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A macrohistory of legal evolution and coevolution: Property, procedure, and contract in early-modern 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 early-modern English court cases. Leveraging existing topic-model estimates, we construct annual time series of attention to each of the three legal domains between the years 1552 and 1764 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 caselaw. 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.

1. Introduction

The history of English law is to a notable extent 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. 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, legislation and abstract jurisprudence influenced judicial decision-making and legal practice, but were not as prominent as sources of law as they would later become.[1]

The central aim of this paper is to develop a quantitative macrohistory of the process of caselaw evolution during the early-modern era, focusing on three areas of law that formed the core of the English legal system in the two centuries before the Industrial Revolution: procedure, property, and contract.[2] We do this by applying vector-autoregressive (VAR) analysis to a novel time-series dataset generated on the basis of

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[1] See, for example, Hoppit (1996, 2017).

[2] Aspects of the law of torts, for example, certainly already existed already before the Industrial Revolution. However, given the pre-industrial nature of early-modern England, the law of torts was before the Industrial Revolution limited in scope and, as such, comparatively much less fundamental to the English legal system as a whole than procedure, property, and contract. In particular, the law of negligence, a major area of modern-day tort law, began to develop only in the late 18th century as a result of a growing number of highway accidents (Cornish et al. 2019: Ch. 7). As we clarify in Section 3, the attention to torts was accordingly very small in the corpus of law reports that form the basis of our data.

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prior topic-model estimates. Specifically, existing topic-model estimates, which provide a machine-learning digest of a large corpus of early-modern legal texts, facilitate the construction of time series of the legal system's attention to each of procedure, contract, and property over the years 1552–1764. VAR applied to these time series enables the investigation of their intertwined dynamics, offering insight into the coevolutionary development of the three aspects of caselaw during the two centuries immediately preceding the Industrial Revolution.

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 legal development during the early-modern era. In particular, we provide a characterization of the coevolutionary development of three fundamental areas of caselaw, 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. Throughout the analysis, our approach is therefore inductive. Much like traditional legal historians, we strive to uncover and synthesize new information about the flow of legal history, rather than test particular hypotheses.

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.[3] 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.

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 caselaw 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 caselaw reacts quickly to external shocks and does not coevolve with the two other areas of caselaw.

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 caselaw 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 caselaw. This observation has relevance to the debates on when the most critical developments occurred in England in the 17th century (North and Barry, 1989; Clark, 2007; McCloskey, 2010; Acemoglu and James, 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). Using conceptualizations of legal autonomy directly implied by our VAR approach, 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.

[3] 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 Terence, 2009, and Wells and Wills (2000).

2. Background on the most pertinent aspects of English legal history

In this section we offer a brief overview of selected aspects of English legal history, intended for readers with limited prior knowledge of the subject.[4] We highlight especially those historical features and developments that are most relevant to understanding the basic activity of the courts during the early modern era, the period covered by our data (see Section 3). But many important legal developments, including those relevant to procedure, property, and contract, certainly took place already during the prior, medieval, era.[5]

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 traveled 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 authority in the 16th century, was abolished in 1641. In contrast to property, contract, and tort 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 judgments arose in the 15th and 16th centuries, once written pleadings replaced oral pleadings.[6] At that point, the disputing parties were able to clarify the applicable point of issue before the trial. The focus of the trial or hearing then became only the agreed-upon disputed issue, which in turn increased the importance of knowing and referring to past judicial decisions made in similar cases. Therefore an emphasis on precedent-based reasoning emerged gradually.[7] The modern-day notion of a binding precedent (*stare decisis*) arose only sometime in the late 18th or 19th centuries.

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

From its 12th-century consolidation under Henry II, 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.[8] 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.

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.

[4] Elements of this section draw on portions of Section 2 in Grajzl and Murrell (2022a). English legal history has been the subject of a very large volume of scholarship. In the interest of brevity, as well as to avoid unjustly prioritizing works of only a subset of scholars, we intentionally omit in-text citations to the specific works on which this section is based. Examples of textbooks offering a (relatively) comprehensive coverage of the pre-industrial era include Baker (2019), Plucknett (1948), Maitland and Montague (1978), Harding (1973), Kiralfy (1962), and Jenks (1938). An early comprehensive project is Holdsworth's A History of English Law, published in 17 volumes between 1903 and 1966. The most recent, still ongoing, project in this spirit is The Oxford History of the Laws of England (https://global.oup.com).

[5] English law and legal institutions during the medieval times have been the subject of much research by legal historians. Pollock and Frederic (1898) offer an older comprehensive overview of medieval English law. Among more recent and specialized works, see, for example, Biancalana (2001) and Hudson (1994) for law of real property; Brand (1992) for courts and the legal profession; and Biancalana (2002, 2005a, 2005b) for aspects of law relevant to contracting.

[6] See Duxbury (2008) and Lewis (1930a, 1930b, 1931, 1932) on the history of precedent in English law. Early collections of records of judicial proceedings existed in the form of Year Books, available already in the 13th century. Year Books, however, were merely unsystematic collections of handwritten private notes on court proceedings, typically generated by pleaders and apprentices, and thus quite far even from the early law reports that emerged in mid-16th century. Year Books certainly did not reflect the entire body of law, were not intended to be used as authoritative texts, were not sanctioned by the courts, and, especially importantly, focused on pleadings as opposed to judicial decisions. As such, the Year-Book period (from circa 1290–1535) did not yet allow for emergence of full-fledged precedent-based thought.

[7] Using the data and the estimates that we draw on for purposes of the present paper (see Section 3), Grajzl and Murrell (2021b) show that an emphasis on precedent-based reasoning began to increase by 1650. The corresponding legal ideas, however, diffused slowly and solidified only after 1730.

[8] Hudson (1994) examines the law on real property during the Anglo-Norman period in the 11th and 12th centuries, focusing on the upper echelon of the society and issues of security of tenure, heritability, and alienability. Biancalana (2001) analyzes land-law developments from the late 12th to early 1500 s with a focus on fee tail (entail), the legal mechanisms for the destruction of a fee tail, and the corresponding land transfers.

In the 17th century, property law was greatly influenced by the attempts of the old landowning elites and the new gentry to preserve their family estates.[9] 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.[10] 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.[11] 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 an 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. 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 of early-modern caselaw to property, contract, and procedure

3.1. The underlying corpus and selection issues

Our measures of attention to property, contract, and procedure in early modern English caselaw are derived from the estimates of Grajzl and Murrell (2021a, 2021b; henceforth GM). GM draw on the definitive version of the English Reports (Renton, 1900–1932; ER, in brief), assembled and printed between 1900 and 1930, to construct a corpus of 52,949 reports on cases heard between the mid-16th century and the second half of 18th century. The mid-16th century captures the start of the period when the number of available reports becomes sufficiently large to facilitate statistical analysis. The second half of the 18th century marks the approximate onset of the Industrial Revolution and, at the same time, the beginning of an era when law reporting became much more regularized and systematic than it had been previously.[12]

Importantly, the ER entail neither the population nor a random sample of cases adjudicated in the English courts during the applicable era. Rather, the ER encompass a selection of cases considered by the superior courts. As emphasized by Grajzl and Murrell (2021a: Appendix A), reporters were especially eager to provide a record of cases that highlighted unsettled or novel aspects of law, that is, cases that gave rise to legal development. However, the record of how exactly cases were selected for inclusion in the collections of reports that were later consolidated in the ER is lost to history and the details of the selection process remain elusive to modern-day researchers. Thus, the ER cannot be viewed as reflecting the historical dynamics of English caselaw in the widest sense.

Despite the selection issues, however, our analysis of data generated on the basis of the ER is, we argue, deeply informative of the broader developments in English caselaw, for two key reasons. First, the ER became the de facto record of court cases that the English legal profession has used as its authoritative source for early-modern legal precedent.[13] Thus, even though the ER are not a complete record of the gamut of judgments made in the superior courts, they do provide a record of the large majority of the important cases that came to influence the law.[14] In this sense, the ER provide unique insight into the nature of English caselaw development between the mid-16th and late 18th centuries. No comprehensive computational exploration of English legal history during the early modern era could be conducted without the ER. At the same time, no other machine-encoded (OCR-ed) legal-historical corpus of comparable breadth and depth currently exists for the period between the mid-16th and the late 18th century.[15]

[9] 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.

[10] See Morley (2016) on the importance of the legal device of trust as means of wielding corporation-like powers long before the development of law on corporations.

[11] The term 'assumpsit' referred to the promise made in undertaking to do something.

[12] See, for example, Veeder (1901) and Winfield (1925).

[13] The publishers of the English Reports in the index of cases begun in volume 177 thus (perhaps too bravely) state that the reports provide "Complete Verbatim Re-issue of the Decisions of the English Courts prior to 1866".

[14] For example, Baker (1981) notes that it is the selection of printed cases, as opposed to rulings at large, which influenced legal development. Similarly, Ibbetson (1985: 85) states: "In part, no doubt, the marked infrequency of citations from imprinted [manuscript] reports is attributable to the relative awkwardness of finding cases in manuscripts as compared to the printed books, which could be used in conjunction with easily manageable abridgements and indexes. In part, though, it must be attributed to the fact that manuscript reports were inherently less persuasive than those which were in print".

[15] The Anglo-American Legal Tradition (AALT) project, hosted by the O'Quinn Law Library at the University of Houston (http://aalt.law.uh.edu/), could provide a complement to the ER in the future. Presently, however, the digitized materials (images of manuscripts) included in the AALT are neither machine-encoded (OCR-ed), nor made consistent in orthography, nor translated from the original Latin. Thus, they are not amenable to computational analysis, that is, to the large-scale consideration of a whole corpus of cases whose size would overwhelm a non-computational analysis.

Second, we tackle the selection issues by carefully delineating the scope of our analysis and the conclusions we draw. For example, if in investigating the data generated on the basis of the ER we found that at some point in time the overall attention of the corpus to property exceeds the total attention to procedure, it would be dangerous to conclude that the English legal system at large was at that time prioritizing contract over procedure: this finding would be quite likely an artifact of selection of reports. But if we established that changes in relative attention to procedure subsequently altered the relative attention to property, it would be much harder to attribute this finding to selection only: evolution of the underlying substantive legal ideas is much more likely to have played a prominent role. We stress this point to clarify that, as has been well understood by statisticians and social scientists, the effect of sample-selection on findings can be diminished if one is careful in engaging in appropriate kinds of comparisons in reaching those findings.

3.2. Topic model estimates as a source of data

GM first carefully pre-processed the corpus.[16] 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).[17] 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 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.[18] Third, in pre-processing the corpus, GM standardized the English orthography, eliminated Law French reports, and translated Latin.[19] 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.[20] For example one topic in GM is characterized by keywords such as 'judgment', '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.[21] 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.[22] Of course, this is just one example of 100 topics.[23]

3.3. Generating the time series of caselaw 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 Fig. 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.[24] 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

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

[17] 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 dominate the 100-topic model on the basis of scores on average semantic coherence and exclusivity.

[18] 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.

[19] Initially, there were 60,249 pre-1765 reports in the data set. 6917 were dropped because they were in Law French and a further 383 were removed because they contained too many unrecognizable words. This left 52,949 reports. As emphasized by Grajzl and Murrell (2022b: fn. 12), the omission of the corresponding reports is a blemish on the application of the computational methods. However, a central objective of GM was to include as many reports as possible, which necessarily implied computational processing of all reports.

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

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

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

[23] 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.

[24] 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.

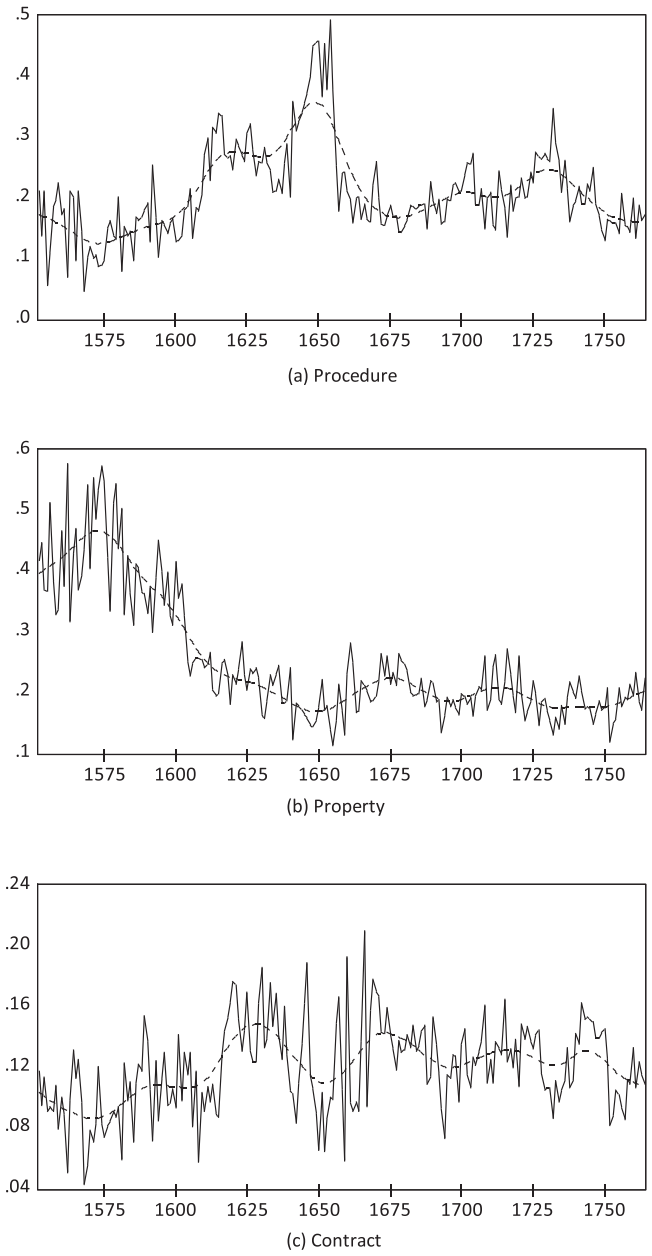

Fig. 1. Time series of attention to procedure, property, and contract, with trends.

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.[25] 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.[26] 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[27] manual approach. Table 1 lists the topics falling into each of these three themes and provides summary information on topic attention. Procedure, property, and contract jointly constitute approximately 59% of the attention in the entire pre-1765 ER corpus, a clear indication of the overarching importance of these three areas of law during the period under investigation. In contrast, torts, which were comparatively much less central to the pre-industrial English law and are thus excluded from our analysis, encompass no more than 3% of the attention of the[28] pre-1765 ER corpus.

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 early-modern English law, can feature prominently in the 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.[29] 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. Fig. 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 Figs. A1–A3 present timelines of each of the 55 topics.

3.4. *Using the time series of caselaw attention to study legal evolution*

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.

[25] 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.

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

[27] 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: Section 3).

[28] See Grajzl and Murrell, 2021a; (Table 1) and Grajzl and Murrell (2021b), Table 1.

[29] This approach is algebraically exactly 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.

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 Judgment	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.

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. Using an evolutionary game-theoretic framework, GM show that the attention paid to a topic (or a set of topics) 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 of attention to a specific area of caselaw captures the intensity of yearly development, or evolution, of that area of caselaw. In the remainder of the paper, we thus use the terms 'attention to', 'development of', and 'evolution of' an area of caselaw interchangeably.[30,31]

Importantly, our time series of the evolution of different areas of caselaw reflect refinements in those areas of law from the perspective of legal professionals (judges and lawyers). Given inherent uncertainties concerning the future effects of law and the self-serving motives of the legal profession, clearly not all instances of legal evolution are necessarily beneficial from a broader, societal, standpoint.[32] Legal history provides examples illustrative of this point. For instance, between the late 13th and early 15th centuries, the courts, especially the Chancery, actively endorsed statutory restrictions on alienation of land. Those legal provisions presumably benefited wealthy landowners and their lawyers, but impeded growth of land markets.[33]

At the same time, our time series by construction do not trace the micro nuances of legal evolution that could only be inferred from the study of individual court cases. Rather, the series shown in Fig. 1 are informative of the macro evolution in the three core areas of English law in the early modern era. Periods when a series has an increasing trend are times when the legal system enters a period of intense legal development in the pertinent area of caselaw. Times when a series peaks are eras of especially vigorous legal evolution. 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 caselaw 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 evolution.

3.5. *The evolution of caselaw on procedure, contract, and property: some descriptive insights*

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

[30] 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.

[31] This is fully congruent with the terminology adopted in the broad legal-historical research. For example, Henry Maine's famous 1861 dictum that "the movement of the progressive societies has hitherto been a movement *from Status to Contract* [emphasis in the original]" has long been viewed as a central postulate about "legal evolution" (see, e.g., Landman, 1930; Rehbinder and Manfred, 1971)—even though Maine, a contemporary of Darwin, himself never used the term "evolution" anywhere in his Ancient Law. Of course, our use of the term legal evolution does not imply that in our analysis we adopt a full-fledged Darwinian conceptualization of law. For the discussion of the latter, see Grajzl and Murrell (2016).

[32] Our use of the term 'legal evolution' thus also broadly resonates with that of Wigmore (1918: 533) who argued that "[t]he evolution of law…does not imply progress…but merely movement…".

[33] See Biancalana (2001: Ch. 2) on the pre-16th-century legal developments leading to fee tails that endured indefinitely. Hodgson (2022: Ch. 3) offers an overview of the literature providing insights into the corresponding economic effects.

information presented in Fig. 1, A1, A2, and A3. Even without the VAR analysis, they provide their own narrative of the evolution of English caselaw.

The 17 time series for procedure appear in Fig. A1. The most prominent era of evolution in procedure was from 1610 to 1660. Developments in many areas contribute (Fig. 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).

Fig. 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 common law not only during the previous medieval period, as emphasized by legal historians, but also during the subsequent early-modern era covered by our data. Indeed, 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 evolution of contracting contrasts with that of procedure and property. Here developments are more pronounced in the 18th than in the 16th century (Fig. 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 (Fig. 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. Fig. 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 (Fig. A3). Thus, the years immediately before the industrial era saw the intensification of legal evolution pertinent to multiple contracting domains.

The above discussion provides our introductory descriptive account of legal evolution in each of the three focal areas of early-modern English caselaw. This approach, however, does not yet allow for the investigation of the coevolution of the three focal areas of caselaw as captured by the comovement in and the interrelated dynamics of the pertinent time series. Moreover, as we emphasize in Section 5.3 below, explicitly allowing for coevolutionary dynamics is also critical to obtaining a nuanced understanding of legal evolution in an individual area of caselaw. Specifically, in that section we clarify how a purely descriptive examination of an individual time series can obscure substantively important information about legal evolution that can be obtained once the analysis permits examination of the interrelations between multiple areas of law. To examine legal coevolution, we next build and estimate a tractable empirical model.

4. The empirical approach: modeling legal evolution and coevolution

4.1. VAR

We analyze 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. The processes of legal evolution and coevolution can then be thought of as operating via two related but distinct mechanisms.

The first are the 'normal' operations of the court system. These imply that $\boldsymbol{y}_t$ is a function of its own lagged values: $\boldsymbol{y}_{t-1}, \boldsymbol{y}_{t-2}, \ldots$. Thus, 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.

The second are the idiosyncratic, 'abnormal' events, or shocks, that occur outside the normal operations of the court system and induce one-time 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, the empirics of the system can be estimated using vector autoregression (VAR). 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 caselaw 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 evolution, thereby increasing our stock of knowledge about critical 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 caselaw, caselaw evolution 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:

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

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.

4.2. Identification

The model (1) is a simultaneous system of temporally interdependent

equations. The estimation of the parameters of model (1) thus requires identification assumptions. 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 **A**. We base our argument on two core characteristics of the early-modern 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, **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

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

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 $\boldsymbol{\varepsilon}_t$.

If these identification assumptions hold, then our analysis produces estimates of the causal effects of the shocks and of past legal developments. However, given the possibility of omitted confounders and our macro approach to law, we emphasize the inductive use of our estimates for the purposes of generating novel legal-historical insights, as opposed to testing specific ex-ante hypotheses. Our goal is simply to provide a credible macro-historical narrative of the evolution and coevolution of early-modern English caselaw that is based on a novel, quantitative approach.

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 a structural shock to a particular area of caselaw has on that and other areas of caselaw as implied by 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 evolution 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.[34]

Fig. 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 caselaw that is affected by the shocks. For legibility, each element of Fig. 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 Fig. 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 caselaw to which they apply, but rather cause heightened attention to that area of caselaw 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

[34] Our use of one-standard-error confidence bands for interpretation of the impulse-response results follows a broad swath of the VAR-based literature. See, for example, Jalil (2015), Quinn and Roberds (2019), Romer and David (2004), Stock and Mark (2001).

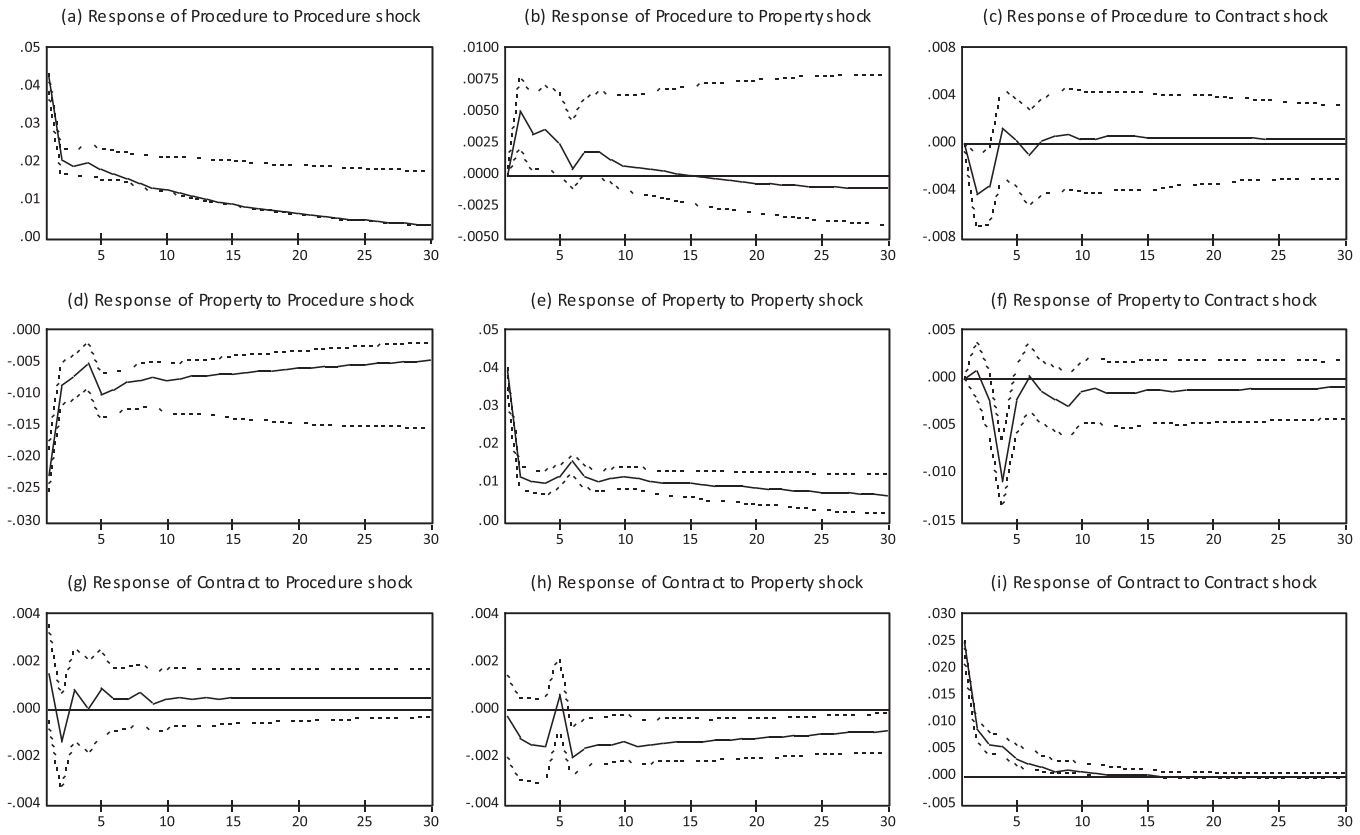

Fig. 2. Responses to one-standard-deviation structural shocks. One-standard-error confidence bands computed using Kilian's (1998) bootstrap method.

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 Fig. 2. Shocks occurring in one area of caselaw 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 caselaw are therefore easily characterized as crowding-out effects, suggesting that developments in contract were not tightly tied to developments in procedure and property.[35]

The interaction between procedure and property is of a different character, suggesting stronger complementarities between these two areas of caselaw. 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 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.

[35] 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.

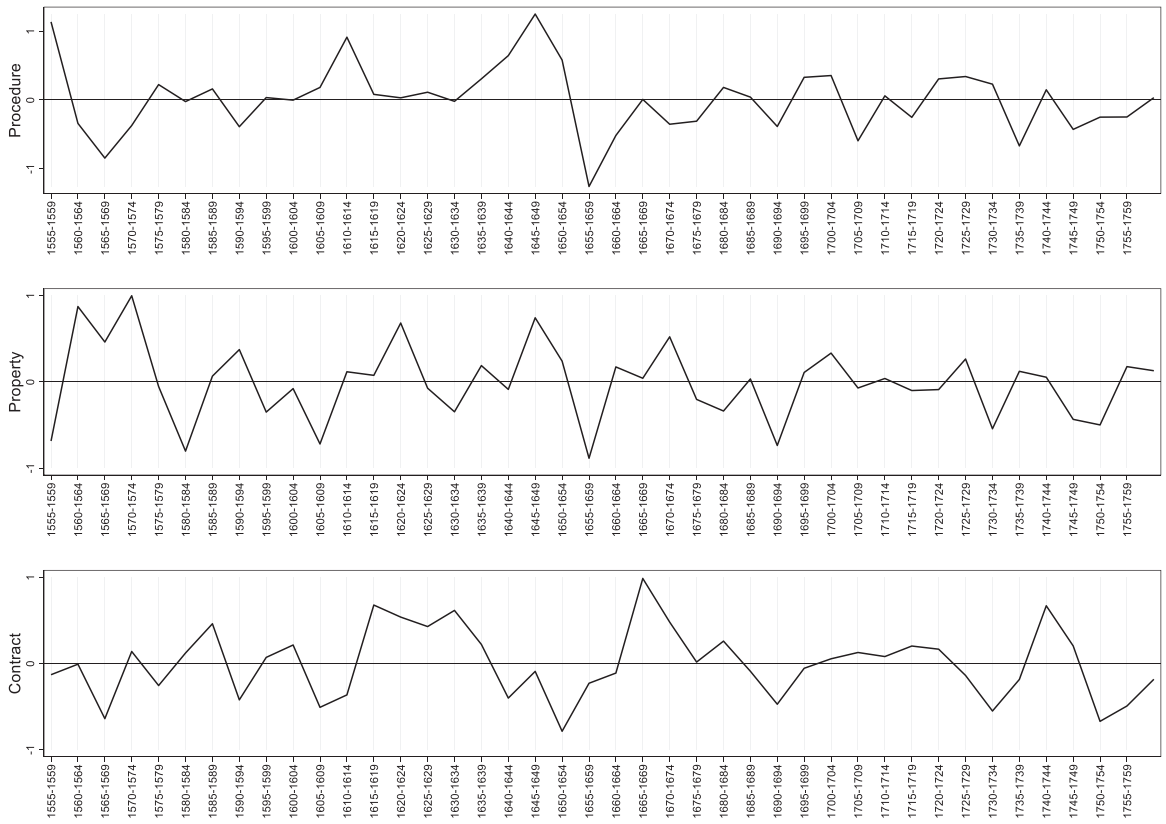

Fig. 3. Historical evolution of the structural shocks.

5.2. *Evidence on the historical incidence of different shocks*

Fig. 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 Fig. 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.

Fig. 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). Our estimates do not reveal the precise reasons for Coke's distinct procedural emphases. Coke likely saw procedural rigor as the epitome of the law's "perfection of reason" and a reflection of the common law's deeply historical character, two central tenets that he passionately professed throughout his life (see, e.g., Tubbs, 2000: Ch. 7). In addition, Coke's focus on procedure could have been a potent jurisprudential weapon in his clashes with James I, who viewed the common law as inherently subordinate to the Crown (see, e.g., Plucknett, 1948: 230–231). Regardless of why Coke stressed procedure, our estimates indicate that shocks can arise from the actions of a highly unusual individual—indeed a world historical figure—operating within the

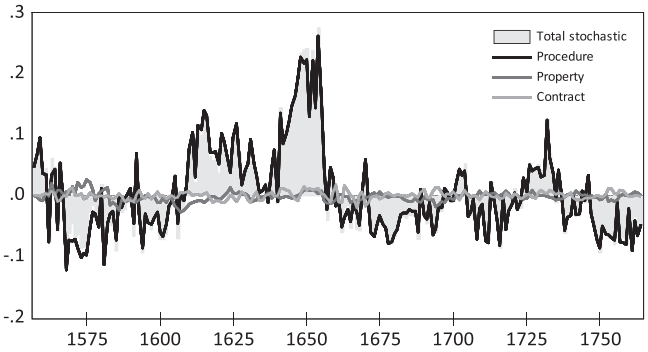

Fig. 4. Historical decomposition of the time series of attention to procedure.

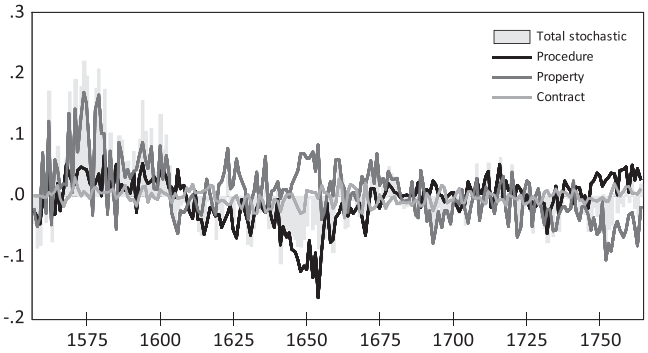

Fig. 5. Historical decomposition of the time series of attention to property.

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.

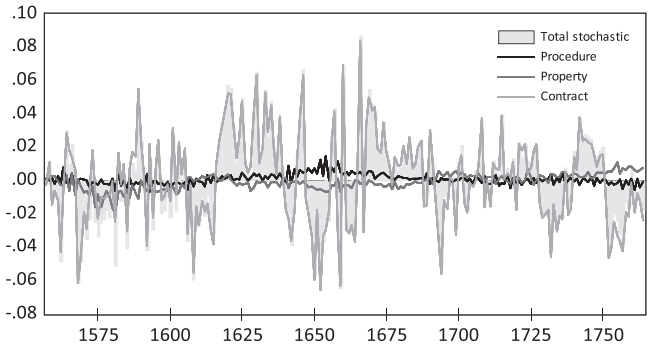

Fig. 6. Historical decomposition of the time series of attention to contract.

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

Figs. 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 (Fig. 2) and in the individual shock estimates (Fig. 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 Figs. 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 caselaw, particularly that on procedure (see Fig. 5). Examples from the mid and later 17th century are particularly illuminating. Examining the raw data (Fig. 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 (Fig. 3), which generally have a depressive effect on the attention to property (Fig. 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 (Fig. 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 Barry, 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 Fig. 2(e) reminds us, if those measures had any indirect effect on property law, there would have been continuing attention to property caselaw with litigation concerning their integration into existing caselaw continuing for many years. We do not detect this in our historical decompositions (see Fig. 5).

Thus the facts uncovered by VAR on developments in property caselaw 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 indispensable 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.[36]

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

5.4. Implications about the autonomy of legal processes

The question of the degree and nature of law's autonomy has occupied generations of scholars (see, e.g., Lempert, 1988; George, 1999; Tomlins, 2007). Unsurprisingly, the discourse has been heavily influenced by both the specific conceptualization of autonomy and the participants' position along the formalist-instrumentalist jurisprudential spectrum. The existing literature, however, has not investigated the issue of law's autonomy using systematic, large-scale quantitative evidence. Our analysis casts novel empirical light on this venerable debate by bearing on two distinct aspects of autonomy of law that are readily amenable to empirical exploration using our methodological approach.

First, there is the question of whether each of the areas of caselaw—procedure, property, and contract, in our case—developed independently of each other or exhibited coevolutionary interactions. Within our VAR framework, we say that caselaw in domain X is relatively autonomous from caselaw in domain Y when structural shocks to caselaw in domain Y are not particularly important for explaining the dynamics in attention to caselaw in domain X.

Second, there is the degree to which legal developments are affected by forces external to the legal system (i.e. society at large), as opposed to arising purely from the normal dynamics of legal processes. Drawing on our VAR model, we say that caselaw in domain X is comparatively less autonomous from forces external to the legal system than caselaw in domain Y when the structural shocks to caselaw X are relatively more important for explaining the dynamics of attention to caselaw X than are

[36] 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.

structural shocks to caselaw Y for explaining the dynamics of attention to caselaw Y.

The results presented in the previous subsections allow us to characterize the comparative degree of autonomy, as defined above, for each of the three areas of caselaw under consideration. We emphasize here that all of our interpretations are necessarily in relative terms: by definition, in a system of caselaw all areas of law are affected to some degree by both the internal operations of the legal system and social, political, and economic forces external to the legal system.

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 caselaw. Moreover, contract reacts much more to its own shocks than property and procedure do to theirs. Similarly, 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 caselaw.

Our empirical findings therefore indicate that, from the three areas of caselaw under investigation, caselaw on contract evolved comparatively more autonomously from the other two legal domains that did caselaw on property and procedure. But property and procedure exhibit a distinctly coevolutionary character. Interestingly, the intertwined nature of evolution of caselaw on property and procedure of the kind revealed by our data for the early-modern period has been noted by legal historians for earlier periods, too. For example, the 12th-century use of the writ of right, the assize of novel disseisin, and the assize of mort d′ancestor has been viewed as the legal profession's procedural response to numerous real-property issues that required attention after Stephen's chaotic reign (see, e.g., Brand, 1992: Ch. 9).[37] Our analysis advances the existing stock of legal-historical knowledge by providing quantitative evidence of the coevolutionary (non-autonomous) character of property and procedure caselaw during the later, early modern era.

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 addition, the comparison of the three equations (one per each area of caselaw) of the estimated VAR reveals that the R-squared is smallest for contract (0.33), followed by procedure (0.70) and property (0.82). Therefore, relative to property and procedure, the development of contract caselaw is more influenced by shocks from outside the legal system and less a reflection of the internal dynamics of the legal system. In this sense, our evidence indicates that contract caselaw is less autonomous from society than are the two other areas of caselaw. One interpretation of these results is that, in comparison with contract, property and procedure are more dependent on each other and the rest of caselaw, while contract caselaw is more attuned to reacting to the needs of economic agents rather than an instrument to establish a core element of the legal system (Smith, 2021).[38]

5.5. Sensitivity analysis

We performed two main sets of robustness checks. For brevity, we only summarize our findings.[39] 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 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 caselaw are permitted to exert a contemporaneous effect on attention to procedure, but shocks to procedure may affect attention to property only with a lag.[40] 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 caselaw causes attention to other areas of caselaw to rise. This effectively means that the estimated model would preclude the possibility that a change in one area of caselaw might necessitate changes in, and increased attention to, other areas of caselaw. 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-modern 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.

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

[37] We thank an anonymous reviewer for drawing our attention to this example from the medieval era.

[38] We thank Henry Smith for this insight.

[39] Full results are available on request.

[40] 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.

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 caselaw. 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 caselaw and contract. Compared to property and procedure, the historical evolution of contract caselaw 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-modern contract caselaw was comparatively less autonomous from society than were caselaw 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 foundation of the English state, on property.

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Disclosure statement

The authors declare that they have no conflict of interest.

Data availability

The data that support the findings of this study are available from the corresponding author upon request.

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Appendix

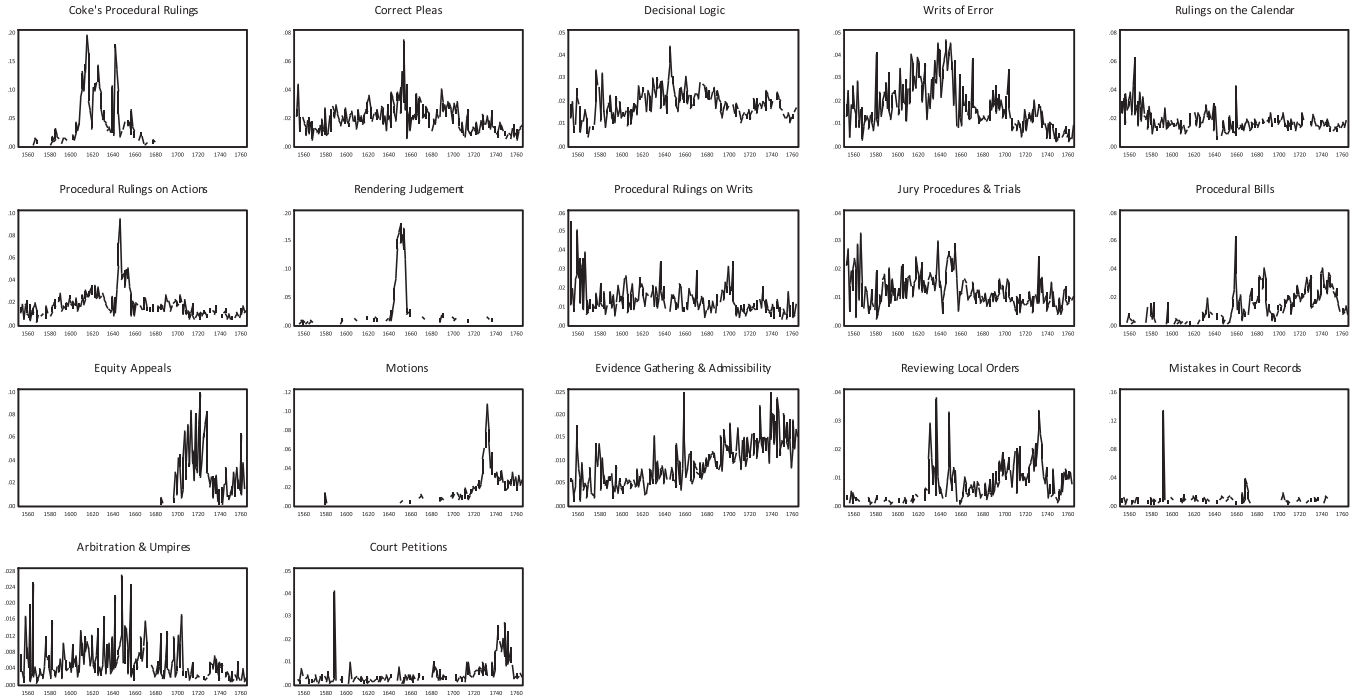

Fig. A1. Yearly attention to the topics included in the procedure theme.

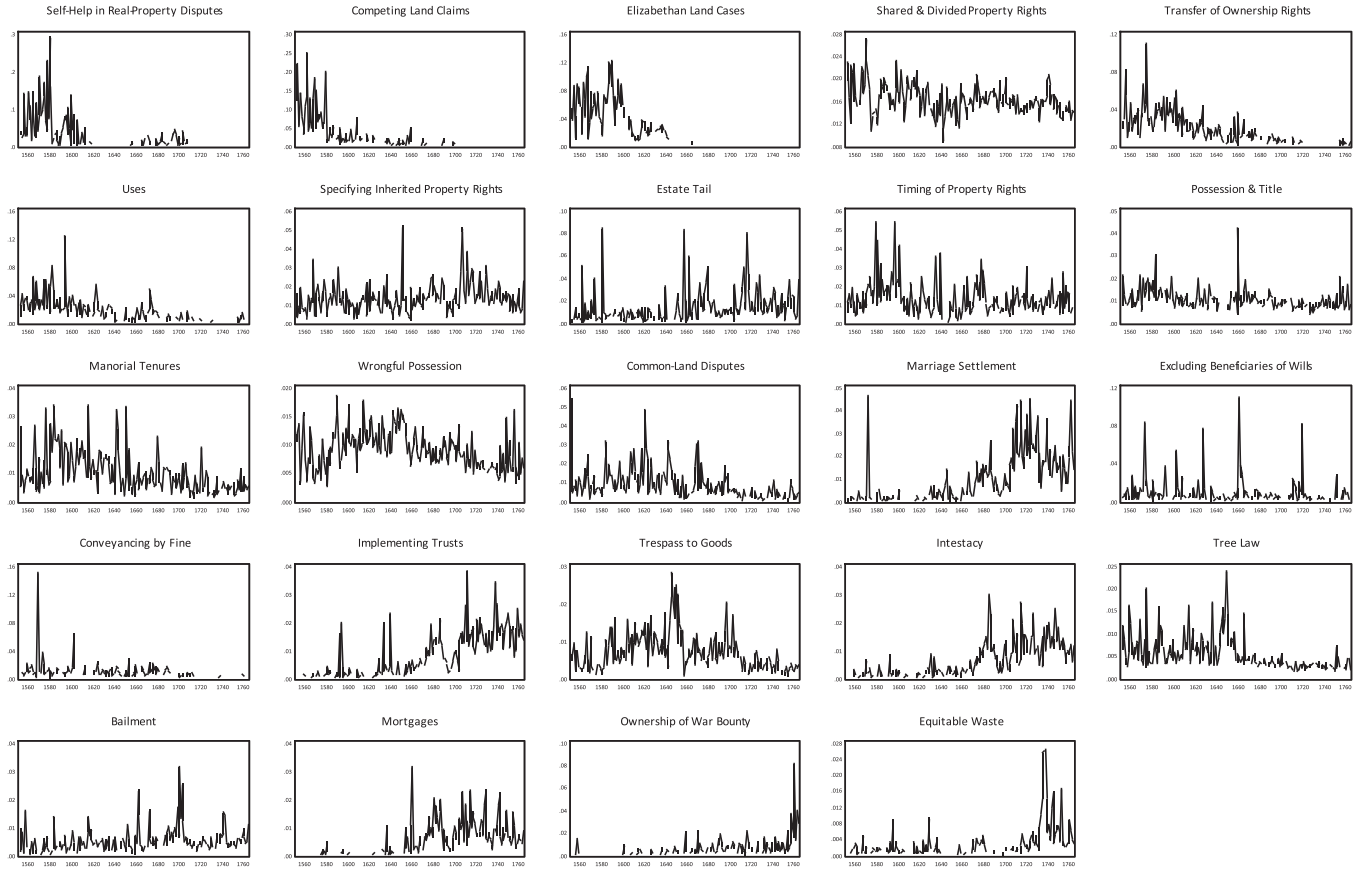

Fig. A2. Yearly attention to the topics included in the property theme.

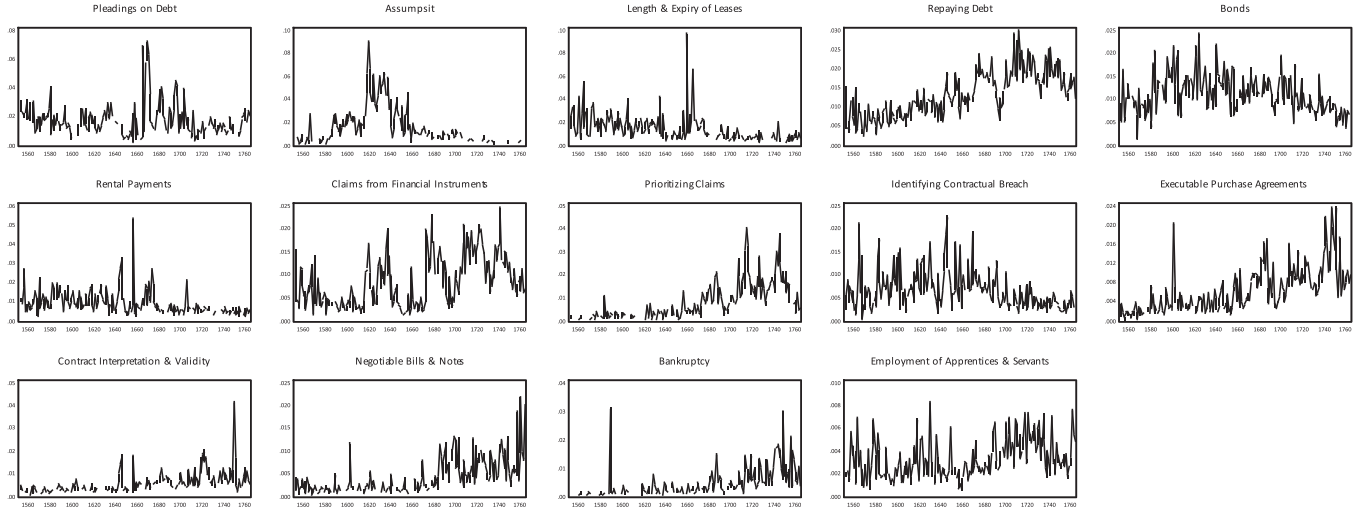

Fig. A3. Yearly attention to the topics included in the contract theme.

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