The Coevolution of Culture and Institutions in Seventeenth Century England

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Abstract

We examine how cultural and institutional development interact with each other over time, constructing new annual measures of cultural dynamics and institutional development for a paradigmatic episode of change, seventeenth century England. The institutional measures reflect citations of cases and statutes appearing in later legal decisions, thereby capturing the growth of formal legal institutions weighted by usage. The cultural measures reflect frequency of word use in publications, interpreted using a model of social learning that elucidates the relationship between cultural diffusion and word frequency.

We find that institutional development takes place over the whole period that we study (1559-1714). Especially fecund years are from the mid-1580's to the mid-1620's and from 1660-1680. There is no indication that the Glorious Revolution of 1688 spurred institutional development. The diffusion of modern ('whig') political culture is much more concentrated in time than is institutional development. Until 1640, the diffusion of whig culture is limited, but then dramatic change occurs, with over half of the cultural diffusion that we focus upon completed by 1660. The process of cultural change was largely completed by the time of the major constitutional legislation of the late 17th century. Vector-error-correction estimates of the relationships in the annual data suggest that culture and case-law coevolve but that statute law is a product of the other two.

Keywords: culture, institutions, coevolution, Stuart England, Glorious Revolution

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1. Introduction

The central role of institutions in economic development has been confirmed by over a decade of empirical work, adding to more venerable historical insights (North 1990, Acemoglu, Johnson and Robinson 2001). Despite the significant role attributed to norms and ideology in early work on institutions (e.g. North 1981), the economics literature has only recently come to view culture as of similar importance (Aoki 2001, Guiso et al. 2006, Greif 2006, Tabellini 2008a, Gorodnichenko and Roland 2010). The appreciation of the importance of institutions and culture has led to renewed interest in a broad variety of historical experiences, since institutions and culture seem to be highly persistent phenomena. Thus the roots of modern economic behavior are often placed centuries ago (e.g. Guiso et al. 2008, Nunn and Wantchekon 2010).

The deep historical origins of institutions and culture mean that the processes of cultural change and institutional development are difficult to study. There is much to learn about how culture and institutions evolve over time and how they interact with each other.[1] For example, do they mutually reinforce each other or is one a precursor to the other? Do cultural diffusion and institutional development coevolve, or is causality unidirectional, or do they proceed independently? Empirical answers to these questions depend upon obtaining a chronology of both cultural and institutional change, and examining the inter-relationships between them.[2]

Seventeenth century England, the subject matter of this paper, provides a powerful example of the absence of detailed, quantitative chronologies. There is almost universal agreement that the events of the seventeenth century were critical in making modern England, and even the

[1] Important contributions in this respect are a theoretical paper by Acemoglu and Robinson (2008), which develops a model of institutional change and persistence, and theoretical work by Bowles and Gintis (Bowles 2004, Bowles and Gintis 2011), which models the coevolution of preferences and institutions.

[2] Cross sectional work on culture and institutions, which has produced important recent contributions, cannot fully capture temporal processes. It is possible, for example, that the prime initial force is culture, which leads to the growth of effective institutions, which in turn means that culture becomes much less important in current cross-section.

modern world. All historical accounts emphasize how much culture and institutions changed between the beginning and the end of that century. This is not in doubt. But there is no consensus on when they changed and especially on how they interacted with each other (Hayek 1960, North and Weingast 1989, Pincus 2009, Murrell 2009, Pincus and Robinson 2010). The problem in addressing such issues is obvious: where are the data that could provide a chronological picture of cultural and institutional development during the century? The key contribution of this paper is to provide those data.

We construct new annual data on cultural dynamics and institutional development in seventeenth century England. We are aided in this process by the increasing digitization of historical records. This facilitates the use of text-search procedures to produce measures from large databases of archives.

The construction of the cultural and institutional chronologies requires two different procedures. For the institutional variables, we use reports on eighteenth-century court decisions. These reports cite the statutes and earlier cases used by judges to support decisions and by lawyers to litigate. Obtaining the dates of the cited statutes and cases, we build a chronology of development during the seventeenth century of the law that was used in the eighteenth. The resultant data series avoids a Gordian knot that appears in many attempts to measure institutions. Measures reflecting institutional inputs (e.g., laws, regulations, etc) do not reflect usefulness because it is difficult to find weights that capture relative importance in use. Measures reflecting usefulness usually capture outcomes rather than inputs, and therefore reflect much more than formal institutions.[3] Our measures reflect institutional inputs weighted by their later use by judges and lawyers in arguing and deciding real economic and political cases.

[3] The importance of the trade-off between these two problems has been captured, for example, in the debates on the various merits of Doing Business (2010) and the World Governance Indicators (2010).

Our cultural variables reflect data on word usage in a catalog of publications (books, pamphlets, etc) from the seventeenth century, the *English Short Title Catalogue*. We capture the diffusion of a 'whig' political culture, which emphasized the virtues of freedom and the necessity of constraints on the monarchy. We do this by tracing patterns in the use of words that are emblematic of that culture. However, as we show, the mapping from word frequency to cultural diffusion is not a simple one, where more frequent word usage immediately implies higher levels of cultural diffusion. To make that mapping, we employ theories of cultural evolution to interpret trends in the data (Boyd and Richerson 2005, McElreath and Boyd 2007, Gintis 2009). The resultant measures provide new insights into the chronology of cultural change in seventeenth century England.

The paper's results appear in the many figures that display time series of cultural diffusion, case-law development, and statute law development. In this introduction, we can only highlight a few important conclusions. There is gradual institutional development over the whole time period that we study (1559-1714). Especially fecund years are from the mid-1580's to the mid-1620's and from 1660-1680. Although much development occurred after the Glorious Revolution of 1688, there is no indication in the data that this spurred a surge in institutional development. Notably, case-law development slowed after 1700, which is particularly notable since the major piece of constitutional legislation on judicial independence was passed in 1701. Our data show little sign of the effect of constitutional judicial independence in the development of case law.

The diffusion of whig culture is much more concentrated than the development of legal institutions. Until 1640, the diffusion of whig culture is limited, but then there is dramatic change with over half of the cultural diffusion that we focus upon completed by 1660. We

interpret the period after 1660 as a time when the new cultural ideas are gaining a large majority of adherents within the relevant population. The process of cultural change therefore was largely completed in the years before the Bill of Rights of 1689 and the Act of Settlement of 1701, the two major pieces of constitutional legislation.

Given yearly data from 1559 to 1714, we can apply standard time-series methods to analyze interactions between cultural diffusion and institutional development. We use a vector error correction model, which relates changes in culture and institutions to each other and to deviations of each from their long-run relationships. The results suggest that culture and case-law institutions coevolve but that statute law is a product of the other two. We find no evidence of statute law influencing the development of case law or culture. Cultural diffusion apparently spurs the development of case and statute law, but the development of case law appears to have a negative effect on cultural diffusion. These conclusions are very preliminary, the product of exploratory methods to generate a picture of change during a critical juncture of history. Nevertheless, as preliminary as they are, they depart from past accounts in providing a detailed picture of the temporal processes of cultural and institutional development that relies upon an explicit methodology generating quantitative measures from original sources.

The paper proceeds as follows. Section 2 discusses the construction of the measures of institutional development and Section 3 interprets the results. Section 4 lays out the methods for assessing cultural diffusion and Section 5 interprets those results. Sections 2 and 4 are both supported by lengthy methodological appendixes. Section 6 presents the results of the time series analysis, showing the evolution and coevolution of institutions and culture.

2. Measuring the chronology of institutional development

England had a cohesive legal profession from the earliest times, perhaps as far back as the 12th century (Brand, 1992). By the fourteenth century, judges were chosen from that profession and the profession acquired control over the education of its prospective members (Plucknett, 1983). From the earliest times, case reports were an integral element of this education. Eventually, such reports were systematized in a series of official Year Books (Winfield 1925). Although the Year Books were discontinued in 1537, the tradition of reporting was so well entrenched, the legal profession so cohesive, and the whole system so dependent on its stock of reported cases that independent reporters filled the void (Van Vechten Veeder, 1901a). Very often these reporters were highly respected judges. From 1537 to 1865, this unorganized system was the primary source for knowledge of past cases for judges and lawyers.

These reports, especially in the early times were not a systematic record: "…the long period from 1537 to 1785 is precariously covered by more than one hundred reporters of various degrees of merit." (Van Vechten Veeder, 1901a) But the reports of earlier cases were what judges and lawyers relied upon when becoming educated, arguing cases, and making decisions. Over time quality improved. This was especially so during the seventeenth century, when English was made mandatory, rather than law French or Latin, when the citing of precedent became common practice, and when an increasingly sophisticated legal procedure relied on past court decisions for its rules. Ironically, the desire of the Stuarts to seek precedence in the law for their actions led to a demand for publication of old reports, which had previously appeared only in manuscript form (Wallace 1882). Thus, by the time of the Glorious Revolution the reports were increasing in availability and importance (Van Vechten Veeder, 1901a).

In the mid-nineteenth century, public and private initiatives led to new official procedures of reporting and the old ad hoc system ended (Daniel, 1884). The latter half of the nineteenth century saw various attempts to produce revised, edited, and complete versions of the old historical reports. This resulted in an edition that seems to be regarded as definitive, called the *English Reports* (1990). It is available online in various forms from various sources (Commonwealth Legal Information Institute 2010, HeinOnline 2010, Justis Publishing 2010). Comprising 178 volumes and reflecting the work of several hundred reporters, these reports cover the years 1220 to 1865. Cases decided before the mid-sixteenth century constitute only a small proportion.

With their quality rising and coverage much more complete in the eighteenth century, the value of the *English Reports* for this paper is that they present a rather complete picture of the law that judges used to decide cases brought before them. Under English law, these cases and statutes together constitute the corpus of formal law. Moreover, it is possible to date the cases and statutes to which judges refer. Hence, by using the *English Reports* of a later period, one can develop a chronology of the development of law in England in earlier times. By weighting each case and statute by the number of times that it is cited in later volumes of the *English Reports*, the chronology reflects the importance of the various elements of the law. For example, a previous statute that is not used in a subsequent case is not counted in our measures. Our index of the development of English law therefore reflects formal legal development weighted by subsequent use.

We focus on the development of law in the Stuart period and immediately before (1559-1714). Therefore, we use the *English Reports* of the early Hanoverian years and collect references in those reports to cases and statutes for the preceding time period. Four principal

courts are reflected in the reports, King's Bench, Common Pleas, Chancery, and Exchequer. For each of these courts, we use the volume of the *English Reports* that is the first to contain the post-1714 cases. These are volumes number 25, 94, 125, and 145. No cases decided before 1720 are used to avoid counting cases that are simply reported, rather than cited within decisions. The overwhelming majority of reporting cases are in the 1720's and 1730's.

We are able to date 6616 citations to cases decided in the years 1559-1714 and 699 statutes passed during the same period, providing a complex, chronological picture of legal development during the Stuart era. To our knowledge, there is nothing in the literature that is similar to these data in providing such a detailed picture of the development of formal law for a long critical time period, certainly not for England in those times of its fundamental change. The production of such a detailed picture is only practicable using computerized text search procedures. Appendix 1 describes these procedures, highlighting the assumptions that we use in finding and dating cases and statutes. It also contains estimates of the reliability of these procedures. We now turn to the data that are generated.

3. Assessing the chronology of institutional development

The chronology begins in 1559, the first full year of the long reign of Elizabeth I and the beginning of a long period of stability after the tumultuous years of Henry VIII, Edward VI, and Mary. The ending date is 1714, the last Stuart year. All the paper's figures identify three crucial years, 1603, the beginning of the Stuarts, 1642, the beginning of the civil war, and 1688, the year of the Glorious Revolution.

Figures 1 and 2 show the distribution of the dates of the law created in 1559-1714 that was used in the early eighteenth century. Figure 1, for cases, adds double exponential smoothing,

which aids in visually identifying the patterns in the data.[4] Smoothing, however, adds nothing to the chronology of statutes. Given the sporadic meeting of parliaments and the very great significance of a few statutes, the absence of a clear pattern over time in Figure 2 is a fundamental characteristic of the development of statute law. Fewer than 10% of the years before 1688 are responsible for approximately two-thirds of the development of statue law during 1559-1688.

Figures 3 and 4 provide cumulative distributions of case and statute development. In contrast to many other interpretations of English history (North and Weingast 1989, Pincus 2009, Pincus and Robinson 2010), these new data show a picture of gradual institutional development over the whole time period, rather than change concentrated after 1688. Moreover, much change in legal institutions occurs quite early. The 40 years from the mid-1580's to the mid-1620's—one-quarter of the time under review—contain one quarter of the whole development of statute law. The same period witnesses 20% of the development of case law. According to our data, legal development during late Elizabethan and early Stuart England was much more significant than has been traditionally depicted in standard histories.

Not surprisingly, the data show the hiatus in legal development that occurs in the long years of struggle between King and Parliament, 1630 to 1660. This is almost definitional in statute law, given the absence of Parliaments in the 1630's and the questionable legality of parliaments under the Commonwealth. However, the slowdown in institutional development also occurs in case law. In contrast, during the uneasy truce between King and Parliament in the Restoration period, legal development proceeds apace. The two decades from 1660-1680 (13% of the whole time period) contain 30% of statute legal development and 22% of case law development. There

[4] The smoothing criterion is least squares.

is an interesting comparison here with the 25 years following the Glorious Revolution (16% of the time period), which contain 30% of statute law development and 33% of case law development. Thus, the Restoration era is just as productive as the post-Glorious-Revolution era in terms of statute law and only slightly less productive in case law. Thus the story from our data stands in contrast to a common theme in the economics literature, where the role of parliament in the years after 1688 is considered the vital key in understanding the development of the modern English state (North and Weingast 1989; Pincus and Robinson, 2010).

Notably, case law development declines after 1700: 12% of the total occurs during the 13 years from 1702 to 1714 in contrast to 22% in the 13 years from 1688 to 1700 and 15% in the 13 years from 1675 to 1687. Yet, the Act of Settlement of 1701 has always been cited as the major piece of constitutional legislation affecting judges, for the first time making mandatory their continued appointment on good behavior, as opposed to the king's pleasure (Trevelyan 1920, Tarkow 1943, Klerman and Mahoney 2005). Evidently, there is no sign of the establishment of constitutional judicial independence in the development of case law.

Figures 1 to 4 provide a new view of English legal development in the Stuart years. It relies explicitly on a quantitative assessment of when legal development occurred. No doubt our data provide a crude approximation to actual developments. Nevertheless, the value of the data is shown in the insights in the paragraphs above, which challenge conventional wisdom in a number of aspects of English history. We now turn to another area in which we provide new quantitative information, cultural development.

4. Measuring the chronology of cultural diffusion

Our objective is to develop a measure of changing culture in seventeenth century England. The notion of culture that we use is one now common in the economics literature and consistent

with that in cultural anthropology: values or beliefs that are socially transmitted through teaching or imitation, within a pre-defined group of individuals. Social transmission should and, in principle can, be distinguished from individual learning (Boyd and Richerson 2005).

In applications of culture, economists study values and beliefs that impact economic decisions and foster economic exchange. The focus is commonly on values and beliefs that are persistent across time (see e.g. Gerard 2004, Guiso et al. 2006, Fernandez 2008). Empirical studies usually compare aggregate measures of values and beliefs across specific groups of individuals where the groups are defined by social categories like country of birth, ethnicity, geography, or religion (see e.g. Fisman and Miguel 2007, Tabellini 2008a, Fernandez and Fogli 2009, Roland and Gorodnichenko forthcoming). Some empirical studies identify extraordinary historical periods as causes for the change of normally persistent values and beliefs (e.g. Guiso et al. 2010, Nunn and Wantchekon forthcoming). Theoretical models usually build on cultural evolution models (e.g. Cavalli-Sforza and Feldman 1981, Bisin and Verdier 2001, Boyd and Richerson 2005), often extending them into new domains (e.g. Bowles 2004, Tabellini 2008b, Guiso et al. 2009). The theoretical models generally show the existence of multiple equilibria with very different characteristics for cooperation and economic performance. In this paper we document an extraordinary period of changing political values and draw on a standard cultural evolution model to guide our interpretation.

One way in which social learning and the consequent cultural change can manifest itself is through intellectual activity. We exploit data on publication activity that reflects intellectual exchange to derive estimates of changing culture. During the Stuart era in England, publication of books and pamphlets increased enormously. The *English Short Title Catalogue* (ESTC) is the most complete record of what has survived of this publication process (ESTC 2010). It is a

machine-readable catalogue of nearly half a million books and pamphlets printed primarily in Britain and North America from 1473 to 1800 and held in the collections of a consortium of over 2000 libraries. We use the entries published in English in England from 1559 to 1714.

The typical element of the ESTC is a library catalog entry, containing title, date, place of publication, and subject classification. The 'short-title' is somewhat of a misnomer, since in the seventeenth century titles were very long. They are often an abstract of the work (Moretti, 2009).[5] We include the whole catalog entry in our search database, including the subject classification made by bibliographers at later dates. This is appropriate since the classification is an indication of subject matter from skilled professionals.

The core of our method is to use changing patterns of word usage in the catalog to indicate changing patterns in culture. However, as will be abundantly clear in what follows, there is no simple monotonic relation between frequency of word usage and prevalence of related cultural patterns. To show this and to develop our methods, we focus first on an example, use of the word 'freedom' in the ESTC, as an indicator of political culture and social learning. Because the number of records changes radically over time, from less than a hundred in 1559 to several thousand in 1714, all data are in proportions of publications in a given year that contain particular words, not in absolute numbers of publications.

Figure 5 shows the yearly proportion of ESTC catalog entries that contain the word freedom from 1559 to 1714.[6] The scatter plot reveals a high variance of points around a changing trend.

[5] For example ESTC citation R14734 by Francis Bugg published in 1682 has the title "De Christiana libertate, or, Liberty of conscience upon it's [sic] true and proper grounds asserted & vindicated. And the mischief of impositions, amongst the people called Quakers, made manifest. In two parts. The first, proving, that no prince nor state ought by force, t compel men to any part of the doctrine, worship, or discipline of the Gospel. By a nameless, yet an approved author, &c. The second, shewing the inconsistency betwixt the church-government erected by G. Fox, &c. and that in the primitive times: being historically treated on. To which is added, A word of advice to the Pencilvanians. By Francis Bugg."

[6] All reported ESTC searches used variant forms e.g. freedoms as well as freedom.

Double exponential smoothing is therefore used to obtain a clearer picture of the underlying patterns (Figure 6).[7] For the same reason, most subsequent figures are presented using smoothed data.

Despite its very clear chronology, the data in Figure 5 present a challenge of interpretation. There is absolutely no basis for thinking that the notion of freedom was held more strongly within English political culture in the late 1670's than it was thereafter. Therefore, word usage does not simply reflect the prevalence of political values or beliefs. There is another natural interpretation that does have more historical plausibility: the data reflect ongoing cultural change, that is change in the prevalence of political values or beliefs. Figure 5 is consistent with common intuition about changing political culture in seventeenth century England if the prevalence of the use of the word freedom in any given year approximated the change in the proportion of the population subscribing to new political ideas. Figure 5 would then approximate the derivative with respect to time of an S-curve, a temporal relationship that is characteristic of many processes of innovation diffusion (see e.g. Rogers 2003).

We provide support for this interpretation of our ESTC data in two ways. We first examine a process with which all readers are familiar, the endorsement of concepts in the economics literature. Even though concepts are different from political values, the general characteristics of diffusion of innovations of many kinds are very similar (see e.g. Rogers 2003). Figure 7 shows the proportion of economics papers in JSTOR that contain the term 'consumption function' from 1940 to 2004. It has the same pattern as the use of freedom in the Stuart years. There is an increase, which begins when the idea of a consumption function is new, and then a decrease,

[7] The smoothing criterion is least squares.

during the time in which the idea is endorsed by the large majority of economists.[8] The interpretation therefore is that the use of a term in publications is not primarily a measure of overall acceptability of a cultural concept, but is rather predominantly a measure of use during a process of cultural change.

The second justification of the interpretation draws on the large existing literature studying the diffusion of innovations within human populations (e.g. Rogers 2003, Jackson and Yariv forthcoming). The appearance of an S-shaped form describing diffusion dynamics is a common feature of a large number of plausible models independent of underlying mechanism, interaction structure, or heterogeneity of agents (see e.g. Young 2009, Jackson and Yariv forthcoming). For example, S-curves result when diffusion of innovations is driven by biased social transmission of information, a special type of social learning, but S-curves do not result from individual learning mechanisms (see e.g. Henrich 2001). Whenever references in publications are correlated with the rate of adoption of an innovation one will obtain chronological profiles of relative publication activity that are similar to the examples of freedom in the Stuart era and consumption function in modern economics.

Appendix 2 uses a basic, highly stylized model to illustrate the application of social learning and cultural evolution models to ESTC publication data. The model implies that the rate of cultural diffusion is a function of two factors, the frequency of encounters between opposing views and the value derived when the social learning results in an individual changing cultural allegiances. In Appendix 2 we give reasons why publication activity largely approximates the rate of change in the number of individuals subscribing to specific cultural ideas so that publication activity and cultural diffusion are closely related. Then:

[8] Figures with similar patterns were obtained for "production function', 'rational expectations', 'impossibility theorem', and 'folk theorem'. These are available from the authors on request.

1. The frequency of use of a new cultural term in the ESTC data proxies the rate of change in the proportion of the population subscribing to the cultural ideas associated with that term.

2. The rate of change of this population proportion has qualitative characteristics similar to those in Figures 5 and 6.

3. The diffusion of the new cultural ideas traces out a standard S-curve.

4. The integral over time of the presence of the new cultural term in the print media is a proxy for the diffusion S-curve. Assuming 'freedom' is emblematic of a new set of cultural ideas, then at any time the proportion of the population subscribing to that set of ideas is proxied by the area under the curve up to that time in Figures 5 or 6. Figure 8 contains the corresponding diffusion S-curve.

Our main goal is to establish a timeline of changing adherence to a whig political culture, where we use the term 'whig' not in any of its specific senses but rather as a very general label for a political culture that values political freedom, limits on the power of the monarchy and the state, and rights for a broader class of citizens. We cannot rely solely on the use of the word freedom to capture changes in this culture. Thus, using Johnson's dictionary (1792) and the OED (2000), we isolated a small set of terms that reflect modernizing ideas on the nature of the individual and the state. A crucial property sought in these terms was that their modern meaning existed throughout the relevant time period, in order to ensure that the data were not confounded by changes in meaning over time. The terms we use, in addition to 'freedom', are 'liberty', 'free', and 'right'. Figures 9(a)-(c) show the smoothed timelines of the use of these terms in the ESTC.

The timelines in Figures 9(a)-(c) have characteristics similar to those of 'freedom' in Figure 6. The most prominent characteristic is a large increase in usage beginning approximately in 1640 and ending in roughly 1688 or before. The patterns are somewhat obscured for 'right',

since it is clear that this term was in common usage during Elizabethan times, with connotations different from those of a political right.[9] To ensure that these older usages are not reflected in our estimates of cultural change, we subtract from the smoothed series on 'right' the value of that series in 1580.[10] The resulting data appear in Figure 9(d). These data are used in all of the subsequent analysis.

To produce an aggregate series on cultural change, we combined the data for freedom, liberty, free, and right, by adding up the proportions in any given year for the four series, weighting the data for each series so that all four contributed equally to the aggregate.[11] Given the above arguments, a proxy for the proportion of the relevant population that subscribes to whig ideas at any time is simply the sum of the ESTC proportions for periods up to that time. Since our data gives no information on absolute values, we normalize by setting that proportion equal to zero in 1559 and 100 in 1714. Figures 10 and 11 show the estimated incremental and cumulative diffusion of whig culture.

The ESTC data presented so far has focused only on one aspect of cultural change, political. Given later developments in England, readers might naturally wonder whether the ESTC provides any evidence of changing economic culture, in terms of attitudes to markets and capitalism. To assess this, we gathered data from the ESTC on four terms relating to economics, markets, prices, profits, and money. The data are presented in Figures 12(a)-12(d). It is immediately clear that there is no pattern in these figures that could plausibly match a process of cultural diffusion. Thus, the ESTC data reflecting political terms is very distinctive, emphasizing our interpretation that something very special was occurring in political culture in England

[9] It is often used in the sense of 'correct' or 'truly' or in an honorific 'right honorable'.

[10] And redefine negative data points as zeroes.

[11] Aggregating these four different searches with the Boolean "OR" operator does not change the picture.

during the Stuart period. Of course, the absence of something similar in economics does not mean the absence of developments relevant to economics. Political culture can affect economic development. Moreover, perhaps attitudes on matters of business and capitalism were changing in a narrow circle of specialized economic agents. But there is no evidence of that in the general print culture.

5. Assessing the chronology of cultural diffusion

Figures 10 and 11, which summarize the measures of cultural diffusion, show a much simpler pattern than that of institutional development. Up to 1640, change is limited, with only 23% of the total cumulative diffusion in the whole period occurring in the first half of the period.[12] Then during 1641 and 1642 there is dramatic change. This is not surprising. These are the years when open conflict breaks out between King and Parliament. The Star Chamber, one of the institutions that had made political debate especially dangerous, was abolished in 1641 and the civil war began in 1642.

The model of cultural diffusion in Appendix 2 interprets the downward sloping part of Figure 10 (or the declining slope of the S-curve in Figure 11) as the time when the new cultural ideas are now accepted by a majority of those who will eventually come to adopt them. Indeed, it is notable that our data indicate that the point of 50% of cultural diffusion is reached in 1660, the year of the restoration of the monarchy. The time period after that is when the new cultural ideas are gaining a large majority of adherents.

Most importantly, the process of cultural change was beginning to slow during the years leading to the first element of the final constitutional settlement, the Bill of Rights of 1689. Only a minor amount of diffusion of our measured 'whig' culture occurred after the Bill of Rights:

[12] The percentage figures given in this and the subsequent paragraphs use the smoothed data.

16% to the end of the Stuart period in our metric. By the time of the second and final element of the constitutional changes, the Act of Settlement of 1701, the pace of cultural diffusion had slowed to levels not seen since the conflict between King and Parliament had broken into the open. If as we propose, our data fit a standard model of cultural diffusion, then 1701-1714 witnesses the final stage of a process of cultural change that has saturated the relevant population.

6. Interrelationships between culture, statutes, and cases.

Figure 13 brings together the results of the data collection process, showing cumulative cultural diffusion and institutional development (for both cases and statutes).[13] In this section, we parse the relationships between these series using time series analysis. The objective is not to conduct rigorous testing of any specific hypotheses: in fact, there are no obvious hypotheses in the literature that currently provide the substance for tests on coevolution. Rather, we aim simply to provide a picture of the inter-relationships of cultural diffusion and institutional development, using standard statistical methods. The methodological aims underlying this picture are as close to those typical of the verbal description of history books as to the precise theory of time-series econometrics. We aim at only a systematization of available information using a mapping from basic information to systematic summary that is clearly defined by the statistical techniques that are used.

The possibility of cointegrating relationships between the three series is obvious from Figure 13. The first step is to determine the number of these relationships. We follow Johansen

[13] The cultural variable is focused on political terms, but the institutional variables include references to all types of cases. The following exercise assumes either that political culture is reflected in all institutional changes (or vice versa) or that a measure of all institutional changes is a reasonable proxy for a measure of institutional changes relevant only to political institutions. The former assumption is justified especially in the English 17th century. (See, for example, the Case of Monopolies, 1602, in which economic issues and liberty were confounded.) We have checked that the latter assumption is reasonable by examining institutional measures that reflect only cases that mention political terms.

(1991). Both the trace and the maximum eigenvalue statistics suggest there is at least one cointegrating relationship using critical values at the 1% level (or even the 0.1% level). The same tests indicate the rejection of two cointegrating relationships (instead of one) at the 10% level.

The normalized cointegrating coefficients (with standard errors in parentheses) are:

culture	*caselaw*	*statutelaw*
1.0000	-1.0097	0.2033
	(0.2503)	(0.2640)

where the three variables *culture*, *caselaw,* and *statutelaw* correspond to the three series in Figure 13. That is, they are the stock, not flow, variables.

Over the seventeenth century, the development of case law and the diffusion of culture maintain a relationship with each other. Thus, there is long-run Granger causality between these variables, with direction as yet undetermined. Engle and Granger (1987) show that the presence of a cointegrating relationship implies a vector error correction (VEC) representation of the underlying processes. The VEC is simply a VAR in the first differences of the variables plus a term reflecting the deviation of the variables from their long-run relationship, the cointegrating error term. The VEC formulation corresponds to the structure of a coevolutionary relationship, where the change in a stock is a function of the existing stocks and past changes in stocks (McElreath and Boyd 2007). The VEC provides a simple mechanism to detect the presence and nature of a coevolutionary relationship.

Although *statutelaw* is not significant in the cointegrating relationship, we include it in the subsequent analysis in order to examine whether there are short-run relationships between this and the other variables, as captured in the VAR. We use the Akaike and the Schwarz

information criteria to choose the lag length of the VAR. Both criteria are minimized with a lag length of one. The resultant maximum likelihood VEC estimates appear in Table 1.

Using conventional levels of significance, the cointegrating error term is statistically significant in determining changes in both *culture* and *caselaw*, but not *statutelaw*. When considering the error correction effect alone (that is the short-term effect of long-run imbalances), the effect of culture on case-law institutions is positive, but case-law institutions negatively affect cultural diffusion. This is one piece of evidence that *culture* and *caselaw* are in a coevolutionary relationship.

Further evidence appears in the short-run relationships captured in the VEC. Granger causality tests on the first difference terms in Table 1 suggest a strong coevolutionary relationship between *culture* and *caselaw*, that is, causality is in both directions. There is weak evidence of Granger causality from *caselaw* to *statutelaw*. But there is no evidence that *statutelaw* has an effect on either culture or case-law institutions.

Impulse-response functions combine the effects of the cointegration error and the first-difference terms. We use one-standard deviation Cholesky innovations. Figures 14 to 17 show impulse responses for 50 periods for innovations in *culture* and *caselaw.* Since the effects of innovations in *statutelaw* are negligible (consistent with the results above), they are not presented.[14] However, we do examine the effects of *culture* and *caselaw* on *statutelaw*, since the above indicates a weak effect from *caselaw* to *statutelaw* and therefore also an effect from *culture* to *statutelaw*, via *caselaw*. The impulse response functions show these effects clearly.

[14] We also omit the effects of innovations of variables on themselves.

The effects are numerically important. To judge their size, not that the innovations in *culture* and *caselaw* are equal in magnitude to approximately one-half a year's growth.[15] After 50 periods, the innovation in *culture* increases *caselaw* by an amount equal to more than two-years in-sample average growth and *statutelaw* by more than one-year's growth. Similarly, after 50 periods the innovation in *caselaw* decreases *culture* by an amount equal to more than two-years in-sample average growth and *statutelaw* by slightly less than one-year's growth.

At this juncture, we resist the temptation to make extensive comments on implications for interpretations of English history should these results be robust to further analysis. Rather we emphasize the fact that results of this kind are new to the literature, certainly for early English development, and perhaps for any time period for any country. Among the general features of the results that are worth emphasis are the following:

1. We find no evidence of a causal link from statute law to the development of either culture or case law. In contrast, there seems to be weak evidence of causal links flowing in the reverse direction.

2. In our data, there seems to be a coevolutionary relationship between the diffusion of culture and the development of case law.

3. Culture seems fundamental to institutional development, spurring direct changes in case law and indirectly changes in statute law (in the longer term).

4. The apparent negative effect of case law institutions on culture is very surprising. This is present both in the effect of the first-difference terms and in the effect of the cointegrating error

[15] To judge the size of the innovations, in the sample, the stock variables grow at an average of 0.64 units a year, while the initial effect of the innovation in cultural diffusion on itself is 0.37 and the initial effect of the innovation in case-law institutions on itself is 0.23.

term in Table 1. This empirical finding is in search of a theory, given its highly unexpected nature.

It is exactly the possibility of finding the unexpected that justifies collecting new data using new methods, as we have done in this paper.

Appendix 1: Extraction of case and statute citations

This appendix describes the approach used to extract case and statute citations from text files that contain those parts of the *English Reports* relevant for the time period we study. We further estimate the reliability of our approach by using a random sample of the text and comparing the results of our computational method to hand-collected results.

As indicated in the text, we extracted information from all reported cases that occurred in the years closely following the death of Queen Anne in 1714. Our data reflect the information in the *English Reports* of post-1720 cases by Bunbury, Barnardiston, Fitzgibbon, Barnes, Cunningham, Cooke, Willes, King, Mosely, Kelynge, Talbot, and Hardwicke.

Case citations in the English reports can be nominative or explicit. Nominative citations first list an abbreviation of the reporter of the court proceedings that cited the relevant case. This is followed by a page number, which refers to the original folio page on which the case was originally reported (not the page of the printed volume). For example, 2 Levinz 24, refers to the second volume of Levinz's Reports and a case that is reported on folio page 24. In contrast, explicit citations refer to cases by stating one or more of the parties that are involved in the case. For example, Fisher versus Patton, is the explicit case citation of the case that is reported in 2 Levinz 24. Explicit citations nearly always identify a case uniquely, but the same case can be reported in different reporter volumes. For example, Fisher versus Patton is not only reported in 2 Levinz 24, but also in 2 Keble 826.

Within the cases reported in the above list of *English Reports* we extracted nominative citations by searching the text for abbreviations of *Report* names and then extracting the abbreviation and the (folio) page number that followed the abbreviation. To compile a list of abbreviations to drive the search, we started with a list of all those abbreviations in the index

chart that was constructed by the editors of the *English Reports*, dropping volumes whose reported cases occurred only after our period of interest (1714). However, the 'official' abbreviations in the index chart are only the ones that are most commonly used and often became conventional only after the eighteenth century (Williams 1940). In the earlier time period, reporters used a variety of abbreviations. For example, Coke's seminal reports are cited variously as 'Coke', 'Coke Rep.', and 'Rep.'. Thus, we used a variety of sources to collect possible alternative abbreviations for all *Report* names and also to cross-check the validity of abbreviations (Williams 1940, Soule 1884, Cardiff Index to Legal Abbreviations 2010, JustCite English Reports References 2010).

To make sure that the list of *Report* name abbreviations was as complete as possible, we compared the abbreviations in our constructed list to the output of a computer program that searched the volumes of the *English Reports* listed above. The computer program was written in Python and used regular expression matching to extract text strings that had patterns approximately the same as those of nominative citations. We manually examined all text strings that had the specified structure and that did not match any of our already-identified abbreviations, seeking *Report* names that were missing. The newly discovered abbreviations were then added to the list, which in its final version included 672 items.

Drawing on the abbreviation list, we used a Python program and regular expression matching to extract relevant nominative citations from text files that contained the *English Reports* referred to above. Information on case dates outside the text files does not exist and direct extraction from text files would involve enormous extra complexity. Therefore, we approximated the dates of cited cases by noting the chronological arrangement of cases within reporter volumes and using information on the time periods and page numbers that each *Report*

covers. We used the page number of an extracted nominative citation to determine the relative position of a case in a given *Report* name and then translated the relative position into a specific year. The translation relied on the assumption that, in any given reporter volume, there is a linear relation between year and page. For example, the nominative citation 2 Levinz 24 would be combined with our knowledge that the second volume of Levinz's reports runs from page 1 to page 225 and covers the years 1671 to 1679. Consequently we would determine the relative position of 2 Levinz 24 as 0.09 and the corresponding date as therefore 1671. Unfortunately, in a minority of *Reports* the cases appear in subject order, rather than chronological order. In that situation, our method results in choosing a year for a case that is random within the years covered in the cited report. Obviously, these procedures introduce noise into our chronology, but an acceptable amount given the near impossibility at this stage of dating every case by an alternative more accurate method.

To assess the reliability of our results we drew a random sample from all pages in the *English Reports* listed above. The random sample consisted of 50 randomly drawn pages. We identified by hand all nominative citations in these pages that were relevant, i.e. nominative citations that referred to cases in the *English Reports* with dates before 1714. We then compared the ability of our computer program to identify relevant nominative citations within the random sample of pages. The program was identical to the one used to identify the full set of 6616 case citations. The random sample featured 151 relevant nominative citations and our computer program was able to identify 137 of these. No citations were identified incorrectly so that the estimate of the rate of success for the identification of nominative citations equaled 90.7 percent[16]. Minor fixes with regard to sequences of nominative citations and punctuation issues

[16] Assuming nominative citations are independently distributed, the confidence interval is [85.9%, 95.5%]

in regular expression searches allowed correct identification of 149 references. These fixes are likely to improve the success rate for the whole collection of cases so that the success rate of 90.7 percent is a lower bound.

We did not try to find case citations in the form of explicit case names. Explicit case citations are more difficult to identify and to date by computational methods. They occur far less frequently than nominative case citations. The random sample featured only 22 distinct relevant explicit case citations. If we take into account that, for now, explicit case citations cannot be identified by our computer program, the overall lower-bound success rate for identification of case citations then becomes 76.1 percent. Importantly, within the random sample we investigated whether our computational procedure and our manual method (including explicit case names) differed in chronology. Explicit case citations tend to be later than nominative citations, with a mean year of 1661 for nominative and 1669 for explicit citations. But this seems to be because of differences in the very early years of the chronology: for cases after 1650, the nominative citations have a mean year of 1686 and the explicit case citations have a mean of 1684. Thus, we conclude that omitting the explicit case citations does not distort our chronology in any significant way. And of course the benefit of excluding these is being able to rely on computational methods, which means that our chronology reflects information on over six thousand cases.

Statute citations within the *English Reports* appear in two forms that superficially resemble that of the case citations. The most common form consists of the regnal year in which the statute was enacted together with the chapter number of the statute. The chapter number reflects the order in which statutes were enacted within a year. Regnal years count the number of years having passed from the beginning of the reign of a specific monarch. For example, 29 Car. 2,

cap. 3 refers to the 3rd statute that was enacted in the 29th year of the rule of Charles II, i.e. 1662. The correspondence between regnal years and calendar years was taken from Justis Publishing 2010. A less common form of citation is the citing of well-known statutes by a special name. For example, the Statute of Frauds refers to the same statute as 29 Car. 2, cap. 3.

The first step in the statute search was to extract statute citations by searching the text of the *English Reports* listed above for occurrences of regnal years. As with nominative citations, regnal years are cited differently by different reporters. For example, Car. 2 can also appear as cha. 2, Ch. II, Car 2 and further variations of these. To compile a list of relevant monarch abbreviations we started with those used in Justis (2010) and, with the help of a computer program, searched in our case reports for occurrences of patterns that began with a one to two digit number followed by a short string of text containing as initial letters the first letters of monarch names and concluded with a one digit number or its roman number equivalent. We used a subsample of all case reports to add appropriate monarch abbreviations to the original list from Justis (2010)

Drawing on the list of monarch abbreviations we used a Python program and regular expression matching to identify all occurrences of regnal years. As regnal years occur in varied contexts, not only for statute citations, the computer program extracted all words that appear in the proximity of an identified regnal year. It is a premise of computational linguistics that word sense ambiguity can be resolved most reliably by consideration of words that appear in the proximity of ambiguous words (see e.g. Agirre and Edmonds 2007). We then used a decision tree based on the appearance of proximate words to classify the regnal year occurrence as a statute citation or something else. Proximate words like Michaelmas, Paschie, Trinity, Hillarii, versus, decree or charter that point to case dates, court session dates or dates of a charter were

taken as indication that the regnal year did not refer to a statute citation. On the other hand, occurrence of proximate words like statute, act, law or cap. indicated a statute citation. Whenever we concluded that a regnal year referred to a statute citation we translated it into the corresponding calendar year.

Prominent statutes are sometimes cited by specific names. To identify all statutes with specific names in our case reports we used a computer program to find all patterns where the words statute, statutes, or stat. are followed by a string of text. We then identified valid statute names and dated them. We added all statutes with specific names and corresponding years of enactment to a list that we used to search all case reports for the occurrence of the specific statute names. Every occurrence of a string that contained specific statutes names from the list was deemed an unequivocal indication of a statute citation. Every citation of a statute with a specific name was then dated.

We assessed the reliability of our approach using the same random sample of report pages that we used for the assessment of case citations. The random sample contained 54 statute citations, 8 of which were statutes with specific names, 42 were statute citations using the regnal year format, and 4 did not have enough information to identify them without advanced legal knowledge. Our Python computer program identified 7 of the 8 statutes with specific names (the one error being due to an OCR transcription error), none of the 4 statutes that are identifiable only with advanced legal knowledge, and 38 of the 42 statute citations in regnal year format. No citations were identified incorrectly so that the estimate for the overall success rate was 83.3[17] percent if one includes statute citations that are identifiable only with advanced legal knowledge and 90 percent otherwise.

[17] Assuming statute citations are independently distributed, then the 95% confidence interval is [73.1%, 90.4%]

One caveat to bear in mind when considering the accuracy of statute citations is that, in contrast to case citations, the same statute is sometimes cited multiple times in one case. Ideally the computer program would be able to distinguish different cases and discard multiple counts. In the present version of our research, this is not possible. In the random sample, statute citations that are repeated within a case occur 9 times within the 54 statute citations: for 2 of the 8 statutes with specific names, 2 of the 4 statutes that are identifiable only with advanced legal knowledge, and 5 of the 42 statute citations in regnal year format. Perhaps, this effect does tend to overstate the occurrence of statute citations, but it also seems plausible that a more important statute is mentioned more frequently within cases.

Appendix 2: Using word usage in the print media to estimate cultural diffusion

We examine a large group of individuals of constant size. Individuals differ only in their stance with regard to the power of the monarch. We call royalists (R) those individuals who support the divine right of kings and absolute power of the monarch. Those who question the divine right of kings, demand freedoms, and support constraints on the power of the monarch are called whigs (W). Individuals in the population interact with each other in the economic, political, and social spheres. R and W are adopted purely for the sake of convenience because they roughly match the subject matter, rather than for any historical veracity. The fraction of whigs in the population at time t is q_t.

We use a basic evolutionary game theory model of biased social transmission and corresponding cultural diffusion. One standard mechanism of biased social transmission is payoff-based social learning. Here individuals who interact with each other will sometimes end up comparing their payoffs and, if they find out the payoff difference, adapt their behavior to the behavior that generates higher payoffs, (see e.g. Boyd and Richerson 2007, McElreath and Boyd 2007, Gintis 2009). We assume pairwise random interactions, one for each person per time period. The interactions result in payoffs according to the following matrix:

	W	**R**
W	B, B	B-C, 0
R	0, B-C	0, 0

where $C > B > 0$.

Two ideas underlie the structure of payoffs. First, after becoming accustomed with the basic ideas of freedom and rights, individuals have a natural propensity to value them. (See e.g. Boehm 1999 for a possible evolutionary justification.) They receive a payoff from holding these views while interacting socially or politically with other individuals. Thus, $B > 0$. Second,

whigs face repression. Whenever interacting with a royalist they have a chance of being singled out and incurring a cost, such as governmental interference in their contract or property rights or criminal prosecution for their views. The expected cost is C. A royalist's expected benefit from interaction with a whig is 0. In an age of repression, C will be large relative to B.

The expected payoff from a random encounter at time t is $\pi_{Wt} = q_t B + (1-q_t)(B-C)$ for whigs and $\pi_{Rt} = 0$ for royalists[18]. At each interaction, individuals find out, with some probability, the difference in expected payoffs between themselves and the randomly matched individual. The probability of finding out the difference in expected payoffs is assumed to be proportional to the difference in payoffs, equal to $\beta|\pi_W - \pi_R|$ where β is a scaling parameter ensuring that the probability is in the appropriate interval, [0,1]. If individuals find out that their behavior results in a lower expected payoff than their counterpart they change their behavior immediately. Thus, the probability of changing behavior from R to W is $\beta(\pi_W - \pi_R)$, when it is known that $\pi_W > \pi_R$, and 0 otherwise. An analogous reasoning holds for the probability of changing from W to R.

This mechanism leads to the following replicator equation (see e.g. Gintis 2009):

$$q_{t+1} = q_t + q_t(1-q_t)\beta(\pi_L - \pi_R)$$

and in the case of the above payoff matrix:

$$q_{t+1} = q_t + q_t(1-q_t)\beta(B-(1-q_t)C)$$

This process has 3 equilibria:

$$q^* = 0,\ q^{**} = 1-\frac{B}{C},\ \text{and}\ q^{***} = 1.$$[19]

[18] We abstract from complications that arise from assortment, e.g. individuals avoiding interactions with the other type and actively seeking interactions with their own type. If a sufficient number of interactions continue to happen between different types of individuals the basic implications of the model remain unchanged. Assortment could, for example, modify the expected payoff so that $\pi_{Wt} < \pi'_{Wt} = f(q_t)B + (1-f(q_t))(B-C)$ with $f(q_t) > q_t$ for all $q_t \in (0,1)$. The overall dynamic relationship and in particular the S-shape of diffusion curves would be unaffected.

[19] With assortment and modified expected payoff $\pi'_{Wt} = f(q_t)B + (1-f(q_t))(B-C)$ the new unstable equilibrium point q'^{**} would lie below the unstable equilibrium point q^{**} that results from random matching.

Of these, only q^* and q^{***} are stable. Their basins of attraction are $[0, q^{**})$ and $(q^{**},1]$. The dynamics of q_t depend on the initial value, q_0. If q_0 is sufficiently close to q^{**} then q_t approaches the relevant stable equilibrium (q^* or q^{***}) by tracing out a standard S-shaped diffusion curve.

We can now match this model against the broad sweep of seventeenth century developments, interpreting the figures of Sections 4 and 5. At the beginning of that century, the costs of being a whig (C) were high and q^{**} was therefore far away from 0, so that royalists were predominant and $q \approx 0$ was the stable equilibrium. During the first half of the seventeenth century, repression began to decrease. Notably, the abolishment of the Star Chamber in 1641 matches the beginning of stark change in Figures 6, 9, and 10. This process would have lowered C and thereby q^{**}, enlarging the basin of attraction $(q^{**}, 1)$. In that situation, a small random increase in the proportion of whigs possibly together with assortment would result in a value of q lying in $(q^{**}, 1)$, leading, eventually, to cultural sea change. This change would manifest itself in the form of an S-shaped diffusion curve given that the small random fluctuation is likely to result in an initial value of q only slightly greater than q^{**}.

If one makes the plausible assumption that whig publication activity P_t reflects individuals' expression of group membership or identity, one can connect the S-shaped diffusion curve to observed whig publication activity, P_t. Whigs might be separated into recent converts, i.e. individuals who converted between period t-1 and t, and non-recent converts. Recent converts are likely to have a higher demand for the ideas that are new to them and also a greater amount of zeal, which will lead them to have a greater propensity to absorb the costs of publication. Whig publication activity P_t is then a function of $q_t - q_{t-1}$ and q_{t-1}. The simplest possible functional form that connects whig publication activity to the size of the two subgroups of whigs is $P_t = a + bq_{t-1} + c(q_t - q_{t-1})$. Greater demand for the new ideas by new converts and their greater

zeal translates into c being much larger than b. The constant a reflects publications that appear as whig publications in our data, but do not originate from whig individuals.

If, as is usual, cultural diffusion follows an S-shaped function, then publication activity is a weighted sum of the S-shaped function and the inverted-U function typical of replicator dynamics. Figures A.1 and A.2 provide a numerical example. A.1 depicts an S-shaped cultural diffusion process conforming to the model above, which starts in the basin of attraction $(q^{**},1]$ slightly above q^{**}.[20] A.2 shows corresponding whig publication activity P_t (which is determined up to an unknown scale factor). If c is much greater than b, which is the case for the example in A.2, then the whig publication activity curve is largely determined by the replicator dynamics.[21] As is clear in the Figure, the total and recent-convert publication activity profiles are qualitatively very similar, until the final stages of the diffusion process.

In our specific historical example of whig publications (see Figure 10) the diffusion process apparently has not come to an end by 1714. Therefore, recent converts are still largely responsible for observed publication activity and as a first approximation we can neglect the publications from non-recent converts. Hence, P_t is proportional to $(q_{t+1} - q_t)$, the per-period rate of cultural change: P_t is a proxy for incremental cultural diffusion. This factor of proportionality is unknown, but can be ignored when comparing the relative amounts of diffusion that occur in any two time periods. Thus, we phrase our interpretations in the text as referring to the amount of diffusion in a specific time period compared to the total amount of diffusion from 1559 to 1714.

[20] The parameters are B = 5, C = 6, and $\beta = 0.035$.

[21] In the numerical example, a = 0, and c is 50 times b.

References

Acemoglu, Daron, Simon Johnson, and James Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation", *American Economic Review*, December, 2001, volume 91, pp. 1369-1401.

Acemoglu, Daron and James A. Robinson. 2008. "Persistence of Power, Elites and Institutions" *American Economic Review,* 98(1), pp. 267-93.

Agirre, Eneko and Philip Edmonds (eds.) 2007. *Word Sense Disambiguation – Algorithms and Applications*. Springer

Aoki, Masahiko. 2001. *Toward a Comparative Institutional Analysis*. Boston, MA: MIT Press.

Bisin, Alberto and Verdier, Thierry. 2001. "The Economics of Cultural Transmission and the Dynamics of Preferences." *Journal of Economic Theory*, 97: 298–319.

Boehm, Christopher. 1999. *Hierarchy in the forest: The evolution of egalitarian behavior*. Cambridge, MA: Harvard University Press

Bowles, Samuel. 2004. *Microeconomics – Behavior, Institutions, and Evolution*. Princeton, NJ: Princeton University Press

Bowles, Samuel and Gintis, Herbert. 2011. *A Cooperative Species: Human Reciprocity and Its Evolution*. Princeton, NJ: Princeton University Press

Boyd, Robert and Peter J. Richerson. 2005. *Not By Genes Alone: How Culture Transformed Human Evolution*. Chicago, IL: University Of Chicago Press

Brand, Paul. 1992. *The Origins of the English Legal Profession*. Oxford, UK: Blackwell Publishers, Oxford.

Cardiff Index to Legal Abbreviations. http://www.legalabbrevs.cardiff.ac.uk/

Cavalli-Sforza, Luigi L. and Markus W. Feldman. 1981. *Cultural Transmission and Evolution: A Quantitative Approach*, Princeton, NJ: Princeton University Press.

Commonwealth Legal Information Institute. http://www.commonlii.org/uk/cases/EngR/

Daniel, William T. S. 1884. *History of the Origin of the Law Reports*. London, UK: William Clowes and Sons Limited

Doing Business. 2010. World Bank. http://www.doingbusiness.org/

Engle, R. F. and Granger, C. W. J. 1987. "Co-integration and error-correction: Representation, estimation and testing", *Econometrica* 55, 251—276.

English Short Title Catalogue. http://estc.bl.uk/

Fernandez, Raquel. 2008. “Culture and Economics." *New Palgrave Dictionary of Economics 2nd edition*. Palgrave Macmillan

Fernandez, Raquel and Alessandra Fogli. 2009. "Culture: An Empirical Investigation of Beliefs, Work, and Fertility." *American Economic Journal: Macroeconomics*. 1 (1):1 46-177.

Fisman, Raymond and Edward Miguel. 2007. "Corruption, Norms, and Legal Enforcement: Evidence from Diplomatic Parking Tickets." *Journal of Political Economy*, 115 (6): 1020-1048.

Gintis, Herbert. 2009. *Game Theory Evolving*, Princeton, NJ: Princeton University Press.

Gorodnichenko, Yuriy and Gerard Roland. 2010. "Culture, Institutions and the Wealth of Nations." NBER Working Paper.

Greif, Avner. 2006. *Institutions and the Path to the Modern Economy: Lessons from Medieval Trade.* Cambridge, UK: Cambridge University Press.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2006. “Does Culture Affect Economic Outcomes?" *The Journal of Economic Perspectives*, 20 (2): 23-48.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2008. “Long-Term Persistence.” *NBER Working Paper Series*. NBER Working Paper 14278. http://www.nber.org/papers/w14278

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2009. "Social Capital as Good Culture", *Journal of the European Economic Association,* 6 (2-3): 295–320.

Hayek, Friedrich. 1960. *The Constitution of Liberty.* Chicago, IL: University Of Chicago Press.

HeinOnline, Buffalo, NY : William S. Hein & Co.
http://www.heinonline.org/HOL/Index?collection=engrep

Henrich, Joseph. 2001. "Cultural Transmission and the Diffusion of Innovations: Adoption dynamics indicate that biased cultural transmission is the predominate force in behavioral change and much of sociocultural evolution." *American Anthropologist*, 103:992-1013.

Jackson, Matthew O., and Leeat Yariv. Forthcoming. “Diffusion, Strategic Interaction, and Social Structure.” *Handbook of Social Economics*, Elsevier

Johansen, S. 1991. "Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models", *Econometrica* 59, 1551—1580.

Johnson, Samuel. 1792. *A Dictionary of the English Language - Tenth Edition.* London, UK.

JustCite English Reports References. http://www.justcite.com/support/valid-references-english-reports-abb.html

Justis. 2010. London, UK: Justis Publishing Limited. http:// justis.com

Justis Correspondence Regnal Years – Calendar Years. http://www.justis.com/support/faq-calendar-to-regnal.aspx#1600

Klerman, Daniel and Paul Mahoney. 2005. "The Value of Judicial Independence: Evidence from Eighteenth Century England." *American Law and Economics Review* 7(1) : 1-27.

McElreath, Richard and Robert Boyd. 2007. *Mathematical Models of Social Evolution: A Guide for the Perplexed*. Chicago, IL: University of Chicago Press

Moretti, Franco. 2009. "Style, Inc. Reflections on Seven Thousand Titles (British Novels, 1740–1850)." *Critical Inquiry*, 36 (1): 134-158.

Murrell, Peter. 2009. "Design and Evolution in Institutional Development: The Insignificance of the English Bill of Rights" http://ssrn.com/abstract=1522864

North, Douglass C. 1981. *Structure and change in economic history*. New York, NY: Norton.

North, Douglas. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge.

North, Douglas and Barry Weingast. (1989) "Constitutions and Commitment: The Evolution of Public Choice in Seventeenth-Century England." *The Journal of Economic History*, 49 (4): 803-832.

Nunn, Nathan and Leonard Wantchekon. 2010. "The Slave Trade and the Origins of Mistrust in Africa." *American Economic Review*, forthcoming.

OED Online. Oxford University Press. 2010.

Pincus, Steven. 2009. *1688: The First Modern Revolution*. Yale, CN: Yale University Press.

Pincus, Steven and James Robinson. 2010. "What Really Happened During the Glorious Revolution?"

Plucknett, Theodore F. T. 1983. *Studies in English Legal History*. London, UK: The Hambledon Press.

Plucknett, Theodore F.T. "The Place of the Legal Profession in the History of English Law." in *Studies in English Legal History*. London, UK: The Hambledon Press.

Renton, Alexander W. (ed.) 1900. *English Reports.* Edinburgh, UK: William Green and Sons. London, UK Stevens & Sons Limited

Rogers, Everett. M. 2003. *Diffusion of Innovations*. New York, NY: Free Press

Roland, Gérard. 2004. "Understanding institutional change: Fast-moving and slow-moving institutions." *Studies in Comparative International Development*. 38 (4): 109-131

Tabellini, Guido. 2008a. "Institutions and Culture." *Journal of the European Economic Association*, 6 (2-3): 255-294.

Tabellini, Guido. 2008b. "The Scope of Cooperation: Values and Incentives." *Quarterly Journal of Economics.* 123 (3): 905-950.

Tarkow, Naamani. 1943. "The Significance of the Act of Settlement in the Evolution of English Democracy." *Political Science Quarterly*, 58 (4): 537-561

Trevelyan, George M. 1920. *England under the Stuarts*. London, UK: Methuen & Co. Ltd.

Soule, C. 1884. *The lawyer's reference manual of law books and citations*. Boston, MA: John Wilson & Son

Van Veechten, Veeder. 1901. "The English Reports, 1292-1865." *Harvard Law Review*, 15 (1): 1-25.

Wallace, John W. 1882. *The Reporters Arranged And Characterized With Incidental Remarks Fourth Edition*, Edinburgh, UK: Carswell & Co

Williams, Glanville L. 1940. "Addendum to the Table of English Reports." *The Cambridge Law Journal*, 7 (2): 261-264.

Winfield, Percy H. 1925. *The Chief Sources of English Legal History*. Cambridge, MA: Harvard University Press

World Governance Indicators. 2010. World Bank. http://info.worldbank.org/governance/wgi/index.asp

Young, Peyton. 2009. "Innovation Diffusion in Heterogeneous Populations: Contagion, Social Influence, and Social Learning." *American Economic Review*. 99(5): 1899–1924.