US Treaty-making with American Indians

Institutional Change and Relative Power, 1784–1911

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Abstract

Native Americans are unique among domestic actors in that their relations with the United States government involve treaty-making, with almost 600 such documents signed between the Revolutionary War and the turn of the twentieth century. We investigate the effect of constitutional changes to the treating process in 1871, by which Congress stripped the President of his ability to negotiate directly with tribes. We utilize a general bargaining framework familiar to scholars of international relations, and we construct a comprehensive new data set by digitizing all of the treaties for systematic textual analysis. Employing scaling techniques validated with word use information, we show that a single dimension characterizes the treaties as more or less 'harsh' in land and resource cession terms. We find that specific institutional changes to treaty making mechanisms had little effect on agreement outcomes. Rather it is the relative bargaining power of the United States in economic and military terms that contributes to worsening terms for Indians over the course of the nineteenth century.

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1 Introduction

Between the War of Independence and the turn of the twentieth century, approximately two million square miles of land was transferred from the sovereignty of Native Americans to that of the United States. At a rate of two square miles *per hour*, there can be little doubt that the shift in possession was both rapid and comprehensive.[1] Since the history of the United States is in large part the history of its relationship with Indian Nations, the treating process and its consequences are of profound practical concern and have thus received considerable attention from students of government, historians and legal scholars (see, e.g., Prucha 1986; Deloria and DeMallie 1999; Wilkins 2007 for an overview, and see, e.g., Johansen and Deloria 2004 for recent, treaty-specific, contributions).

While many scholars have focussed on area- and tribe-specific studies (e.g. Edmunds, 1978; McKee and Schlenker, 1980; Miller, 1991; White, 1991; St. Germain, 2001; Ethridge, 2003; Gibbon, 2003; O'Brien, 2003; Calloway, 2008), it is the effects of institutional change on the treaty-making process that is likely to be most interesting to political scientists. In particular, the successful 1871 attempt by Congress to strip the President of his right to treat with Native peoples directly. As a consequence, treating became part of a broader legislative process, involving Congressional actors with incentives and constraints potentially very different to those of the President. But while there certainly was a classification change, it is unclear to what extent there was a discontinuity in the nature of the documents themselves (Deloria and DeMallie, 1999, 249–250). Experts have been skeptical, noting a 'business as usual' continuation under alternative institutional routes and nomenclature (e.g. Wilkins, 2007, 116). Certainly any claims of 'differentness' for the nature of treating would need to contend with an alternative hypothesis that places this institutional switch in the context of a much more general growth in the relative bargaining strength of the United States over this period, not least due to its own pursuit of enabling legislation—the Indian Removal Act of 1830 being a key example (Banner, 2005, 191–227).

[1] Indeed, had the land transfer progressed unchecked at this rate to present times, the United States would contain an additional, Mexico-sized tranche of territory.

While historians and lawyers have offered detailed qualitative accounts of the 1871 change, there have been few—if any—attempts to study the universe of Native American treaty-texts from a quantitative viewpoint, utilizing statistical methods and testing technologies. This is unfortunate, but unsurprising. It is unfortunate because ignoring the wealth of treaty information that is now available has resulted in an asymmetric understanding of 'inter-national' relations for the United States: while we have garnered much systematic theoretical and empirical knowledge about treaties where *foreign* nations are concerned (see Simmons, 2000; Koremenos, 2005; Von Stein, 2005, for example), we know relatively little about those signed between *domestic* nations. This extends to our understanding of their creation, language and temporal change. This is despite a recognition by scholars that treaties signed under Article II of the Constitution are, in fact, negotiated *contracts*,[2] and a commensurately vast literature in political economy on bargaining, that could potentially provide theoretical underpinnings for our research.

It is unsurprising, in part due to technical limitations that have only recently been overcome. With around 600 treaties to be studied, it is unclear how the researcher should proceed: for reasons of cost alone, it would be preferable to work with automatic coding or classifying. But text analysis approaches in social science typically assume that we seek to uncover the ideological (spatial) position of a document's authors (see, e.g., Budge, Klingemann, Volkens, Bara, and Tanenbaum, 2001; Laver, Benoit, and Garry, 2003; Slapin and Proksch, 2008) or else classify document types with certain categories in mind (e.g. Hopkins and King, 2010). Yet none of these is a natural way to work with treaties.[3] Alternatively then, since the question of purported change alluded to concerns the practical 'difference' between types of texts, it might seem logical to utilize the myriad of document-similarity measures that are currently in existence (see, e.g., Salton, 1989, for a 'textbook' account). But such approaches essentially jettison *word-order* information which, as we explain below in more detail, we might wish to avoid losing in the case of these texts.

[2]See, e.g., Mahoney (2007) for a legalistic discussion of this position and its implications. Miller (2007) applies the same principle to Native Americans specifically.

[3]We are also not particularly concerned with the 'topics' of the treaties—see Quinn, Monroe, Colaresi, Crespin, and Radev (2010) for an overview of such methods.

We seek to rectify this theoretical and empirical deficit in the current paper. Using a new data set with the texts of almost 600 treaties and post-1871 agreements signed between 1784 and 1911, we explain the evolution of treaty making as a bargaining problem. Using (kernel) principal components we demonstrate that a single dimension does a good job of summarizing the data, and that this continuum is primarily concerned with the 'harshness' in terms of land transfer and property cession that the texts document. We show that this dimension provides evidence for a potentially detrimental 'war effect' in the sense that Indian tribes involved in conflict—all of whom were ultimately defeated—found themselves forced to accept worse terms than other nations who avoided such confrontation. While there are structural breaks in the time series of treaties, there is scant evidence that stripping the President of the ability to treat with Indian tribes represents one of them. That is, the general trend of rising American government power outweighs the effect of any specific institutional variation in 1871. More broadly, this paper demonstrates the value of text-as-data, and shows how different theories from political science and history may be contrasted and tested against each other in a systematic manner.

We proceed as follows: in Section 2 we give the substantive background for the current study, and report previous efforts of scholarship. In Section 3, we consider the treaties as contracts and posit some straightforward hypotheses arising from international relations theory concerning bargaining power in negotiations when war is an 'outside option'. In Section 4 we introduce the data, and Section 5 the methods for analyzing the texts. In Section 6 we report results consistent with a bargaining model of behavior, and comment on the evolution of treaties over time. In particular, we demonstrate that earlier treaties were generally more sympathetic to Indian interests than those signed after 1825, when the US used its increasing military, political and economic might to drive harder and harsher bargains with the tribes; so, while 1871 certainly represents a legal change, 'business as usual'—with respect to the terms Indians were compelled to accept—continued uninterrupted and throughout this period. Section 7 concludes.

2 Literature and Orientation

There are some 2.5 million Native Americans living in the present day United States (United States Census, 2000) and the US government officially recognizes 565 tribes and Alaska Native peoples (Federal Register, 2007). They are concentrated in California, Oklahoma and the south-west (United States Census, 2002). Though they constitute an ethnic minority of sorts, Native Americans are properly considered *nations* and are unique in that their relationship with the United States is in part governed by treaties (Wilkins, 2007, 45–46). Treating with Native Americans became common soon after first contact with English settlers in the early 17th Century (Williams, 1999). Implicit in these agreements was the assumption that the Indians actually *owned* the land and were thus able to trade it away (Banner, 2005). By Royal Proclamation in 1763, it was declared that only the Imperial government could *buy* land (private individuals could not do so). This was subsequently confirmed to be true for the US government also, by the Intercourse Act of 1790 and subsequent Supreme Court decisions.[4]

The history of treating making has been the subject of many accounts, some general (e.g. Prucha, 1994; Deloria and DeMallie, 1999), others dealing with particular tribes, times or treaties (e.g. Edmunds, 1978; McKee and Schlenker, 1980; Miller, 1991; White, 1991; Asher, 1999; St. Germain, 2001; Ethridge, 2003; Gibbon, 2003; O'Brien, 2003; Calloway, 2008). In terms of trends, Prucha (1994) argues, and others agree, that the end of the War of 1812 allowed a less-threatened US to assume a "position of dominance" for subsequent negotiations. Indian removal to west of the Mississippi in the post-1830 period has been especially well discussed, in part due the human suffering it entailed (see Deloria, 1985; O'Brien, 2003; Akers, 2004). Exactly what constitutes the 'universe' of treaties for analysis is debated. The most famous collection is that of Kappler (1904), though other scholars—especially Deloria and DeMallie (1999)—have disputed and extended that collection substantially. The latter forms the backdrop for our work here. To contribute to the debate on policy evolution, systematically examining and coding every treaty in a social scientific manner is the ideal way to proceed. But it is problematic—

[4]See, for example, Johnson v. M'Intosh, 21 U.S. (8 Wheat.) 543 (1823)

there are a large number, and hand-coding is likely to be unreliable and expensive.

2.1 Institutional Change in 1871

From a strictly constitutional standpoint, treaty-making with the United States began during the Revolutionary war (1778) and ended in 1868. There are thus 367 treaties with undisputed status. These were negotiated by the President, and ratified by the Senate as is required for treaties under Article II of the Constitution. In 1871, by a complex series of manoeuverings (see Deloria and DeMallie 1999, 233-238 and Gibbon 2003, 139–157), Congress removed this Presidential power.[5] After this point, ratified 'agreements' became the norm for documenting the relationship between the tribes and the government. Wilkins (2007) and others argue that this arrangement—and the self-confident Congress that came with it—ushered in an aggressive new regime of conquest and ruin for native peoples. On the other hand, some scholars have claimed that the substitute institutions were essentially identical in practical effect, if not legal detail (Banner, 2005, 252). Political scientists have long argued for the importance of studying seemingly subtle rules and their changes (e.g. Riker, 1980, 1986), so there is much cross-discipline interest in investigating the linguistic and empirical implications of the changed procedures in this case. In the next section, we this place the institutional change in a slightly more formal, bargaining context, before examining the effects—both in theory and in practice.

3 Negotiating Treaties as Contracts

Several scholars have discussed treaties as contracts (see Miller, 2007; Mahoney, 2007, for recent examples). At least since the American Revolution, treaties negotiated under Article II of the Constitution are interpreted by the Supreme Court as commitments wholly separate to legislation. Whatever their precise clauses and specifications, contracts are the products of bargaining—albeit perhaps implicitly. There is a vast literature in political economy on this topic ('textbook' accounts include Osborne and Rubinstein, 1990; Myerson, 1997; Muthoo, 1999), and scholars of international relations have been particu-

[5] Whether or not Congress had the constitutional authority to strip the President of this right is debated, though not the focus of our efforts here.

larly active in applying the insights therein to conflict between nations (see Powell, 2002 for an overview, and Fearon, 1995; Wagner, 2000; Slantchev, 2003 for examples). The basic model begins with two actors bargaining over territory, with war as an 'outside option' (Powell, 2002, 7–10). Substantively, this means that one, or perhaps both, of the parties will resort to force should bargaining end without a satisfactory mutual agreement. Typically, it is sensibly assumed that the agents have some probability of winning an ensuing conflict and that fighting such a war is costly to both of them.

3.1 Treating before 1871

In the current context, we begin by considering the situation prior to 1871; that is, the case where the President was free to negotiate with Indian nations, subject only to Senate ratification of his efforts. We can conceive of the two parties as being the United States government on the one hand, denoted G, and the various Indian nations on the other, denoted I. Of course, the latter is not a unitary actor, but for any *particular*, tribe-specific treaty negotiation it seems fair to treat them as such. In terms of the bargaining 'protocol'—the way in which offers may be made—it seems reasonable to consider the government as making 'take-it-or-leave-it' offers. Part of the justification is institutional: by the Intercourse Act of 1790, only the Federal government could purchase land (and make treaties) with Native Americans (Banner, 2005, 135). Hence, they faced little competition from alternative buyers. And, there is scant evidence of an open, alternating style of negotiation (in the sense of Rubinstein, 1982): rather, officials frequently used "force, bribery, deception and threats, among other things, to convince Indian leaders to sign land cession treaties" (Satz, 1976, 1).

We will suppose that the 'pie' of land to be negotiated is the interval $[0,1]$ which is currently in possession of the Indians. The Indians receive payoff $q = 1$ from this status quo arrangement, while the Government receives $1 - q = 0$. Ideally, the Government would like to procure the entire area, but understands that smaller requests (perhaps with specific set aside 'reservations' for the tribes) are more likely to be fulfilled. The

bargaining agreement in the treaty is denoted by the pair $(\pi, 1-\pi)$ where $\pi \in (0,1]$.[6] If the Indians refuse this suggestion, the Government then either accepts the failure to treat or attempts to clear (some portion of) the land of its inhabitants by force. If it chooses conflict, then it wins the resulting war—and *all* Indian lands—with probability p, but pays cost c_G. It loses all potential transfers of territory with probability $1-p$. Thus the expected value of conflict for the United States is

$$\begin{aligned} U_G(\text{war}) &= p(1-c_G) + (1-p)(0-c_G) \\ &= p - c_G \end{aligned} \tag{1}$$

Since the treaty offers π, the US fights if $p - c_G > \pi$. Meanwhile, the Indians agree to a peaceful transfer if their treaty payoff, which is $1-\pi$, exceeds their payoff from war:

$$\begin{aligned} U_I(\text{war}) &= p(0-c_I) + (1-p)(1-c_I) \\ &= 1 - p - c_I. \end{aligned} \tag{2}$$

Hence, the Indians fight if $1 - p - c_I > 1 - \pi$ which is equivalent to $\pi > p + c_I$.

The logic of this situation is captured in Figure 1 (a version of Powell, 2002, Figure 3). The utility of the Indians is given on the y-axis, while the US government is represented by the x-axis. At the top left, the status quo has the Indians with all their land intact. A possible treaty, at $(\pi, 1-\pi)$, is given on the contract curve, which is the solid line representing all Pareto efficient solutions which involve no conflict. For any particular value of p, if the parties can threaten war, then the solution changes. Begin, for example, at $W(p)$ which lies on the broken line, parallel to the Pareto frontier, representing the payoffs to a war. This must necessarily be to the left of the contract curve because some costs must be paid to fight—reducing the size of the pie to be divided. The payoff for the Indians in this circumstance has been markedly reduced: from $1-\pi$ to $1-p-c_I$. The best they can do is accept a much harsher government treaty (denoted 'Treaty (war, p)'),

[6] To keep matters simple, we will assume players are risk neutral; alternative assumptions result in essentially similar dynamics to the one presented here, albeit war is more or less likely (instead of a *given* negotiated settlement).

which leaves the US indifferent as regards going to war. Suppose now that p increases to p', implying that the US is more powerful (and hence more likely to win conflicts should it choose to fight). Clearly, this will push the bargaining solution increasingly south and east (into the shaded area); the result is $W(p')$ in war or rather, the US is able to impose the treaty on the frontier at that point. Decreasing costs of war (for either side) pushes the outcome back towards the frontier as denoted by the broken arrow parallel to the x-axis.

[Figure 1 about here.]

3.2 Implications of Institutional Change

What might we expect from the constitutional change of 1871, wherein *Presidential* treaties were effectively prohibited? Recall that the moving parts of the bargaining model are the benefit derived from land acquisition, the probability of wining a war (p), the cost of such a war (c_G) and the treaty offer π. In the aggregate, we might expect none of these things to change simply due the new institutional arrangement. On the other hand, there is an important asymmetry that may now emerge. Given Congressmen (especially those from particular states, such as California (see Deloria and DeMallie, 1999, 745)) had much to gain for a more 'robust' stance towards the Indians, since white settlers in their states were keen to prise the resident tribes away from land that might otherwise be used by whites. Meanwhile the costs of any war were not borne particularly by their constituents, but by the United States as a whole. That is, the benefits of more a aggressive policy are concentrated, while the costs are diffuse. In this way, agreements with Indians after 1871 can be seen as just another example of particularistic legislation subject to all the usual pork-barrel incentives: Congressmen can now log-roll to achieve mutually beneficial trades (Weingast, 1979; Weingast, Shepsle, and Johnsen, 1981), while ensuring universally worse outcomes for Indians themselves.

While the new institutional arrangement suggests a relatively clean 'break point' in harshness terms, a more gradual worsening of terms might be seen via changes in the probability of a United States victory. Scholars have argued explicitly, for example, that the increasing military and industrial might of the United States made enforcing

'harsher' deals easier as time went on (p increased); using qualitative methods, Keohane (1996, Ch4: 5–6), talks of a "power relationship" between settlers and Indians that had "fundamentally changed" by the middle of the Nineteenth century, not least due to overwhelming differences in population size. Satz (1976, 6) argues that a Presidential intent to forcibly move the Indians was a constant since the founding of the Republic, but that by the 1820s the *costs* of such a threat—should it have been realized—became easier to bear as public and intellectual opinion shifted (a decreasing c_G in the discussion above).

In some senses, these are competing theories worthy of investigation: on the one hand, we have sudden institutional variation, and on the other we have a more general trending variable. We now discuss the relevant data and methods, before opining on the plausibility of each account.

4 Data

Our universe of treaties and agreements are those signed between Indians and the United States government between the end of the Revolutionary War and 1911. This means our data is a proper subset of that reported by Deloria and DeMallie (1999) for these two sets of actors but, in practice, the differences are very slight.[7] First, we do not include those few treaties signed with the United States before it had won the war since, up to that point, its authority over its territory was still in some doubt. Hence, our data begins in 1784. Second, we do not include a final document signed sometime after all the others (i.e. 1911) in the data—in particular, we drop the 1954 agreement with the Cheyenne River Sioux. Third, we drop some 'miscellaneous' treaties that appear as (a) 'additional ratified treaties' (Deloria and DeMallie, 1999, 204) which are absent from Kappler (1904) and not included in the State Department files and (b) some so-called 'Conventions' with the Indians (Deloria and DeMallie, 1999, 253), signed between 1825 and 1836. Our plan is thus to steer a 'middle way' in data terms: using the Deloria and DeMallie (1999) corrections to the gross errors of Kappler (1904), while staying

[7]Note that Indian tribes occasionally signed treaties with foreign nations and also non-governmental actors like railway companies. These relationships are not our focus here.

true to the general use of the terms 'treaty' and 'agreement' in the literature.[8] All told, we have 595 documents of interest—all scanned or rewritten as plain text files (UTF-8)—which may broken down into several *legal* categories. First, there are those which are 'Valid and operable' (365 texts): beginning after the Revolution with the Treaty of Fort Stanwix of 1784 signed with the six nations, and ending with a Treaty signed with the Nez Perce in 1868, these treaties have been ratified under Article II. Second, 'Ratified Agreements' (77): these documents originate in 1871 after the purported 'end' of treaty-making and were ratified in *statute* form. Third, 'Rejected by Congress' (85): this class of documents exemplifies the 'broken' treaties in the sense that this term is used to refer to deals that were particularly cavalier regarding Indian rights (Deloria and DeMallie, 1999, 745), and is the sum total of those that were submitted to the Senate, but not ratified. Finally, 'Unratified Treaties' (68): this class of documents includes all the treaties signed before 1868 (and thus potentially includable in the first category above) yet never submitted for Senate ratification in the usual way. As noted earlier, we wish to know how these legal groups differ in practice, and over time.

5 Modeling Indian Treaty Texts

We contend that treaties are contracts; to the extent that they deal with land transfers, they can be viewed as points on the contract curve given in Figure 1. Further examining this substantive speculation requires that we identify the empirical number and meaning of the 'dimensions' of the texts (if any exist).[9] Thus, the first task here is to scale the documents onto some continuum (or set of continua) before more detailed inspection. In order to remain *a priori* agnostic about the actual nature of the dimensions,[10] an 'unsupervised' approach seems reasonable. That is, we will not proceed by assuming a particular treaty (or subset of treaties) is an example of a specific prior-defined

[8]We edit out the lists of signatories—some of which run to several pages—while preserving all other content of the treaties and agreements.

[9]Note that the goal is not to uncover the 'ideal points' of the document authors: (1) we assume that 'bliss points' are maximal in the sense that the parties always want 'more' Indian land and (2) the texts are *jointly* produced by the parties. This means that techniques such as those introduced by Slapin and Proksch (2008) are not quite appropriate here.

[10]We would proceed differently if we knew *a priori* that particular words or phrases signified public positions on some predefined dimension(s)—see Lowe, Benoit, Mikhaylov, and Laver (forthcoming) for a discussion of this idea in the context of manifestos.

phenomenon of interest; rather we will interpret the scaling after it is created by the algorithm at hand.[11]

A very common approach to analyzing texts in this way begins by creating a 'term document matrix' (TDM) which simply records a count, or proportion, or binary presence, of each word (the TDM columns) in a given document (the TDM rows). Typically there is some preprocessing: popular operations include 'stemming'—erasing word suffixes to obtain the 'root' of the word—and the removal of 'stop' words. The latter are tokens that appear in high frequencies in many documents and thus their presence conveys little information (e.g. 'the', 'to', 'and'). A helpful consequence of such operations is that the number of relevant features is reduced to more manageable dimensions. We might then factorize this matrix down to its 'key' components before describing and interpreting the positions of the observations (the documents) relative to one another. For our particular case, however, working with TDMs may not be ideal. In particular, any information about word *order* is essentially jettisoned. That is, from the perspective of a 'stopped' TDM—one in which commonly occurring words thought not to discriminate between texts are dropped—a document consisting of the the phrase "no peace between us" is identical to one constructed of the term "peace between us".

One way to preserve word order is to use 'string kernels' in the sense of Lodhi, Saunders, Shawe-Taylor, Christianini, and Watkins (2002). As a running example, suppose our document was the single word '`apartment`'. A *substring* of 'apartment' is an ordered, contiguous subset of its letters (of length at least 1), so 'part', 'par', 'art', 'me' and 'men' would all be examples—as would 'p', 'ar', 'rtm' and 'tme' though they are not actual words. We say that the p-spectrum of a document is simply the frequency distribution of the substrings of length p within it. The inner product of two documents d_1 and d_2 is then just the number of p-length substrings they have in common. An example is instructive: let the first document be `apartment` and the second be `treatment, part 1`. These documents have three 4-strings— `part`, `ment` and `tmen`—in common. Thus

[11] This caution is simply an acknowledgement that, in fact, we might be wrong: the uncovered dimension(s) may have no relation to the suggested contract curve.

$\kappa(d_1, d_2) = 3$, which is then normalized to account for differing document lengths. The idea is that similarly consecutive characters are an important component of document nearness: texts that share 'war ends' will be closer in space than two which contain 'war ends' and 'ends war' respectively. Thus, word order information is included in the metric.[12] Once all the inner products of all the document pairs in the corpus have been calculated, we have the 'kernel matrix' and scaling can begin. In practice, we use kernel PCA (Scholkopf, Smola, and Muller, 1998) for this last stage, which projects the observations via principal components of the data which are themselves possibly *non*-linearly related to the original variables. To implement kernel PCA for our string kernels, we utilized `kernlab` (Karatzoglou, Smola, Hornik, and Zeileis, 2004) for the `R` language and environment (R Development Core Team, 2009), and our choice of string length was 5 for what follows.[13]

6 Results

The first requirement is to investigate model fit. That is, to determine the number of dimensions that best describe the texts at hand. In Figure 2 we plot the eigenvalues—a measure of variance explained—for a ten (principal) component fit. The scree test (Figure 2) does not show an obvious 'elbow', suggesting there is some variation of substantive interest in a fitted model of up to seven dimensions. Nonetheless, the drop off in fit after the first component is considerable, and we focus on that 'main' dimension in what follows.[14]

[Figure 2 about here.]

[12] See Schütze (1993) for a slightly different justification of this approach. There are more traditional techniques for including word order information, often via bi-grams or tri-grams in a naive Bayesian model (see Manning and Schutze, 1999, 191-224, for an overview). From a classification point of view, the results of implementing these methods have been mixed, at best: indeed, one of the few cases of performance improvement has occurred when such methods have been merged with variants of string kernel measures (see Bekkerman and Allan, 2004, 3–5).

[13] Note that, in English language applications, string lengths between 4 and 7 prove optimal for classification purposes (Lodhi, Saunders, Shawe-Taylor, Christianini, and Watkins, 2002) and there is little practical difference to to the results as this parameter is varied.

[14] Investigation of other dimensions, suggests that they are variants on the first, albeit focussing on different locales and times. For example, the second dimension deals primarily with variation among tribes from the Old Northwest (from Indiana and along the Missouri River), though the overarching 'harshness' differences described below appear to hold here too.

Determining what the uncovered dimension 'represents' substantively is not a trivial task. Here, we proceed by treating the derived scaling as a continuous outcome to be to be predicted by the various frequencies of the words in the documents. The goal is to discover what *types* of words, and what types of phrases, appear to be associated with the relative position of the texts on the unit interval. For now, we focus on the 442 treaties which were ratified under Article II, and thus had a direct impact on Indian welfare in and of themselves. Specifically, our approach is as follows: first, we construct a stemmed (in the sense that different variants of the same word are grouped together) term document matrix $\boldsymbol{M}$ with 'stop' words and punctuation removed.[15] Each cell is calculated as the term frequency–inverse document frequency (tf-idf) of the word. Recall that this measure is increasing with the frequency with which a particular word is used in a treaty, but then down-weighted according the frequency of its use in all the treaties put together. We then remove 'sparse' terms that appear in fewer than ten percent of the documents (leaving a total of 608 individual stems). We take the transpose of $\boldsymbol{M}$, denoted $\boldsymbol{X}$, as a model matrix in the sense that each row corresponds to a treaty and each column a different stem. We perform a (linear) detrending of the scale, to ensure that localized (in time terms) shifts in language can be properly accounted for.[16] Finally, we 'regress' the one dimensional detrended scale Y on $\boldsymbol{X}$ using a 'random forest' (in the sense of Breiman, 2001) machine learning algorithm. The advantage to using the random forest procedure—as opposed to more conventional approaches—is that we can obtain a measure of variable importance despite the fact that the number of columns of $\boldsymbol{X}$ (stems) far exceeds the number of observations (treaties).[17] Figure 3 reports the thirty-five most important stems for our data. As can be seen there, the stems `land`, `tract` and `reserv` are apparently helpful for discriminating the treaties' scaled locations, as are the terms `relinquish` `friendship`, `dollar`, `boundari` and `mutual`.

[15] In principle, one could study the underlying 5-strings directly but two problems emerge: (1) to speed up the process of working with string kernels, dynamic programming is used and the strings themselves are not 'remembered' for the purposes of latter discrimination; (2) even if they were, it is not obvious they would be helpful. For example, an important string might be `ll_re` which is not easily identified as having been derived from `will remove`.

[16] In practice, detrending makes little difference here, but it avoids the attribution of sentiment variation to longer term trends affecting all treaties regardless of their nature.

[17] The metric itself is based on the increase in mean square error in predicting $\boldsymbol{Y}$ when that particular stem is permuted.

[Figure 3 about here.]

To ease the interpretation of this plot, Table 1 reports these important stems and the most common way that they actually appear as words, and in frequent contexts, in the treaties. We sort the entries by the correlation between the frequency (the tf-idf) of the stem and the treaties' positions on the scaled interval. Thus, for example, the stem 'boundari' appears most commonly as the word 'boundary' and in the sentence fragment "the tract of land included within the following boundaries".

[Table 1 about here.]

Studying the table and the correlations, it seems that conciliatory language—speaking of 'friendship', 'peace' and 'mutually'—is associated with more positive values on the treaty scale. By contrast, talk of 'land' 'cession', the need to 'relinquish' property and 'reservations' are correlated with low values on the treaty scale. The latter set of terms are surely indicative of more aggressive treaty-writing relative to the agreeable tone of the former. This result is not an artifact of the restricted sample; though we do not report them here, the direction of the correlations for the words in Table 1 for the full data set (thus including ratified agreements, rejected treaties and those that were never submitted) is as previously: words pertaining to consent and mutualism are associated with higher (detrended) scale scores, while words dealing with land deals, removal and the surrendering of rights are associated with lower scores.

To see this variation in practice, consider Figure 4. Here, we plot the re-scaled positions of each document in our data set, over time. The term 're-scaled' in the context simply means that the original kernel PCA (one dimensional) scores are compressed on a zero–one interval, with no loss of generality. The date for each is as given by Deloria and DeMallie (1999), and corresponds to the *signing*—not necessarily the ratification—of the treaty in question. As noted in the plot legend, [green] circles are valid treaties and agreements, i.e. the first two parts of the data set as discussed in Section 4, while [red] triangles are 'rejected' treaties, and [purple] squares are those that were never submitted for ratification. The broken black line demarcates the purported 'end' of treaty making

after which, as readers can readily see, most of treaties are scaled below the 0.5 point on the y-axis. The solid, undulating black line moving left to right is simply a weighted moving average (a lowess) of the scaled points, to give a sense of the general movement over time. More formally, a (non-parametric) Spearman rank correlation test yields a $\rho = -0.67$ ($p < 0.01$) for the time series, suggesting that the data are indeed generally declining in value over time. If we accept that this scale represents a declining bargaining advantage for the Indians—as we argued above—we thus have *primae facie* evidence that the treaties impose harsher, resource-transfer conditions over time.

[Figure 4 about here.]

With some evidence that the measurement strategy is valid, we will turn to the question of institutional change in 1871 momentarily. Before doing so, we examine another empirical implication of the bargaining framework which should help to shed light on the merits of our strategy here.

6.1 War and Peace and Treaty Making

Our work in Section 3 was predicated on a simple dynamic: the threat of defeat in war is sufficient to encourage parties (specifically Indians) to settle for disadvantageous treaty terms. Strictly speaking then, we should not observe wars in this context since both sides should come to an agreement of some sort short of battle(see Fearon, 1995, on this point). However, the long series of sometimes bloody conflicts known as the 'Indian Wars' suggest that, in practice, other mechanics were at work. Though this is outside the model above, there are still predictions stemming from the general set-up of the bargaining situation. In particular, we would imagine that losing wars leaves Indians worse in subsequent treaty terms since it makes any threat to defeat the United States much more dubious than previously. By exploring whether or not that was indeed the case in terms of the 'main' dimension of treaties above, we can comment further on the reasonableness of bargaining as a structure for understanding US-Indian relations.

Before embarking on this effort in more depth, two issues are worthy of note. First, only some of the Indian wars involved pitched battles, ascribable combatants, identifiable outcomes and obvious start and finish dates. In this way, those cases are similar to

the interstate conflicts studied by students of international relations. An example would be Red Cloud's War (1865–1868) in which the Lakota, Northern Cheyenne and others were able to defeat US government forces and obtain a relatively favorable outcome in post-war negotiation. Conversely, the Third Seminole War (1855–1858), involved very small numbers of Indian warriors (perhaps no more than 200 men) with the conflict itself little more than sporadic raiding attacks on Florida settlers, followed by US state militia attempts to capture the rebel tribe members. Second, related to this contrast, the extent to which we have a 'paper trail' of treaties pertaining to the resolution of the conflicts is very variable: for example, the peace terms of Red Cloud's War are located in the Treaty of Fort Laramie (1868), but we have no similar physical documentation for the Modoc War (1872–1873), Snake War (1866–1868) or the various Seminole campaigns.

With above inconsistencies in mind, we proceed as follows. We use Axelrod's (1993) *Chronicle of the Indian Wars* to define the universe of cases of wars between Indians and the United States, including (approximate) beginning and end dates. For each (primary) tribe involved in a (at least one) war we calculate their 'pre-war' score as the mean of the scaled treaties to which they were signatories before the onset of the (last) conflict they were parties to. We calculate their 'post-war' score as the scaled treaty to which they were signatories after the (last) conflict they were parties to. Our 'control group' are those tribes who are never involved in war. For any given war onset, we take the mean of the control group's treaties in the four years preceding that date as the control 'pre-war' measurement. Conversely, the control 'post-war' measurement is the average treaty scores for these tribes in the succeeding three years after the conflict ends.[18]

The essence of this scheme is that we have a (mean) difference in treaty scores for tribes involved in wars, and a (mean) difference for nations that were never at war. For example, the Shawnees had a pre-war average of 0.561 (on the zero–one interval), which decreased to 0.192 after their conflicts. By contrast, in the rest of contemporaneous sample, the mean for this period began at 0.541, and actually increased to 0.803. In general,

[18]The asymmetry—four year pre, and then three years post—is due to the fact that three years before the date of war onset is not sufficient to include any treaties for some conflicts. For example, the four years before the Creek Civil War in 1813 saw no treaties signed with non-warring tribes.

tribes involved in wars were worse off after they fought than contemporaneously treating tribes that were not directly involved in conflict. This pattern becomes more obvious in Figure 5, where we plot the treaty scores either side of a tribal war (for those cases where the tribes actually signed treaties both sides). Broadly, we see that the tribes fighting wars (the solid [red] lines) find themselves worse off in the post-war period relative to the way they began them (the solid lines slope downwards). When war is associated with a period of welfare improvement, as in the case of the Potawatomi or the Creek, non-warring tribes see their own welfare improve more over the same period. Finally, when non-war tribes see their welfare decreasing—as is the case when compared to the Apache or Cheyenne—it is worth noting that their treaties become harsher at a slower *rate* than those fighting wars in the same periods. The mean difference in differences is statistically significant ($p < 0.05$) via a t-test, and a Wilcoxon signed rank test yields congruent results ($p < 0.05$). In short then, defeat in war is associated with more deleterious treaty terms for Indians. This is consistent with our theory in Section 3: after defeat, the Indians are weaker and must accept the pernicious treaty demands that subsequently arise.

[Figure 5 about here.]

Having now established further validity of our construction and interpretation of the 'main' dimension, we now return to the main theme of the paper. In particular, we want to know whether the removal of the right to treat by the President affected the qualitative nature of the subsequent agreements that emerged in bargaining terms, and how that fits within a general historical trajectory of increasing (relative) US military power.

6.2 The 'differentness' of the agreements

Are the post-1871 agreements 'different' from the treaties that preceding them? One way to investigate this notion is simply to compare the distribution (or the relevant moments of that distribution) for the rejected treaties relative to the others. With Figure 4 in mind however, a straightforward problem emerges: by definition, the agreements were much later than the the treaties. If we believe there is some *general* time trend—as

the previous subsection contends—then a comparison of this type may be inappropriate. In short, it will assign a difference to a agreements when, in fact, the difference is an aggregate one affecting all documents signed later (wherein it so happens that there are only agreements). Indeed, the scaled locations of the valid treaties and ratified agreements certainly differ ($p < 0.01$) according to a t-test (alternative hypothesis being inequality of means), a Wilcoxon signed ranked test (alternative: true location shift not zero) and a Kolmogorov-Smirnov test (alternative being two sided). In order to compare like with like then, we first detrend the data. That is, we re-represent each scaled treaty as a deviation from the linear regression mean at that point. For this detrended data, we cannot reject the null that the treaties and agreements are similar; to the extent that we take general shifts over time into account, there is not linguistic evidence of an 'end' to treaty-making in 1871. This is *primae facie* evidence against the notion of a 'sudden' change to terms due to the constitutional developments of 1871; we return to this notion with more precise tests in the section below.

In passing, we also examined the proposed 'differentness' of the treaties rejected by Congress (which might be described as 'broken' in nature). To deal with this question, we first detrend the time series as above. Second, we 'match' each rejected treaty with the closest (in date terms) non-rejected one and compare the vector of scales for these two groups. Thus, the rejected Wabash treaty signed on September 27, 1792 is paired with the valid and operable Cherokee treaty signed six months earlier. Meanwhile, the rejected treaty signed with the Creeks in January 1899 is paired with the ratified agreement signed with the Crow in June of the same year. In every case, we can reject the null ($p < 0.05$) that, in fact, the rejected treaties are the dissimilar to those that were not rejected. In short, we find no evidence of the rejected treaties being different in linguistic terms than those signed in contemporary periods.

6.3 Change Points: Indian Removal, Reservation System, Civil War

To explore the evolution of treaties a little more, we consider possible 'change points' in the time series of treaties (see Greene, 2002, 116–147, for an overview). If the institutional developments of 1871 represent a new fate for Indians, we ought to see that time

identified as a noticeable break in the data.

Since every document has a single associated score on a continuum, we treat the data generating process as continuous and consider possible instability of coefficients in a classical linear regression sense. Using the method derived by Bai and Perron (2003), implemented by Zeileis, Leisch, Hornik, and Kleiber (2002), the best fitting model (selected via BIC) has three breaks.[19] These change points correspond to observations in 1825, 1853 and 1866. In Table 6 we plot the break points, and moving average lines for each (resulting) segment. Notice that, in every case, the mean scale of the treaties is falling. Pre-1825 it is around 0.6, but by the last period (post-1866), it is just 0.224 on average.

From an *empirical* perspective, it seems plausible that the first break corresponds to the events leading up to the Indian Removal Act of 1830. Although well-known, the Act is often misrepresented as providing authority for the President to remove tribes to west of the Mississippi. In fact, that power was not new; the key to this legislation is that it provided specific financial assistance for the movement (Banner, 2005, 217). Either way though, scholars have certainly seen this period as a shift in US treatment of Indians—after which policy became more aggressive and the benefits from land deals were increasingly one-sided (e.g. Deloria, 1985). Satz (1976, 1–6,14–18) argues that, for President Jackson, war with the Indian nations, should it have been required, was much less *politically* costly than for his predecessors, not least due to the efforts of Thomas L. McKenney who was charged with the task of swaying public opinion. Furthermore, recall that our discussion in Section 3 requires the government to make credible threats that it might win a conflict (i.e. the Indians must believe that p is sufficiently large to acquiesce to a 'harsh' treaty). In the decade succeeding this break, the US defeated Indian tribes in the Old Northwest (including those lead by Tecumseh and Black Hawk), the deep south (the Creek War) and the south-east (First Seminole War).[20] In view of

[19] For purposes of fitting, the (default of) a minimum segment size of 15% of the original time series is used.

[20] Indeed, the First Seminole War had personally involved Jackson as a commander.

this threat of force from the United States, Indians were increasingly unable to resist pernicious treaties that offered the government much but the tribes very little.[21]

The period immediately preceding the Civil War sees a drop off in treaty generosity. In terms of specific 'causes', Keohane (1996) discusses the explosion in the US population around this time, and the insatiable search for western lands. As part of this expansion, the 1850s corresponds with a new way of 'doing business' for the US: specifically, the start of the 'Reservation System' (Trennert, 1975) wherein the government both purchased land as it had long done, but then, in addition, carved out a particular parcel within that expanse in which the Indians were expected to live. Exactly why the federal government chose this course of action is the subject of some debate, but part of the argument appears to be humanitarian in nature; it was thought that reservation would offer a safe haven as far afield as possible from rapacious frontiersmen, while Indians would also be more secure in their property and more likely to take on white cultural norms (Banner, 2005, 232–233). The final slump in treaty terms comes after the Civil War as the United States could, once again, turn its attention to the 'Indian question.' In particular, this period sees the beginning and then intensification of military efforts against the Sioux of the Black Hills: the mean treaty value falls from 0.37 down to 0.22.

[Figure 6 about here.]

All told, we do not see an 1871-specific break. This is consistent with our claims regarding the lack of 'differentness' of these agreements in the section above. Otherwise put: the story about the varying relative power of the US seems to fit better with our data than the notion of institutional change as a driver of treating relations.

Figure 7 considers the break points in a slightly different way: here the solid line contract curve from the top left to the bottom right of the plot once again represents the a range of possible treaties: from most sympathetic to Indian interests down to the most deleterious—and thus advantageous for the US government. Each black circle on the

[21] As Prucha (1994, 182) describes, the Indians of the south-east " had been forced into treaties they did not want, treaties whose validity they denied but which were adamantly enforced by the government."

line represents the average scaled score for treaties in a particular period. Note that the intercept of the Pareto frontier with the y-axis would denote a period in which all treaties signed were the best possible for the Indians in relative terms, while the intercept with the x-axis denotes a time in which all are the worst possible from a tribal point of view. The four periods are as identified by our break points. In passing, it is worth noting that Prucha's (1994) hypothesis of a break around 1812 in treaty terms is partly supported by our data. It is certainly true that, on average, treaties are worse for Indians after the 1812-1815 war, though that event does not (of itself) appear to be a break date. In practice, the surge in treaty scores around that time in part results from a series of hurried 'peace' treaties between the US and friendly tribes (such as the Wyandots and Delawares) in an attempt to ally against the British. Logically, this was when those Indians were at their most powerful in terms of bargaining.

[Figure 7 about here.]

7 Discussion

Native American treaties and agreements signed with United States government provide an extraordinarily detailed record of the developing relationship between a rising superpower and a people that now suffer from disproportionate social deprivation and lack of opportunities. This is of interest to political scientists, historians, lawyers and public policy makers, and it is surely difficult to gainsay the profound practical consequence of this collection of documents. Here, for the first time, we took the universe of almost 600 observations of these texts and subjected them to systematic statistical analysis. Our primary concern was to investigate the consequences of an institutional change in 1871, by which the President was stripped of the right to treat by an exigent Congress. By extracting a 'main' dimension of treaty making, we found strong evidence—statistical and substantive—that treaties became harsher over time, though it was not obvious that the 1871 alteration in bargaining rights made much difference of itself. Instead, we noted that the mid-1820s, and then the middle years of the 19th Century correspond to a marked shift in the nature of treaty making. We showed how this behavior corresponds to our theoretical priors about bargaining between parties as circumstances change: as

the US became more powerful in the middle of the Nineteenth Century it was able to drive harsher bargains with enervated tribes. As an aside, we found little evidence that the 'broken' treaties form their own distinct group in the data. We also showed that war was associated with deleterious treaty outcomes for Indians: this may well be because the US felt morally and militarily able to impose harsher terms *ex post*. More generally, this paper showed the usefulness of utilizing texts as data: systematic inferences may be made that allow for the testing of theories from different fields.

To derive our results, we used kernel methods that allow scholars to take word-order information into account when looking for patterns in textual data. International treaties would be an interesting area to extend this analysis: for example, how has the language in treaties between the United States and Russia, and between the United States and China changed over time? And does it correspond to the relative power of the parties during these periods? In that application, of course, countries are not typically bargaining over land as were the Indians and the US government. Nonetheless, one could certainly assess the dimensionality of the texts via the scree plot technique mentioned above, and then interpret their nature using the TDM in the way discussed in Section 6.

Doubtless, there is much work left to do on Indian treaties. If the 'broken' treaties are not obviously different, then a more subtle model and story is required: understanding why certain members of Congress chose not to ratify is certainly of interest. Fortunately, we have good data on their roll call decisions, and so future efforts might profitably consider their motivations and actions. In addition, now that the treaties are digitized and fully machine readable, further content analysis is possible: it might be particularly interesting to examine the precise parameters of the land (and other deals) offered by the parties to get a better sense of the evolving economics of contracts between the US and Indian tribes. In this way, the treaties represent an intriguing testing ground for theories of bargaining discussed and extended in the burgeoning literatures of economics and international relations.

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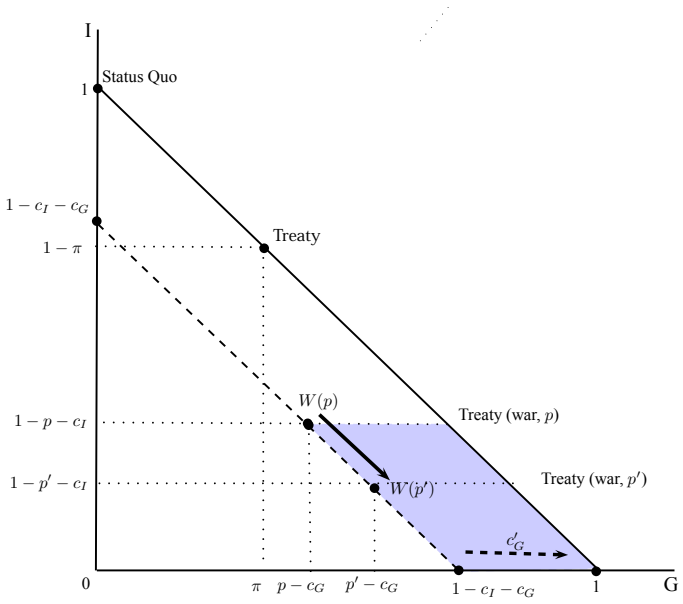

Figure 1: Indian tribes and US Government bargaining over treaties. Note that an increase in the power of the United States and/or a decline in its cost of fighting a war moves bargaining outcomes south and east from the status quo. This implies the Indians are increasingly compelled to accept worse treaties, rather than enter wars.

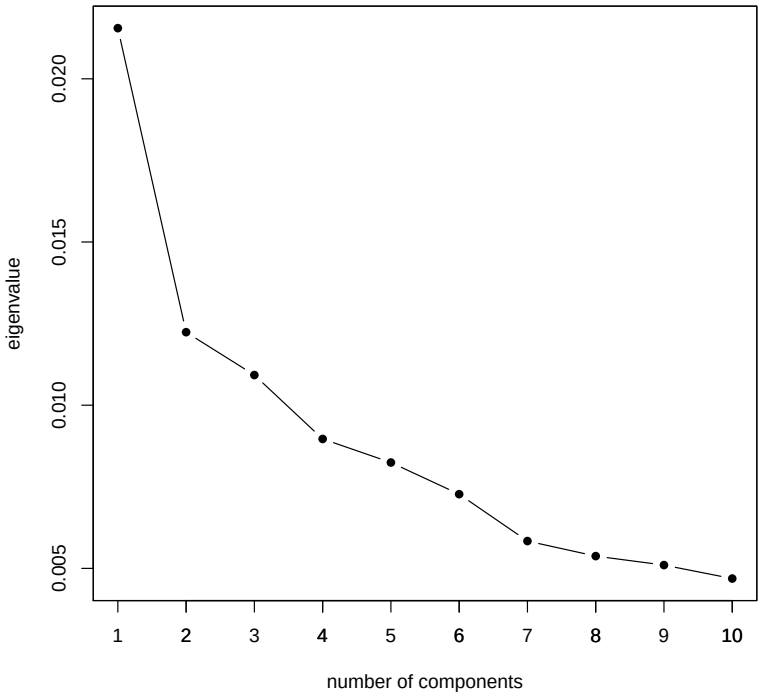

Figure 2: Model fit: eigenvalues for 1 through 10 (kernel) principal components

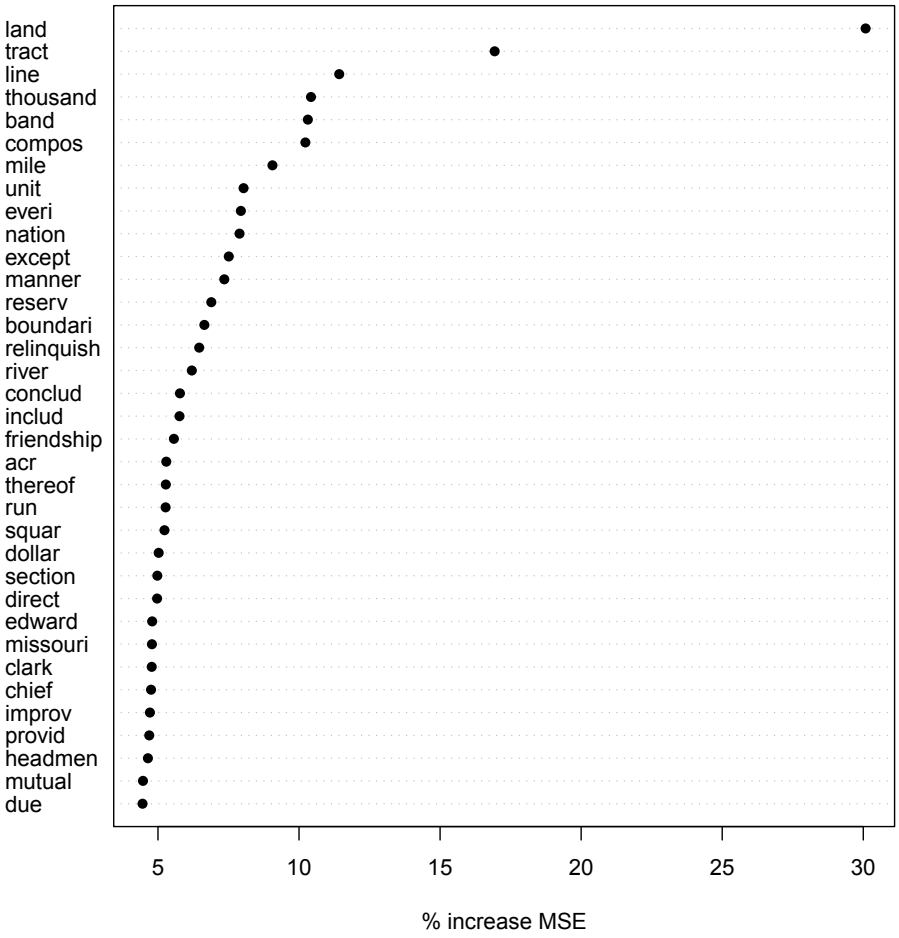

Figure 3: Thirty five 'most important' stems for predicting operable treaty scaling.

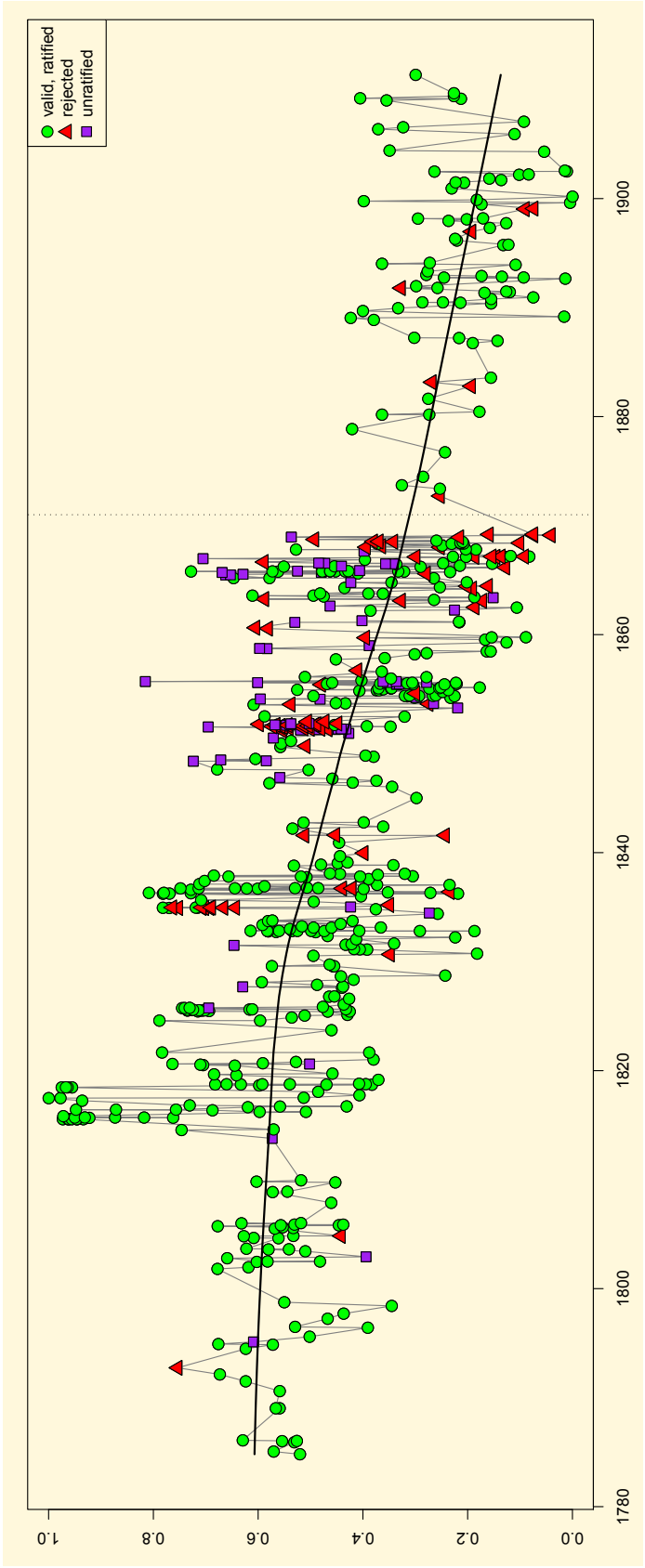

Figure 4: Scaled location of all treaties, by year of signing. Treaties and agreements that are 'valid' are [green] circles, rejected treaties are [red] triangles, treaties that were never submitted and thus unratified are [purple] squares. Broken line corresponds to 1871 and purported 'end' of treaty-making.

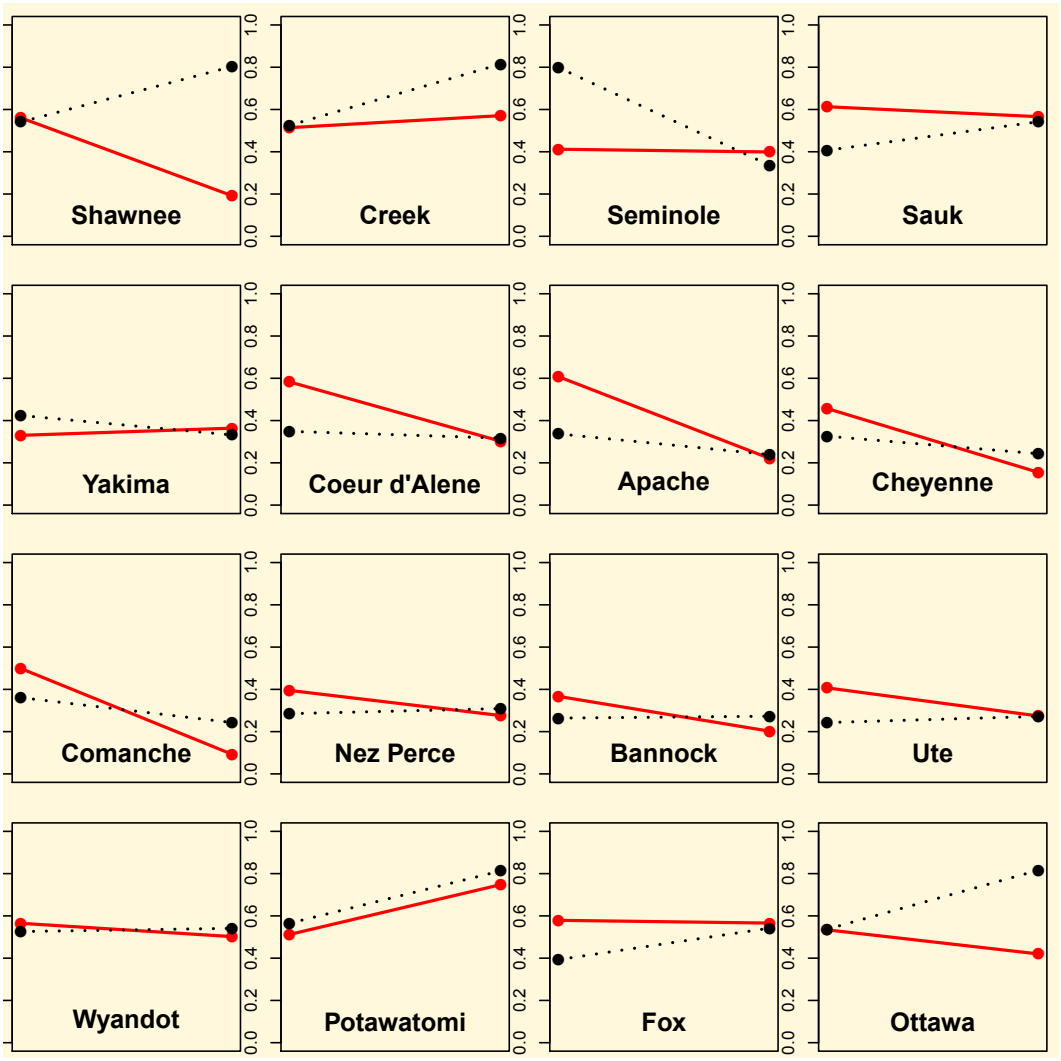

Figure 5: Pre- and post-war treaties, for (complete) cases. The y-axis in every case is the zero–one interval. Solid [red] line connects mean score for war tribe treaties, either side of war. Broken [black] line connects mean score for non-war tribe treaties, either side of war.

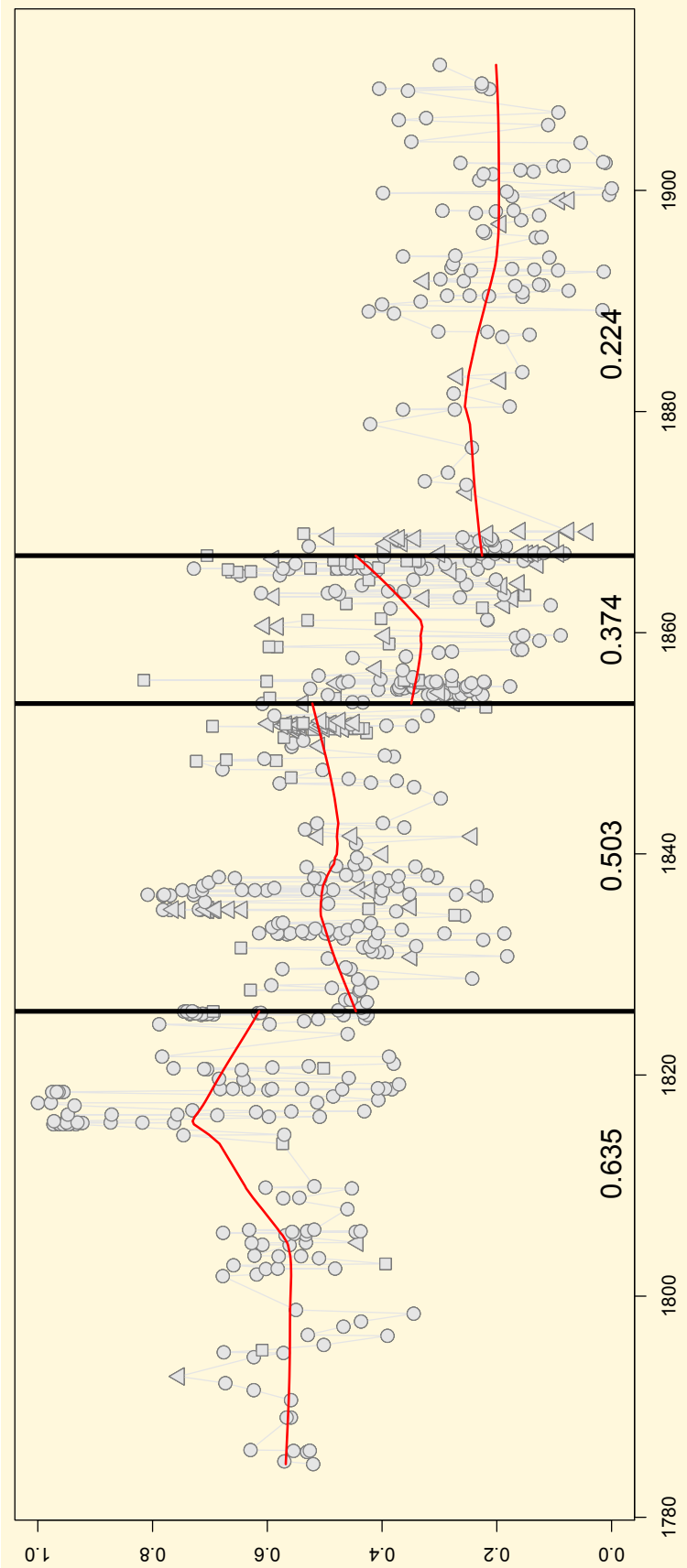

Figure 6: Breakpoints in treaty making. Thick, black vertical lines are segments implied by Bai and Perron test. Means of segments (in terms of pca scale) are text at bottom of segment. The [red] lines descending left to right are lowess moving averages for specific segments.

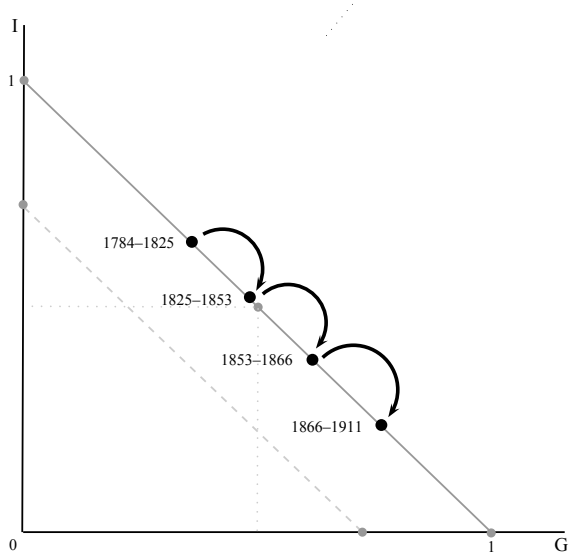

Figure 7: Changing relative power of US and Indian tribes when bargaining over treaties: points on contract curve represent (to scale) mean treaty scale score for that time period.

stem	most frequent use	common phrasing (frequency)	correlation
friendship	friendship	“A treaty of peace and friendship," (16)	0.504
mutual	mutually	“shall be mutually forgiven and forgot" (19)	0.255
peac	peace	“A treaty of peace and friendship" (15)	0.179
cession	cession	“In consideration of the foregoing cession" (15)	-0.205
relinquish	relinquish	“cede and relinquish to the United States" (4)	-0.208
boundari	boundary	“the tract of land included within the following boundaries" (4)	-0.214
tract	tract	“One tract," (14)	-0.442
dollar	dollars	“forty dollars" (11)	-0.457
land	lands	“one section of land" (29)	-0.567
reserv	reservation	“one other reservation" (5)	-0.622

Table 1: Some ‘important’ stems and their use in the valid and operable treaties.