1570's, attention to procedure is heightened by the earlier increased attention to property that continues for two decades (see the previous subsection). And in the first decade of the 17th century, successive negative shocks to property do account for much of the reduced attention to procedure. Perhaps, these developments reflect the decision in Calvin's Case, which resolved the contested issue of when individuals born in Scotland have access to common-law ownership of real-property.

In contrast, the dynamics of property is very much a product of shocks in other areas of law, particularly that on procedure (see Figure 5). Examples from the mid and later 17th century are particularly illuminating. Examining the raw data (Figure 1), the years from 1640 to 1654 are times of unusually depressed attention to property. This is puzzling because this is a time of civil conflict, followed by a radical regime, during which property was destroyed, confiscated, and targeted with financial impositions assessed on losers. The historical decompositions provide a fuller picture. Attention to property from 1640 to 1654 reflects the net sum of two factors: first, there is the

lingering effect of very large past and current shocks to procedure (Figure 3), which generally have a depressive effect on the attention to property (Figure 2); second, there are positive shocks to property, which act in the opposite direction. The net result is the reduced attention to property that appears in the raw series. The raw series, therefore, cannot be used to conclude that the Civil War and its aftermath did not give rise to contentious property issues. In fact, during the Civil War there were positive shocks to property, but this rise is masked in the raw data by the lingering negative effects of past procedural shocks.

Can one tell the same story about the time from 1685 to 1700, also a time of internal struggle and revolution where attention to property cases seems relatively low in the raw data? Here, there are no positive property shocks (Figure 3). While there are negative shocks to property in the years 1690-94, during 1685-1689 and 1695-99 attention to property is at normal levels. Of course, one story that is consistent with those negative shocks of 1690-94 is that they were a reflection of the Glorious Revolution producing a radical change in property law that settled issues (North and Weingast 1989). But there was nothing in the fundamental constitutional measures that was immediately relevant to property issues (Murrell 2017). Moreover, as the estimated impulse-response in Figure 2(e) reminds us, if those measures had had any indirect effect on property law, there would have been continuing attention to property law with litigation concerning their integration into existing caselaw continuing for many years. We do not detect this in our historical decompositions (see Figure 5).

Thus the facts uncovered by VAR on developments in property law in the two great times of revolution are different. We emphasize that this difference is something that does not appear in the raw data—the application of dynamic modeling is absolutely essential in being able to make this differentiation. In the earlier era, new property issues were at the forefront and these raised the attention paid to property within the courts. In the later era, there is no indication in our data and analysis of historical decompositions that property was a bone of contention or that property issues received more attention than usual. Thus, one lesson from our historical decompositions is that the Civil-War/Interregnum era looks very different from the years surrounding the Glorious Revolution, at least in terms of any direct stimulus that heightened attention to property caselaw.[20]

The historical decomposition for property also leads to interesting observations on times outside the 17th century. During 1560-1600, shocks to procedure, contract, and property all heighten the degree of attention to property: the attention to property that appears in the raw data during the Elizabethan era is not only due to large contemporaneous property shocks, but also due to the reverberations of shocks in all three areas. In this early period, the overall dynamics in the legal system is hugely important for the dynamics in property law. The relative quiescence in the raw data on property at the end of the era covered by this paper (1750-1764) is due to large negative

[20] Our results address the effects of political events only to the degree that these events were reflected in the development of caselaw. Nothing in our results should be interpreted as reflecting either negatively or positively on the claim that the Glorious Revolution solved problems by political, and not legal, means.

property shocks alone, outweighing the reverberations due to the shocks in the other areas of the law. Property law was relatively settled by this time.

5.4. Implications About the Autonomy of Legal Processes

The question of the degree of legal autonomy is an age-old one (Tomlins 2007). Answers to it depend critically on the specific definition of autonomy that is used. Here, we do not engage in such definitional debate, but simply report on results that bear on two different aspects of autonomy of law. First, there is the degree to which legal developments are affected by forces external to the legal system, as opposed to arising purely from the normal dynamics of legal processes. Second, there is the question of whether each of the areas of law—procedure, property, and contract, in our case—develop independently of each other or exhibit coevolutionary interactions. The facts presented in the previous subsections all bear on these issues.

The IRFs in subsection 5.1 show that unexpected surges in attention to contractual issues result in short-lived, small declines in attention to both procedure and property. In contrast, the interaction between procedure and property is of a much more significant character, suggesting stronger complementarities between these two areas of law. Moreover, contract reacts much more to its own shocks, than do property and procedure to theirs.

The patterns of individual shocks in subsection 5.2 revealed that noticeable shocks to contract proceeded throughout the time-period under study, whereas shocks to procedure and property became much less noticeable after 1660. In the historical decompositions of subsection 5.3, there are many more indications of important complementarities between procedure and property than between contract and these two other areas of law. There is also one group of statistics that we have not yet reported, but which is relevant here: the R-squares of the three equations of the estimated VAR. These are 0.70 for procedure, 0.82 for property, and 0.33 for contract.

Therefore, relative to property and procedure, the development of contract law is more dependent on shocks from outside the legal system and less a reflection of the internal dynamics of the legal system. Contract law is less autonomous from society than are the two other areas of law.[21] One interpretation of these results is that, in comparison with contract, property and procedure are more dependent on each other and the rest of law, while contract is more attuned to reacting to the needs of economic agents than establishing a core element of the legal system (Smith 2021).[22]

5.5. Sensitivity Analysis

We performed two main sets of robustness checks. For brevity, we only summarize our findings.[23] First, we investigated the sensitivity of our results to increasing the number of lags in VAR specification (1). Specifically, we estimated the reduced-form VAR with ten lags instead of

[21] It must be emphasized here that the phrasing is in relative terms: by definition, in a system of caselaw all areas of law are affected both by the nature of the legal system and social, political, and economic forces.
[22] We thank Henry Smith for this insight.
[23] Full results are available on request.

five and repeated the structural VAR analysis of Sections 5.1 through 5.3. None of our qualitative findings changed as a consequence.

Second, we examined the robustness of our main results to an alternative set of identification assumptions under which developments in legal ideas on procedure are immediately implied by heightened attention to aspects of substantive law. Under this scheme, in contrast to the assumptions in Section 4, innovations in property law are permitted to exert a contemporaneous effect on attention to procedure, but shocks to procedure may affect attention to property only with a lag.[24] We then examined the resultant IRFs for any counter-intuitive results. The presence of results that obviously contradict a plausible model of the world is an indication of the untenable character of the corresponding identification assumptions (Christiano et al. 1999).

We indeed find that the alternative identification assumptions generate results that are counter-intuitive. First, under alternative identification schemes, there are no instances in which a positive shock to one area of law causes attention to other areas of law to rise. This effectively means that the estimated model would preclude the possibility that a change in one area of law might necessitate changes in, and increased attention to, other areas of law. Second, unexpected changes in procedure do not in any way affect the attention to either property or contract in future time periods. This is inconsistent with the standard view of the legal system during the 16th to 18th centuries, where procedures available to litigants deeply affected the channeling of substantive issues before the courts. In sum, alternative formulations of the identification assumptions produce results that preclude the existence of effects that are known to have occurred in legal history (see Section 5.1). These findings bolster the credibility of the identification assumptions used in this paper.

6. Concluding Reflections

The objective of this research has been to provide a quantitative macrohistory of the evolution and coevolution of early English caselaw and legal ideas on property, contract, and procedure. The resultant narrative is our primary substantive contribution. In generating this narrative, our empirical inquiry produces information relevant to interpretation of specific episodes and phenomena that have been of enduring interest to scholars of English history and law. Although our approach has been inductive, rather than aimed at hypothesis testing, we do offer a new organization of the facts that can bear on existing interpretations of events put forth in the literature. This new organization of facts is absolutely critical. For example, without the use of VAR to capture the differences between the normal coevolutionary dynamics and the shocks, a summary inspection of the raw data would often lead to incorrect conclusions. This point is especially pertinent for the example highlighted in the next paragraph.

[24] That is, the critical identification assumption is on whether shocks to property contemporaneously affect procedure, or whether procedure contemporaneously affects property. Whether shocks to property contemporaneously affect contract or vice versa is inconsequential for our results. The reason is that reduced-form residuals from the property and contract equations, respectively, are hardly correlated.

Our quantitative account reveals that the Civil War-Interregnum era gave rise to more shocks that increased the legal system's attention to property than did the Glorious Revolution. In fact, examination of the incidence of property shocks and historical decompositions show that in the late 17th century property issues were not arising at all at an unusual rate. Our evidence is therefore not consistent with suggestions in the literature that institutional developments during the Glorious Revolution directly resulted in a major change in English property rights, at least as far as can be ascertained from the caselaw record. Moreover, it is worthwhile repeating that the differentiation between these two eras cannot be deduced simply by inspecting the raw data: it is only after the application of dynamic modeling that these new findings readily appear.

Similarly, our analysis contributes to the debate about the importance of prominent individuals on institutional development. In investigating the timing of the large fluctuations in the attention to procedure that are caused by factors outside the normal dynamics of the legal system, we identify an effect that is likely attributable to Edward Coke. Thus, the idiosyncratic ideas and preferences of powerful professionals can impact the process of legal development in a manner akin to large-scale economic or political developments.

Our analysis also addresses some long-standing questions on the timing of the most active periods of development in specific areas of law. The time series indicate that attention to property was at its peak before the 17th century. Procedure saw heightened concern in the early and mid-17th century. Attention to contract was relatively more concentrated in later periods. Our estimates show that this timing reflected both the coevolutionary dynamics operating within the legal system and, importantly, extraordinary shocks: for example, to property in the early Elizabethan era, to procedure during the Civil War, and to contract in the Restoration years. A full understanding of the precise mechanisms underlying these specific shocks would require delving much more deeply into the specifics of the legal record than we can do using the techniques of this paper. Nevertheless, these results from our inductive approach do raise questions of a causal nature that are worthy of further investigation.

Relatedly, our macrohistorical narrative casts light on the relative autonomy of various aspects of the law, both relative to other legal domains and vis-à-vis the society in general. Our findings indicate that the interaction between procedure and property within the dynamics of the legal system entailed stronger complementarities than the interaction between these two areas of law and contract. Compared to property and procedure, the historical evolution of contract law was therefore relatively less a reflection of the internal dynamics of the legal system and relatively more a product of shocks from outside the legal system. Early contract law was comparatively less autonomous from society than were law on property and procedure.

Lastly, and very conjecturally, our analysis provides clues on when the English legal-institutional environment became more settled, reaching a point where the legal system itself reacted to changes in the society in routine ways, rather than registering those socioeconomic changes as unusual outside events that shocked the court system. This is one way to view the overall trends in shocks, which diminish in size after the mid-17th century. Over time, fewer

situations arise that could not be handled within the flow of the normal operations of the legal system administered by the courts. This is especially true of the court's rules themselves, on procedure, and the law that provided the bedrock of the English state, on property.

References

Acemoglu, Daron and James A. Robinson. 2012. *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*, New York, NY: Crown Publishers.

Baker, John. 2019. *An Introduction to English Legal History*. Fifth edition. Oxford, UK: Oxford University Press.

Baumeister, Christiane, and Lutz Kilian. 2016. "Forty Years of Oil Price Fluctuations: Why the Price of Oil May Still Surprise Us." *Journal of Economic Perspectives*, 30:1, 139-60.

Blei, David M. 2012. "Probabilistic Topic Models." *Communications of the ACM*, 55:4, 77-84.

Boyer, Allen D. 1998. "'Understanding, Authority, and Will': Sir Edward Coke and the Elizabethan Origins of Judicial Review." *Boston College Law Review*, 39:1, 43-93.

Chang, Yun-Chien and Henry E. Smith. 2019. "Convergence and Divergence in Systems of Property Law: Theoretical and Empirical Analyses." *Southern California Law Review*, 92:4, 785-808.

Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans. 1999. "Monetary Policy Shocks: What Have We Learned and to What End?" In: Taylor, John B. and Micahel Woodford (ed.), *Handbook of Macroeconomics*, Vol. 1, Amsterdam: Elsevier, 65-148.

Clark, Gregory. 2007. *A Farewell to Alms: A Brief Economic History of the World*. Princeton, NJ: Princeton University Press.

Cornish, William, Stephen Banks, Charles Mitchell, Paul Mitchell, and Rebecca Probert. 2019. *Law and Society in England 1750-1950*. Second Edition. Oxford, UK: Hart Publishing.

Crafts, Nicholas and Terence C. Mills. 2009. "From Malthus to Solow: How did the Malthusian Economy Really Evolve?" *Journal of Macroeconomics*, 31:1, 68-93.

Eckstein, Zvi, Paul T. Schultz, and Kenneth I. Wolpin. 1984. "Short-Run Fluctuations in Fertility and Mortality in Pre-Industrial Sweden." *European Economic Review*, 26:3, 295-317.

Edvinsson, Rodney B. 2017. "The Response of Vital Rates to Harvest Fluctuations in Pre-Industrial Sweden." *Cliometrica*, 11:2, 245-268.

Gennaro, Gloria and Elliott Ash. 2022. "Emotion and Reason in Political Language." *Economic Journal*, 132:643, 1037-1059.

Grajzl, Peter and Peter Murrell. 2021a. "A Machine-Learning History of English Caselaw and Legal Ideas Prior to the Industrial Revolution I: Generating and Interpreting the Estimates." *Journal of Institutional Economics*, 17:1, 1-19.

Grajzl, Peter and Peter Murrell. 2021b. "A Machine-Learning History of English Caselaw and Legal Ideas Prior to the Industrial Revolution II: Applications." *Journal of Institutional Economics*, 17:2, 201-216.

Grajzl, Peter and Peter Murrell. 2021c. "How Law Develops: The Influence of Early English Caselaw and Legal Ideas on Caselaw Development During the Industrial Revolution." Working paper.

Hodgson, Geoffrey M. 2017. "1688 and All That: Property Rights, the Glorious Revolution and the Rise of British Capitalism." *Journal of Institutional Economics*, 13:1, 79-107.

Holdsworth, William Searle. 1938. *Some Makers of English Law*. London, UK: Cambridge University Press.

Kilian, Lutz and Helmut Lütkepohl. 2017. *Structural Vector Autoregressive Analysis*. Cambridge, UK: Cambridge University Press.

Kilian, Lutz. 1998. "Small-Sample Confidence Intervals for Impulse Response Functions." *Review of Economics and Statistics*, 80:2, 218-230.

Kilian, Lutz. 2009. "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market." *American Economic Review*, 99:3, 1053-1069.

McCloskey, Deirdre N. 2010. *Bourgeois Dignity: Why Economics Can't Explain the Modern World*. Chicago, IL: University of Chicago Press.

Møller, Niels F. and Paul Sharp. 2014. "Malthus in Cointegration Space: Evidence of a Post-Malthusian Pre-Industrial England." *Journal of Economic Growth*, 19:1, 105-140.

Morley, John. 2016. "The Common Law Corporation: The Power of the Trust in Anglo-American Business History." *Columbia Law Review*, 116:8, 2145-2198.

Murrell, Peter. 2017. "Design and Evolution in Institutional Development: The Insignificance of the English Bill of Rights." *Journal of Comparative Economics*, 45:1, 36-55.

Nicolini, Esteban A. 2007. "Was Malthus right? A VAR Analysis of Economic and Demographic Interactions in Pre-Industrial England." *European Review of Economic History*, 11:1, 99-121.

North, Douglass C. and Barry R. Weingast. 1989. "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." *Journal of Economic History*, 49:4, 803-832.

Ogilvie, Sheilagh, and A.W. Carus. 2014. "Institutions and Economic Growth in Historical Perspective." In: Philippe Aghion and Steven N. Durlauf (eds.), *Handbook of Economic Growth*, Vol. 2, Amsterdam: Elsevier, 403-513.

Pedersen, Maja, Claudia Riani, and Paul Sharp, 2021. "Malthus in Preindustrial Northern Italy?" *Journal of Population Economics*, 34:3, 1003-1026.

Ramey, Valerie A. 2016. "Macroeconomic Shocks and Their Propagation." In: Taylor, John B. and Harald Uhlig (eds.), *Handbook of Macroeconomics*, Vol. 2, Amsterdam: Elsevier, 71-162.

Renton, Alexander Wood. 1900-1932. *The English Reports*. Great Britain. Parliament. House of Lords. Edinburgh, UK: W. Green & Sons.

Roberts, Margaret E., Brandon M. Stewart, and Edoardo M. Airoldi. 2016. "A Model of Text for Experimentation in the Social Sciences." *Journal of the American Statistical Association*, 111:515, 988-1003.

Roberts, Margaret E., Brandon M. Stewart, Dustin Tingley, Christopher Lucas, Jetson Leder-Luis, Shana Kushner Gadarian, Bethany Albertson, and David G. Rand. 2014. "Structural Topic Models for Open-Ended Survey Responses." *American Journal of Political Science*, 58:4, 1064-1082.

Smith, Henry E. 2021. "Systems Theory." In Gold, Andrew S., John C.P. Goldberg, Daniel B. Kelly, Emily Sherwin, and Henry E. Smith (eds.), *The Oxford Handbook of the New Private Law*. Oxford, UK: Oxford University Press, 141-154.

Tomlins, Christopher. 2007. "How Autonomous Is Law?" *Annual Review of Law and Social Science*, 3, 45-68.

Weisdorf, Jacob and Paul Sharp. 2009. "From Preventive to Permissive Checks: The Changing Nature of the Malthusian Relationship Between Nuptiality and the Price of Provisions in the Nineteenth Century." *Cliometrica*, 3:1, 55-70.

Wells, John and Douglas Wills. 2000. "Revolution, Restoration, and Debt Repudiation: The Jacobite Threat to England's Institutions and Economic Growth." *Journal of Economic History*, 60:2, 418-441.

Table 1: Focal themes, the constituent topics, and their prevalence in the corpus

Property topics	%	Contract topics	%	Procedure topics	%
Self-Help in Real-Property Disputes	2.16	Pleadings on Debt	1.66	Coke's Procedural Rulings	2.11
Competing Land Claims	2.09	Assumpsit	1.33	Correct Pleas	1.85
Elizabethan Land Cases	1.98	Length & Expiry of Leases	1.32	Decisional Logic	1.80
Shared & Divided Property Rights	1.62	Repaying Debt	1.30	Writs of Error	1.74
Transfer of Ownership Rights	1.53	Bonds	1.09	Rulings on the Calendar	1.68
Uses	1.48	Rental Payments	0.86	Procedural Rulings on Actions	1.67
Specifying Inherited Property Rights	1.31	Claims from Financial Instruments	0.81	Rendering Judgement	1.40
Estate Tail	1.28	Prioritizing Claims	0.72	Procedural Rulings on Writs	1.29
Timing of Property Rights	1.25	Identifying Contractual Breach	0.65	Jury Procedures & Trials	1.21
Possession & Title	1.03	Executable Purchase Agreements	0.61	Procedural Bills	1.10
Manorial Tenures	0.98	Contract Interpretation & Validity	0.52	Equity Appeals	0.96
Wrongful Possession	0.90	Negotiable Bills & Notes	0.39	Motions	0.95
Common-Land Disputes	0.89	Bankruptcy	0.38	Evidence Gathering & Admissibility	0.90
Marriage Settlement	0.87	Employ. of Apprentices & Servants	0.31	Reviewing Local Orders	0.66
Excluding Beneficiaries of Wills	0.81	Contract theme as a whole	11.95	Mistakes in Court Records	0.64
Conveyancing by Fine	0.79			Arbitration & Umpires	0.52
Implementing Trusts	0.73			Court Petitions	0.40
Trespass to Goods	0.69			Procedure theme as a whole	20.88
Intestacy	0.57				
Tree Law	0.51				
Bailment	0.48				
Mortgages	0.47				
Ownership of War Bounty	0.47				
Equitable Waste	0.24				
Property theme as a whole	25.13				

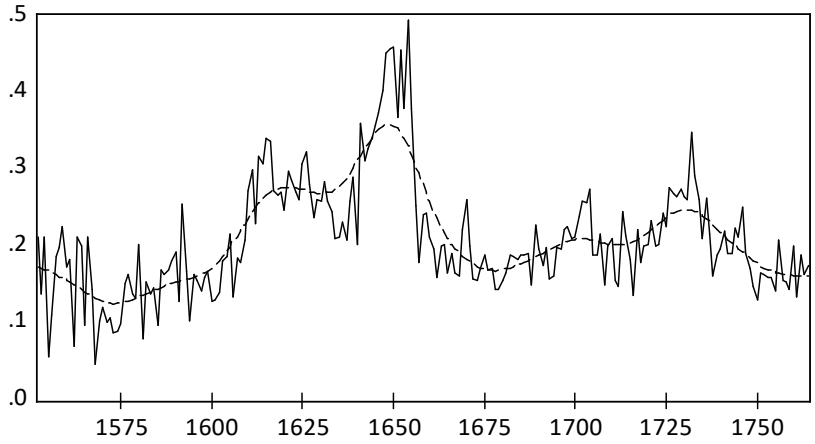
Notes: % denotes the attention to individual topics as a percent of the attention to all 100 topics in the corpus, which comprises 52,949 reports on pre-1765 cases, as recorded in the English Reports.

Table 2: Descriptive statistics for the three time-series variables

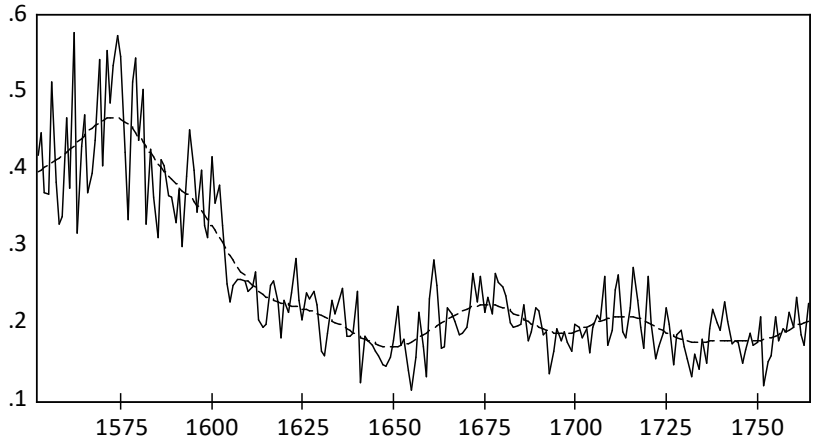
Variable	Obs.	Mean	S.D.	Min.	Max.
Property	213	0.2511	0.1045	0.1130	0.5778
Contract	213	0.1195	0.0293	0.0429	0.2104
Procedure	213	0.2091	0.0755	0.0464	0.4929

Notes: The table presents the descriptive statistics for the yearly time series on relative attention to property, contract, and procedure, respectively, as implied by the English Reports. The sample period is 1552-1764.

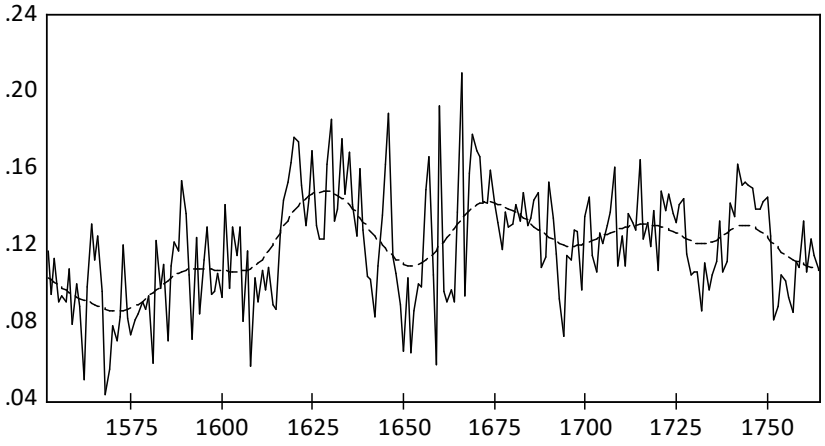
Figure 1: Time series of attention to procedure, property, and contract, with trends



(a) Procedure

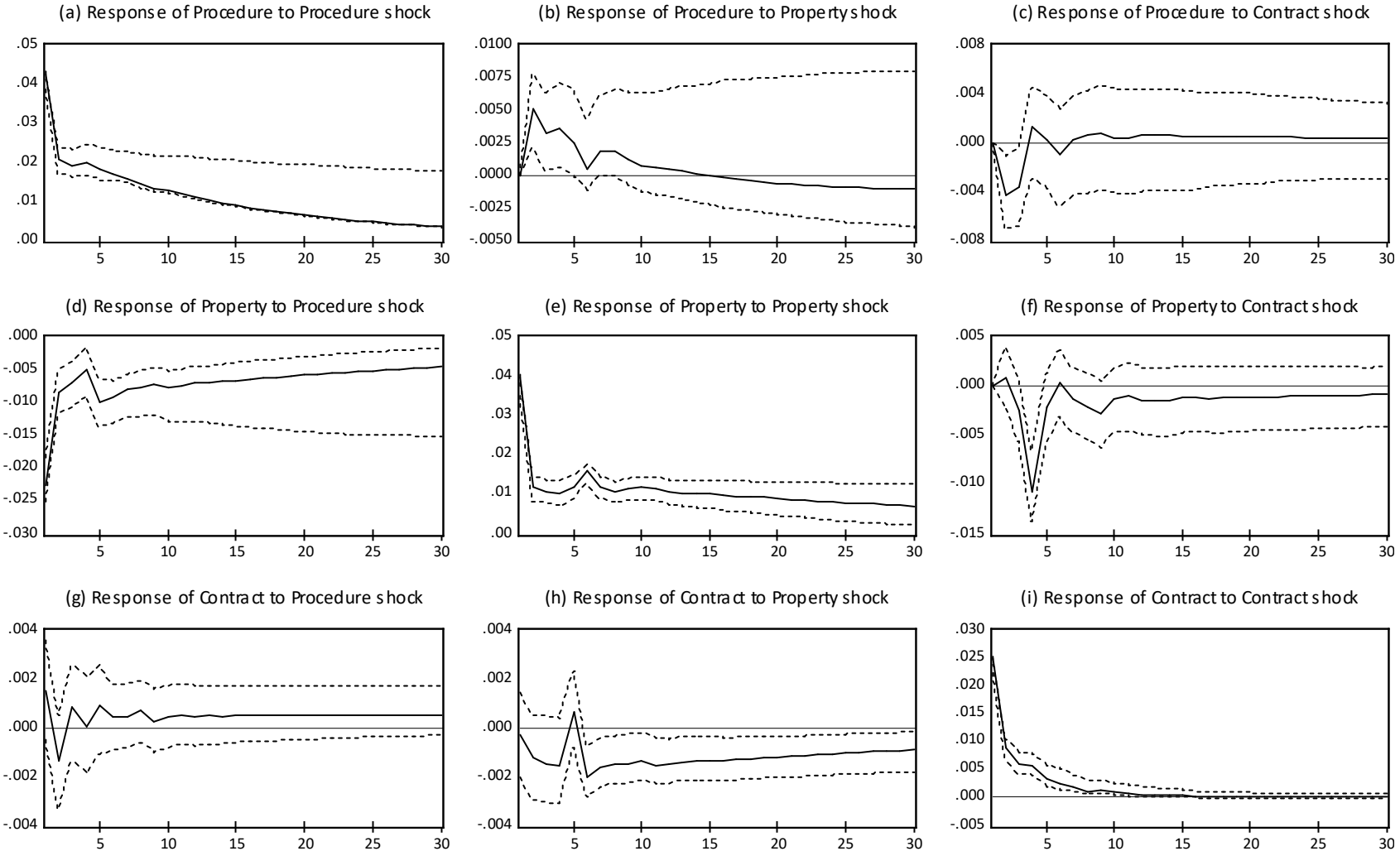


(b) Property



(c) Contract

Figure 2: Responses to one-standard-deviation structural shocks



Notes: One-standard-error confidence bands computed using Kilian's (1998) bootstrap method.

Figure 3: Historical evolution of the structural shocks

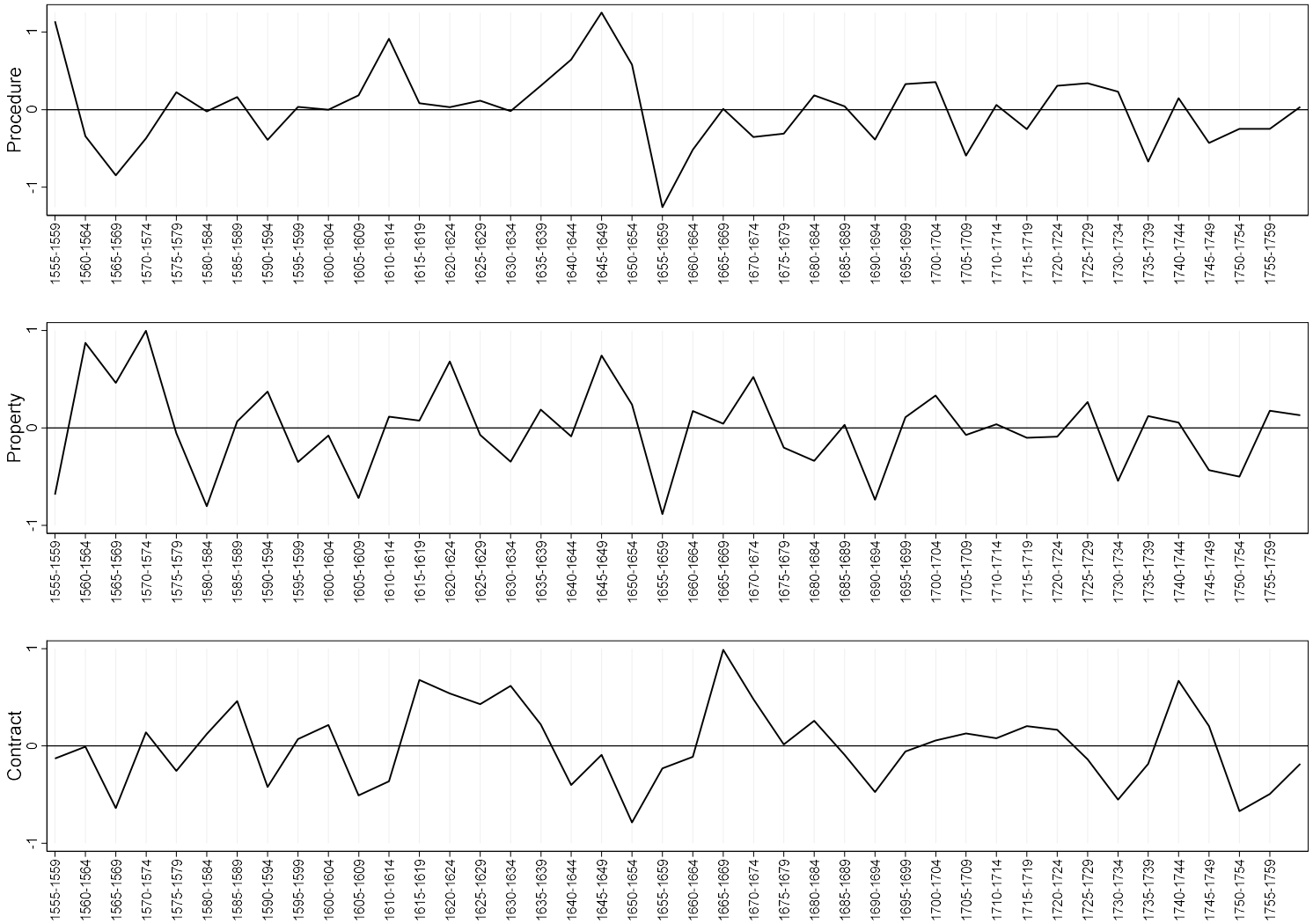


Figure 4: Historical decomposition of the time series of attention to procedure

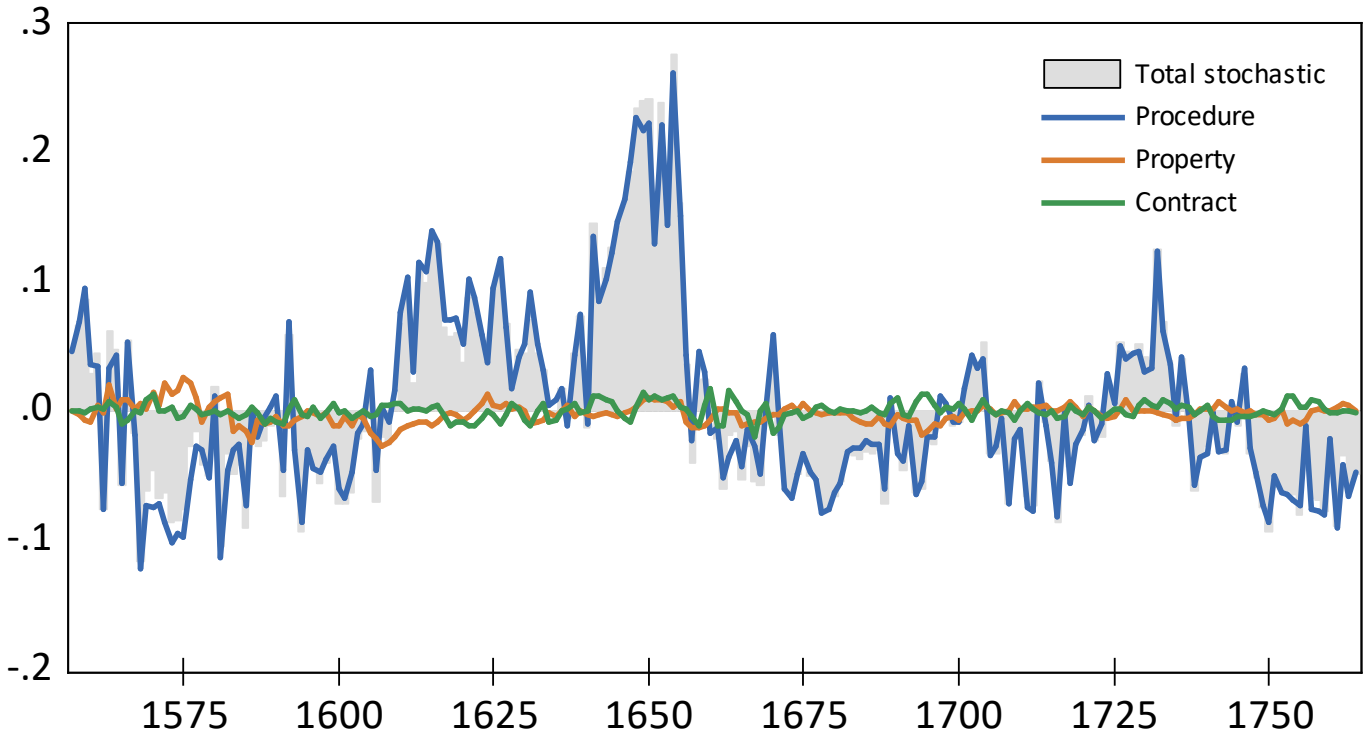


Figure 5: Historical decomposition of the time series of attention to property

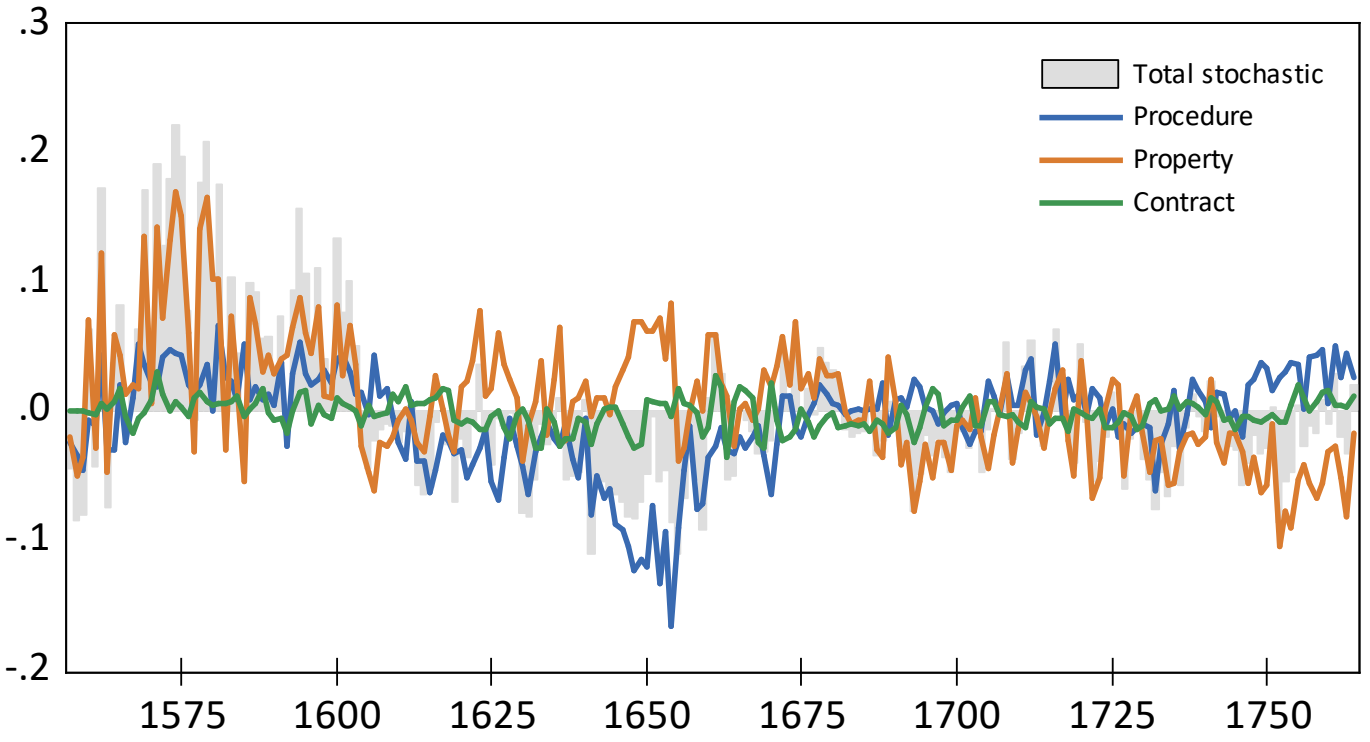
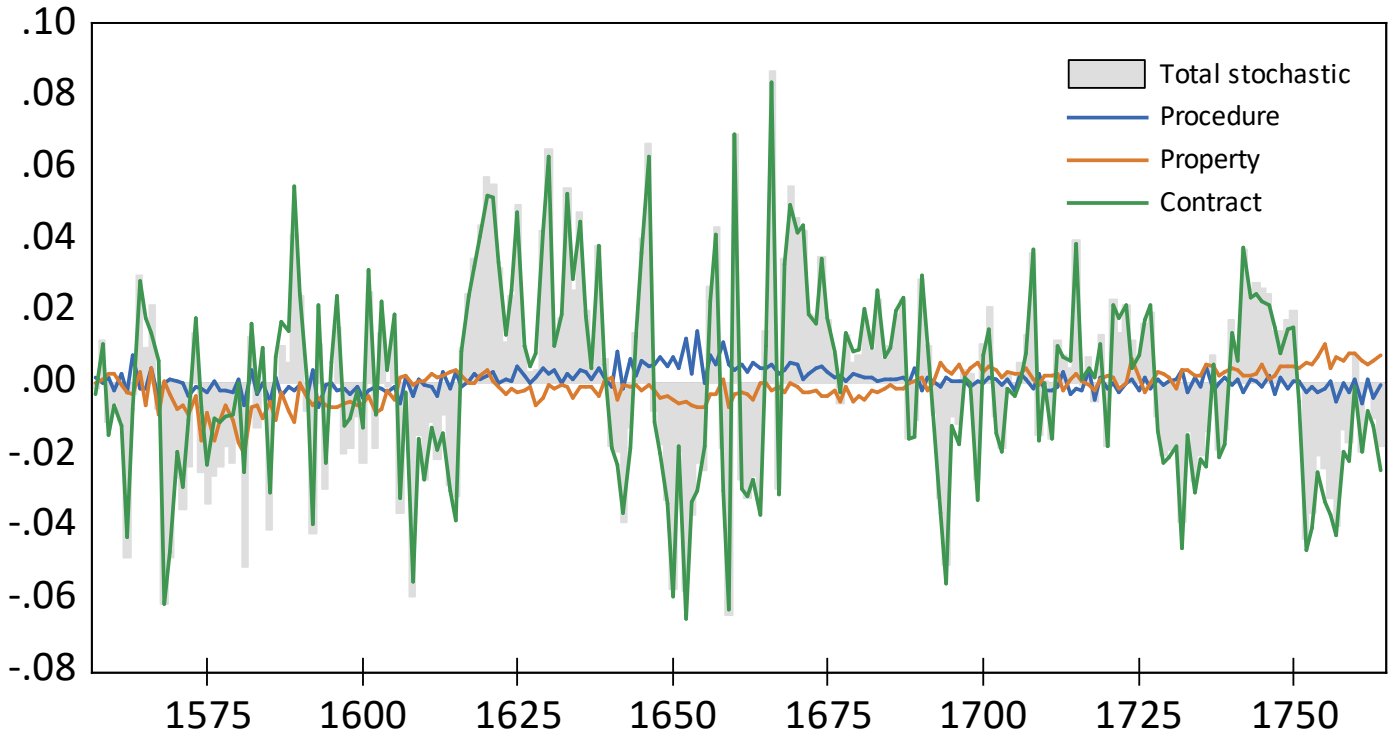


Figure 6: Historical decomposition of the time series of attention to contract



Appendix

Figure A1: Yearly attention to the topics included in the procedure theme

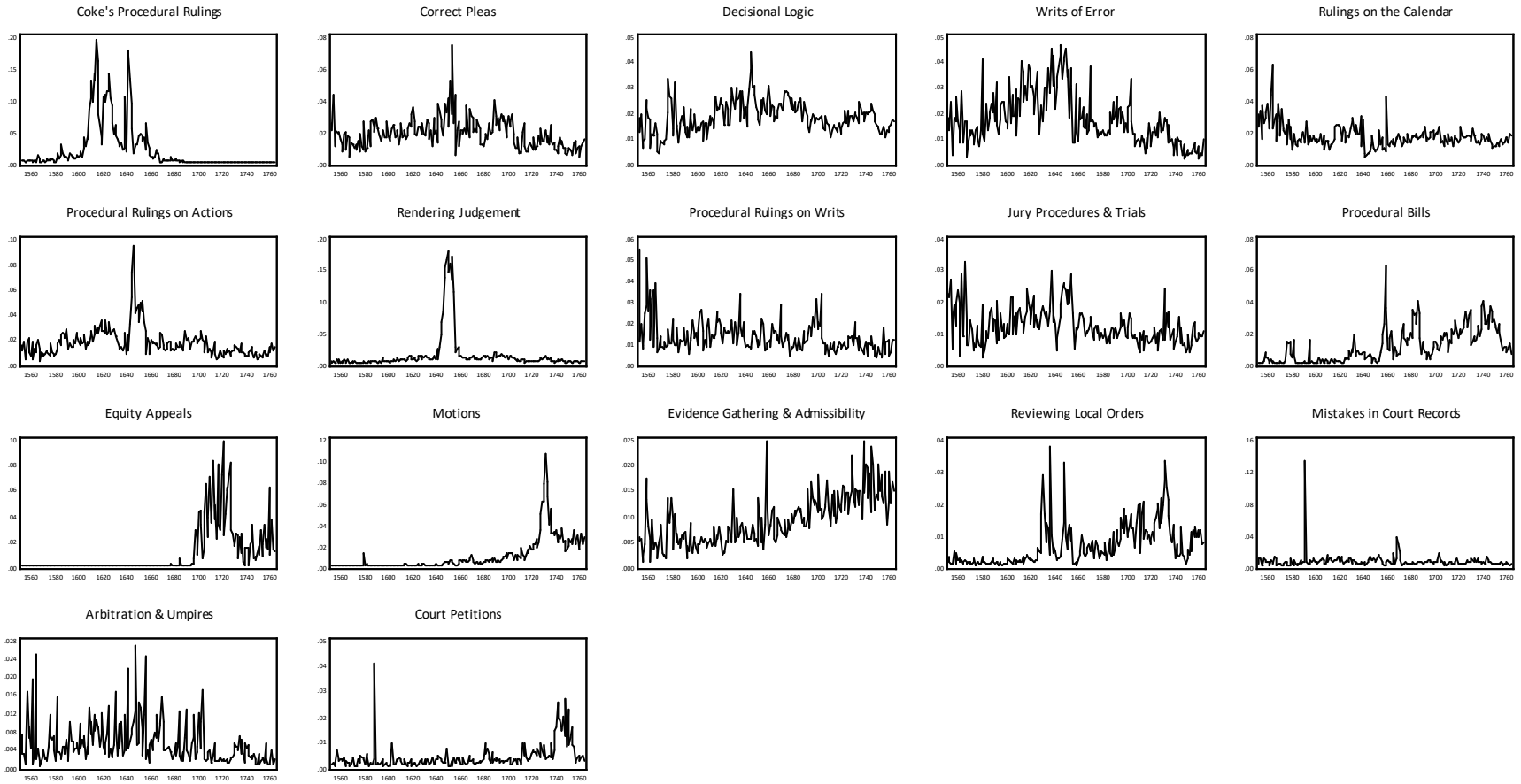


Figure A2: Yearly attention to the topics included in the property theme

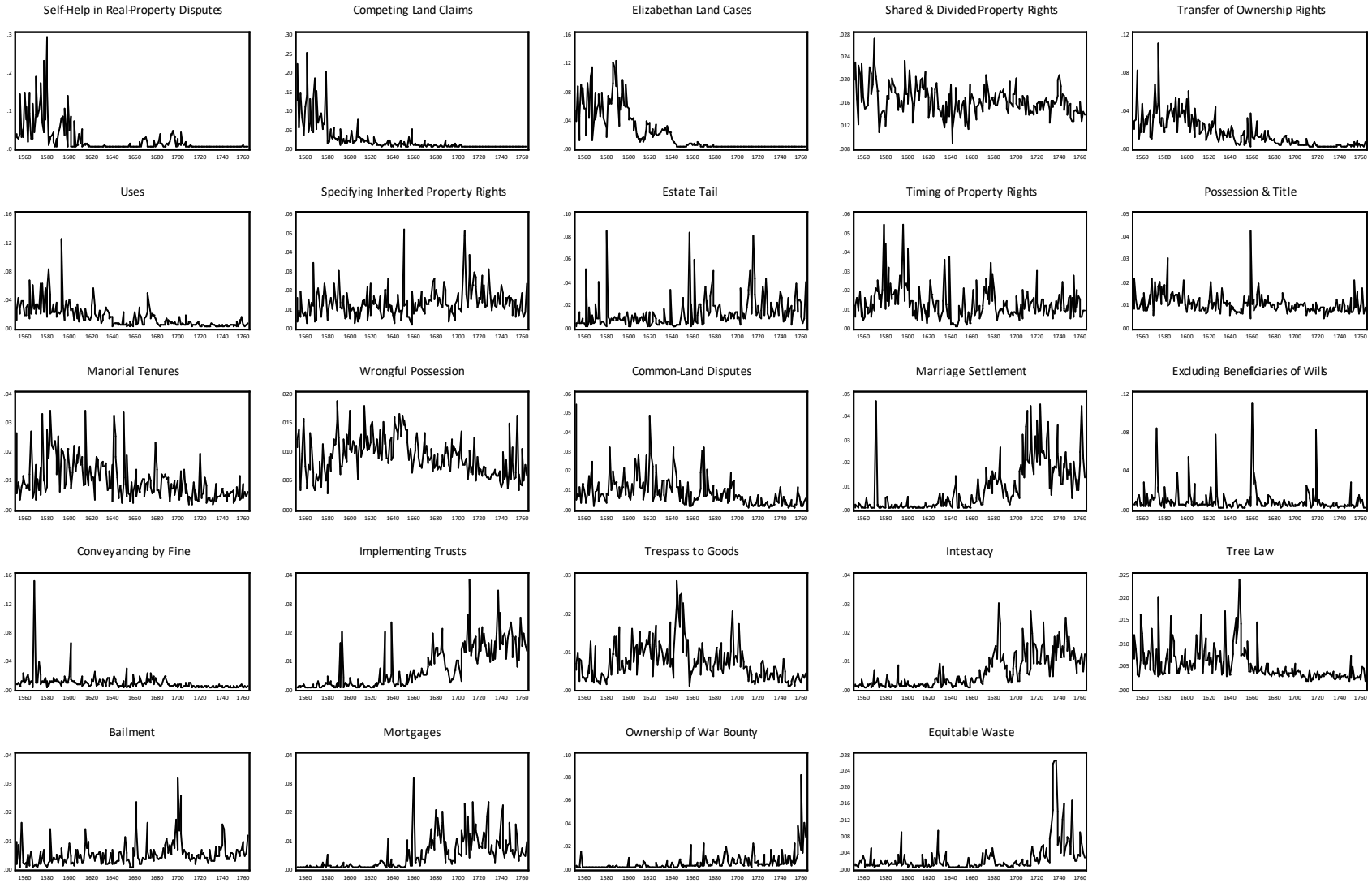


Figure A3: Yearly attention to the topics included in the contract theme