Supplemental Appendix

The following are the Supplemental Materials referenced in the manuscript *Measuring Judicial Ideology Through Text*. Replication materials will be provided upon request and will be deposited to the `Harvard Dataverse` upon acceptance and publication.[27]

Data Overview

Our data incorporates written opinions (Majority, Concurrences, and Dissents) in non-unanimous cases decided between the Court's 2005 and 2022 terms. Our choice of observation period was two-fold. First, given the broad consensus that the Roberts Court (2005-present) represents a period dominated by seminal rulings that often draw on ideologically divergent coalitions, we anticipated a rich volume of observational data. Second, while we recognize that we are omitting the most recent term (OT2023), much of our ability to demonstrate reliability and robustness required direct comparisons with the ideal points estimated by Martin and Quinn (2002). Notwithstanding the robustness and potential for our amended `Wordshoal` methodology, we recognize that Martin and Quinn (2002) – much like DW-Nominate (Poole and Rosenthal, 1985, 1997; Poole, 2007) – still assumes prominent status as the figurative gold standard of representing the liberalism of Supreme Court Justices. However, their most recent updates lapse with the 2022 term (as of January 2025). Given such, we made the conscious choice to ensure complete overlap between our analysis of the Roberts Court and the extent of comparable analyses using Martin-Quinn.

Data Collection

Opinions authored by Justices between the Court's 2005 and 2022 terms were retrieved principally from mining Justia – a legal repository service offering "free case law, codes, opinion summaries, and other basic legal texts," including opinions by the United States Supreme Court in an indexed, HTML format.[28] Supplemental and other meta data drew from the Supreme Court Database (SCDB).[29]

Data Summary Statistics

Below we provide summaries of Term (Figure A1) and Justice-level (Figure A2) opinion data. Given the need to draw distinctions in ideology (θ_i) given vari-

[27] *Note*: All replication materials, including data retrieval and processing, estimation, and figure (table) compilation was compiled using the `R` programming language and its associated suite `RStudio`.

[28] For more information regarding Justia and its repository of legal documents, please visit Here.

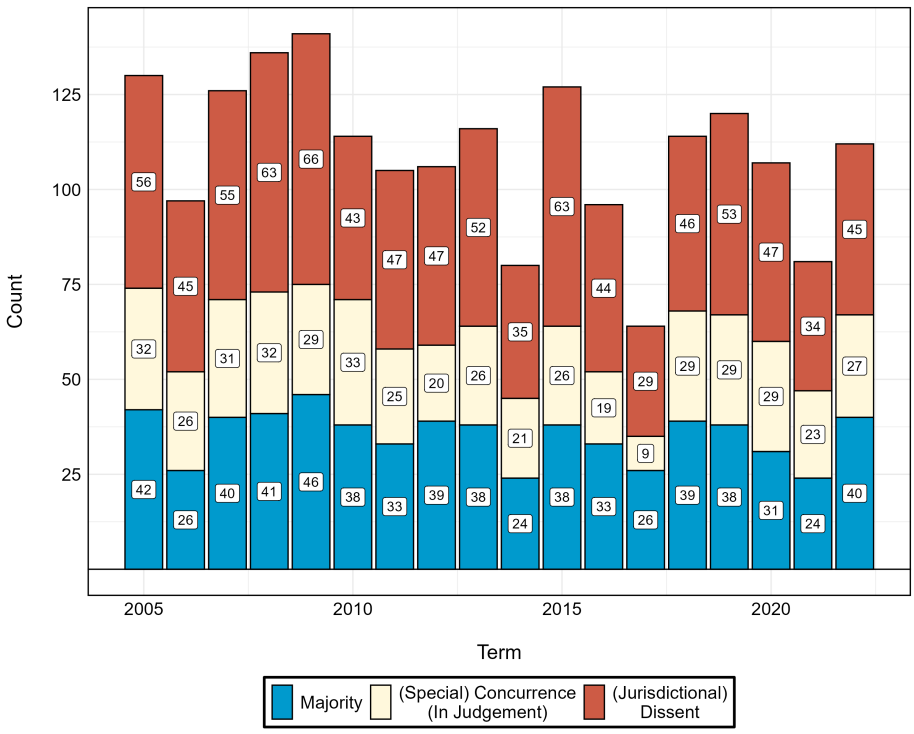
[29] For more information on the SCDB, visit Here. However, as of February 2025, the repository is currently in the processes of relocating from Washington University, St. Louis (MO) to Pennsylvania State University (University Park, PA). For more information, please visit Here.

ance in opinion language, only those cases with an associated concurring or dissenting opinion were included in this analysis.[30] As was conditioned in the `Wordshoal` estimation procedure, Majority, Concurring, and Dissenting Opinions were stratified and organized by their respective typology. For consistency, we observed the following coding rules:

- Majority Opinions: Any opinions representing the majority coalition. These also included opinions representing a *plurality* of the Court, but only if no majority opinion was otherwise rendered.
- Concurring Opinions: Any opinion not reflecting the majority coalition but was nonetheless offered by a member of the non-dissenting (majority) coalition. These included regular concurrences and concurrences *In Judgment*, as well as *special* concurrences (*In-Part*) where the authoring Justice did not fully join the minority.
- Dissenting Opinion: Opinions representing the perspective(s) of the minority (dissenting) coalition(s). These included both regular and *Jurisdictional* dissents.

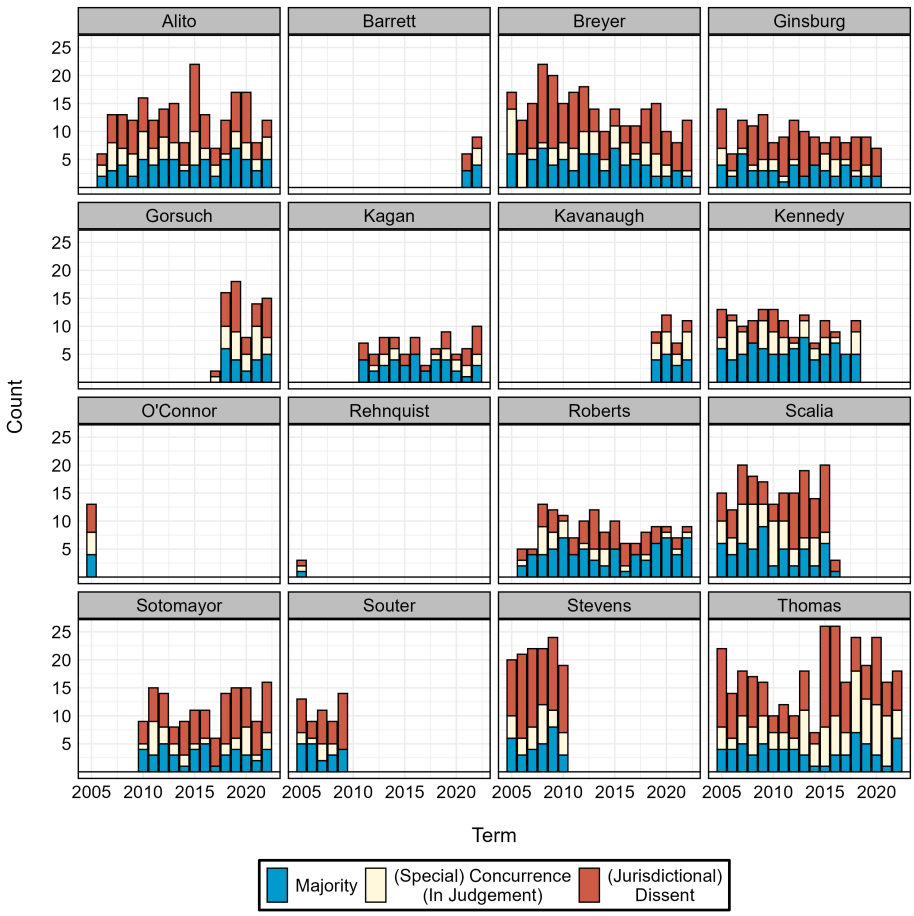
[30] In essence, cases decided without an accompanying concurring or dissenting opinion(s) were omitted. However, cases with an accompanying concurrence, even if the coalitions would otherwise reflect a unanimous agreement of the majority position, were still included. Alternatively, unanimous decisions with no concurring opinions, those decided *per curiam*, or otherwise representing an equally-divided Court with no plurality opinion were omitted.

Figure A1: Distribution of Opinion Data by Term (2005-2022 Terms) Included in `Wordshoal` Estimation.



Note: Bars represent volume of individual opinion types included in the estimation by term. The total observations across terms is 1,972 – while the term-level average is 109 with a median of 113. However, given unforeseen circumstances – e.g., lack of archived opinions on Justia or lack of convergence for at leas two cases (e.g., Docket Numbers: 06-1195 and 08-810), it does not represent a full accounting of non-unanimous opinions between the 2005 and 2022 terms. However, we consider these omissions as missing at random and do not appear to represent any significant inhibition to trusting the validity and robustness of the estimation and subsequent inferences.

Figure A2: Distribution of Opinion Data by Term and Justice (2005-2022 Terms) Included in `Wordshoal` Estimation.



Note: Bars represent the volume of authored opinions (Majority, Concurrences, and Dissents) at the Justice-Term level. For additional information regarding the coding rules to classify opinion types, please *see* the preceding discussion in Section 1.2. Alternatively, please *see* Figure A2 for a special note regarding omissions of observations due to lack of archived opinions on Justia or failure to converge in the estimation procedure.

Testing Weighting of Opinion Ownership

As described in the manuscript, we give special attention to the relative weight(s) associated with opinion authorship. In the original application of `Wordshoal`, Lauderdale and Herzog (2016) are able to identify legislator-specific associations between documents (*speeches*) within group-specific *debates*. In essence, each document-author contribution existed as a single observation, where word-debate usage parameters λ_{jk} and κ_{jk} were unique to legislator i in debate j. Given that much of the members in the chamber (United States Senate or Irish Dáil) do not participate in a given debate, many observations will be missing. However, Lauderdale and Herzog (2016) articulate that in assuming "the positions legislators express are unrelated to their decisions to participate in a debate ..., the measures [they] recover should be interpreted as summaries of the positions actually taken by legislators, relative to their peers, in the debates they participated in" (p. 377). In short, missing observation at random is not detrimental to deriving valid inferences.

However, conditions unique to circumstances where decisions are rendered by panel (and coalitions) – such as the Supreme Court – raise important distinctions. Chief among them being that (1) Instances of Justices failing to participate in the proceedings of any case are fairly uncommon, and (2) as opposed to rendering individual opinions as *seratim*, signed opinions as majority and minority coalitions are the status quo. For all intents and purposes, every $\text{case}_{j..n.}$ will be decided with a majority (plurality or *per curiam*) opinion alongside (perhaps) a concurrence or minority dissent. As only one Justice will author an opinion, those remaining who constitute a majority (minority) coalition will join to varying degrees. Meaning that, unlike Lauderdale and Herzog (2016), each Justice i (generally) participates in every case j and there should be very few missing ψ_{ij}.

As such, the most important question is how to assess relative responsibility of an opinion to a non-authoring Justice. We explore this question in the manuscript and justify our decision to prescribe various weighting schemes as such:

1. Opinion writers, by virtue of being the ascribed author, should be given full weight of association. It is effectively the same as Lauderdale and Herzog (2016) drawing direct association between legislators and their respective speeches. If a distinction must be made to determine which opinions are most reflective of a Justice's latent ideological preferences, the opinions they author should invariably be given the most weight.

2. Notwithstanding implicit dynamics that motivate the Justices towards coalescence, there are no structural barriers to individual (separate) opinion authorship as concurring or dissent. That is, while the holding represents only the opinion associated with a majority (plurality) coalition, there is nothing that inhibits Justices from authoring separate concurrences or dissents. Failure to do so should, at least to some extent, be viewed as a non-authoring Justices assenting to the holding, justification, and other

jurisprudential elements of the opinion they are joining.

3. A justifiable argument exists to assert that Justices who author separate opinions but join broader coalitions (e.g., Justices who offer separate concurrences but remain a member of the majority) should be viewed differently with respect to how much we associate them with those opinions they've joined. In short, the decision to offer separate opinions is evident of their desire to articulate positions separate from those expressed in the principal opinion. Surely, these separate opinions should be given full weight to the authoring Justice. Yet, by still joining the majority – rather than coalescing with the minority – this should still be viewed as a signal of assenting to (at the very least) the judgment. The question then is *how much* should majority opinions be viewed as the perspectives of those who author separate opinions? This string of hypotheticals most acutely apply to those who author separate concurrences, but those in the minority face a similar dilemma: For Justices who join a dissent but similarly author their own, how do we prescribe association for those they join when it is clear they are similarly extrapolating in another opinion?

To account for such a dynamic, we estimated a collection of four ideal points in spaces conditioned on varying weighting schemes (Table A1). While opinion authors were always given full associative weight, each subsequent weighting scheme diminished the associated weight for those who simply joined the Majority, or otherwise authored a separate (Concurring or Dissent) opinion. The emphasis of this exercise being to test the volatility of our estimates given divergent schemes. Yet, as we demonstrate in Figure 1 and reproduce below in Table A2, there is effectively no variance in estimates across schemes. The only exception, of course, is found with the most restrictive weighting scheme (*Sole Weight*), where only opinion authors are given any associated weight for their contributions. However, as we express in the manuscript, the capacity for Justices to author separate opinions if they truly disagree with a Majority (Dissenting) Opinion precludes that they at least substantively agree with the findings and inferences of the principal opinions. As such, at least some relative weight from those opinions should be attributed to those who joined – and instigating variance to how those non-zero weights are represented appear to have little-to-no effect in spurring variance in the resulting estimates.

Table A1: Associative Weighting Schemes by Opinion Authorship

Scheme (Responsibility)	Condition	Majority	Concurrence	(Other) Concurrence	Dissent
Full	JM (Exclusively)	1.0			
	JM AC	1.0	1.0		
	JM ASC	1.0		1.0	
	JM JSC	1.0		1.0	
	AD (Exclusively)				1.0
High	JM (Exclusively)	0.9			
	JM AC	0.9	1.0		
	JM ASC	0.75		1.0	
	JM JC	0.75	0.9		
	JM JSC	0.75		0.75	
	AD (Exclusively)				1.0
Low	JM (Exclusively)	0.75			
	JM AC	0.75	1.0		
	JM ASC	0.5		1.0	
	JM JC	0.5	0.75		
	JM JSC	0.5		0.75	
	AD (Exclusively)				1.0
Sole	JM (Exclusively)				
	JM AC		1.0		
	JM ASC			1.0	
	JM JC				
	JM JSC				
	AD (Exclusively)				1.0

Table A2: Static Wordshoal Summary Estimates by Justice (2005-2022 Terms)

Justice	Full	High	Low	Sole
Alito	3.08	3.08	3.08	2.65
Barrett	1.74	1.74	1.74	1.47
Breyer	-2.81	-2.81	-2.81	-2.68
Ginsburg	-3.42	-3.42	-3.42	-3.12
Gorsuch	1.55	1.55	1.55	1.43
Kagan	-2.84	-2.84	-2.84	-2.67
Kavanaugh	1.91	1.91	1.91	1.51
Kennedy	0.97	0.97	0.97	0.61
O'Connor	0.34	0.34	0.34	0.36
Rehnquist	0.89	0.89	0.89	0.83
Roberts	1.82	1.82	1.82	1.4
Scalia	2.89	2.89	2.89	2.76
Sotomayor	-3.39	-3.39	-3.39	-3.13
Souter	-2.95	-2.95	-2.95	-2.65
Stevens	-3.18	-3.18	-3.18	-2.78
Thomas	3.07	3.07	3.07	2.92

Inferences re: Case Importance and Effects on Justice Locations in Ideal Point Space

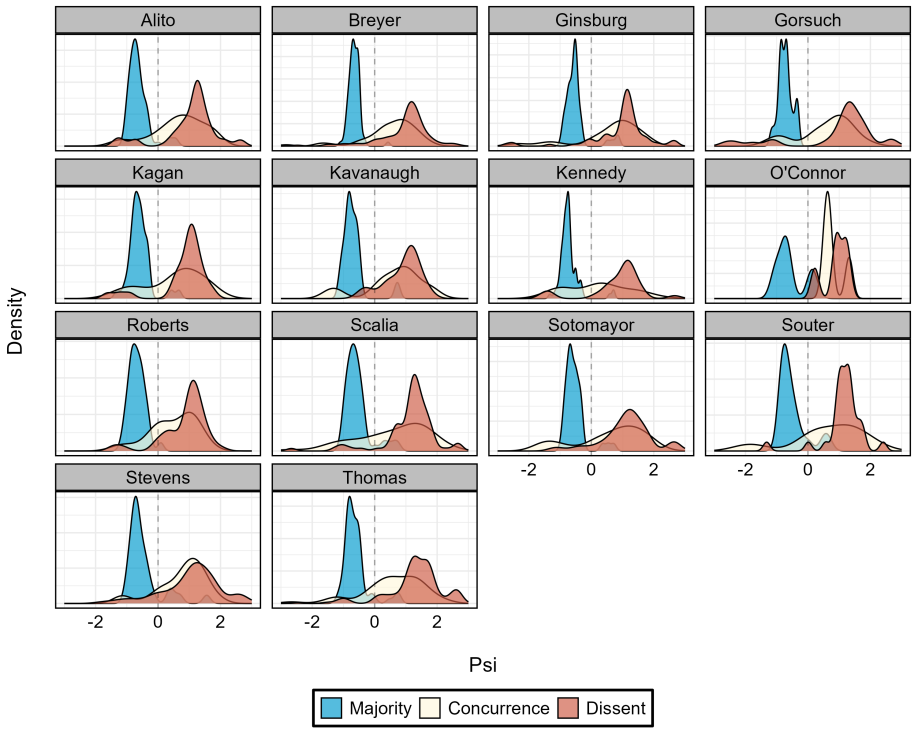
Below we provide summary analyses related to the underlying parameters used to influence each Justice's θ_i. In particular, we produce a sample of the most prominent cases organized by their associated slope (β_j) in Table A3. A similar figure is produced in Table 2 of Lauderdale and Herzog (2016, 12). Alternatively, we produce Justice-level distributions of ψ_{ij} for their authored opinions in Figure 3.

Table A3: Static Wordshoal Summary Outputs by High Beta Estimate

Term	Docket	Case Name	*Abs.* β_j
2005	03-674	Jama v. Immigration and Customs Enforcement	0.351
2005	03-9627	Pace v. DiGuglielmo	0.351
2006	04-1360	Hudson v. Michigan	0.334
2005	04-514	Bell v. Thompson	0.351
2005	04-5286	Dodd v. United States	0.352
2006	04-980	Brown v. Sanders	0.336
2009	07-463	Summers v. Earth Island Institute	0.339
2018	16-1067	Murphy v. Smith	0.335
2018	16-1348	Currier v. Virginia	0.344
2018	16-1362	Encino Motorcars, LLC v. Navarro	0.335
2018	16-1454	Ohio v. American Express Co.	0.335
2018	16-1466	Janus v. AFSCME	0.332
2017	16-373	California Public Employees' Retirement System v. ANZ Securities, Inc.	0.335
2017	16-6219	Davila v. Davis	0.335
2018	16-969	SAS Institute Inc. v. Iancu	0.332
2019	17-1299	Franchise Tax Board of California v. Hyatt	0.332
2019	17-1702	Manhattan Community Access Corp. v. Halleck	0.332
2018	17-530	Wisconsin Central Ltd. v. United States	0.335
2020	18-1109	McKinney v. Arizona	0.332
2020	18-1323	June Medical Services L.L.C. v. Russo	0.34
2019	18-422	Rucho v. Common Cause	0.332
2020	18-725	Barton v. Barr	0.332
2021	19-1257	Brnovich v. Democratic National Committee	0.362
2021	19-438	Pereida v. Wilkinson	0.338
2020	19-7	Seila Law LLC v. Consumer Financial Protection Bureau	0.342
2022	20-1009	Shinn v. Martinez Ramirez	0.355
2021	20-107	Cedar Point Nursery v. Hassid	0.355
2022	20-1088	Carson v. Makin	0.341
2022	20-322	Garland v. Gonzalez	0.364
2022	20-443	United States v. Tsarnaev	0.358
2022	20-826	Brown v. Davenport	0.355
2022	21-12	Federal Election Commission v. Cruz	0.355
2022	21-147	Egbert v. Boule	0.341
2022	21-499	Vega v. Tekoh	0.355

Note: β_j represents the case-specific slope. As Lauderdale and Herzog (2016) note, "this allows the model to select out those debate-specific dimensions that reflect a common dimension (large estimated values of β_j), while down-weighting the contribution of debates where the word usage variation across individuals seems to be idiosyncratic ($\beta_j = 0$)" (p. 5). The cases referenced in this table represent the 95th percentile of absolute values for observed β_j.

Figure A3: Distribution of Opinion-Level Psis by Justice (Static `Wordshoal`)



Note: Figure illustrates the distribution of opinion-level ψ_{ij}, which represents the justice-specific position in a particular case.

Special Note: Modeling Temporal Dependence

Overview

A natural progression of this methodology is the application of dynamic variance in θ_i, which Lauderdale and Herzog (2016) argue can "be achieved from a closely related model that does not change the lower-level model for the texts" (p. 19). They continue by articulating how the application of an existing dynamic strategy similar to Poole and Rosenthal (1997) or Martin and Quinn (2002) would be satisfactory. In the following, we provide an initial attempt at such a strategy, including an updated specification that allows for temporal variance in θ_i as well as updates to figures and tables previously introduced using the original static methodology.

Updated Specification

$$\theta_{i,t} \sim \begin{Bmatrix} N(\theta_{i,t-1}, 1) \text{ If Justice}_i \text{ was present in term}_{t-1} \\ N(0, 1) \text{ If Justice}_i \text{ is newly introduced} \end{Bmatrix}$$

The principal update to the model specification introduced in this manuscript is the amendment to facilitate temporal variance in θ_i. Specifically, for each term, veteran Justices who were present in $\text{term}_{(t-1)}$ will begin the subsequent $\text{term}_{(t)}$ with $\theta_{i,t-1}$. Conversely, newly introduced Justices will assume a standard normal $\theta_{i,t}$. This dynamic structure uses priors from the previous term's θ_i estimates to inform the estimation of the current term's ideal points, capturing the temporal drift of Justice positions. After each iteration, the model refines these estimates until the change in the log-posterior is below a predefined tolerance threshold. Apart from stratifying the observable data to only those observed in term_t, other elements of the model specification remain unchanged.

Updated Tables and Figures Given Dynamic Specification

We replicate the Tables and Figures introduced in the previous sections using the initial attempts at modeling dynamic variance. We further include an additional table (Table A5) to summarize the average ideal points across Martin-Quinn and both `Wordshoal` specifications, as well as two additional figures (Figures A4 and A6) to illustrate Justice-level variance in $\theta_{i,t}$ and the comparative difference given a static or dynamic specification.

Table A4: Dynamic Wordshoal Summary Outputs by High Beta Estimate

Term	Docket	Case Name	*Abs.* β_j
2018	16-285	Epic Systems Corp. v. Lewis	0.564
2009	08-441	Gross v. FBL Financial Services, Inc.	0.565
2010	08-1198	Stolt-Nielsen S. A. v. AnimalFeeds Int'l Corp.	0.567
2010	08-810	Conkright v. Frommert	0.567
2007	06-340	National Assn. of Home Builders v. Defenders of Wildlife	0.568
2007	06-5247	Fry v. Pliler	0.568
2018	16-969	SAS Institute Inc. v. Iancu	0.568
2019	17-1299	Franchise Tax Board of California v. Hyatt	0.57
2019	17-1702	Manhattan Community Access Corp. v. Halleck	0.57
2019	18-422	Rucho v. Common Cause	0.57
2015	14-556	Obergefell v. Hodges	0.572
2010	08-970	Perdue v. Kenny A.	0.574
2020	17-834	Kansas v. Garcia	0.574
2011	09-571	Connick v. Thompson	0.576
2011	09-525	Janus Capital Group, Inc. v. First Derivative Traders	0.577
2011	10-238	Arizona Free Enterprise Club's Freedom Club PAC, et al. v. Bennett, et al; McComish, et al. v. Bennett, et al.	0.577
2011	10-277	Wal-Mart Stores, Inc. v. Dukes	0.577
2011	09-987	Arizona Christian School Tuition Organization v. Winn	0.579
2005	04-5286	Dodd v. United States	0.58
2020	17-1712	Thole v. U. S. Bank N. A.	0.583
2006	04-980	Brown v. Sanders	0.585
2020	18-1109	McKinney v. Arizona	0.588
2020	18-725	Barton v. Barr	0.588
2021	20-107	Cedar Point Nursery v. Hassid	0.589
2010	08-1470	Berghuis v. Thompkins	0.594
2010	08-861	Free Enterprise Fund v. Public Company Accounting Oversight Bd.	0.594
2010	09-497	Rent-A-Center, West, Inc. v. Jackson	0.594
2020	17-1678	Hernandez v. Mesa	0.594
2020	18-1323	June Medical Services L.L.C. v. Russo	0.608
2006	05-493	Ayers v. Belmontes	0.612
2006	04-473	Garcetti v. Ceballos	0.613
2021	19-1257	Brnovich v. Democratic National Committee	0.615
2006	04-1360	Hudson v. Michigan	0.621
2020	19-7	Seila Law LLC v. Consumer Financial Protection Bureau	0.621

Note: β represents the case-specific slope. As Lauderdale and Herzog (2016) note, "this allows the model to select out those debate-specific dimensions that reflect a common dimension (large estimated values of β_j), while down-weighting the contribution of debates where the word usage variation across individuals seems to be idiosyncratic ($\beta_j = 0$)" (p. 5). The cases referenced in this table represent the 95th percentile of absolute values for observed β_j.

Table A5: Comparison of Static and Dynamic Wordshoal Estimates Versus Martin-Quinn by Justice

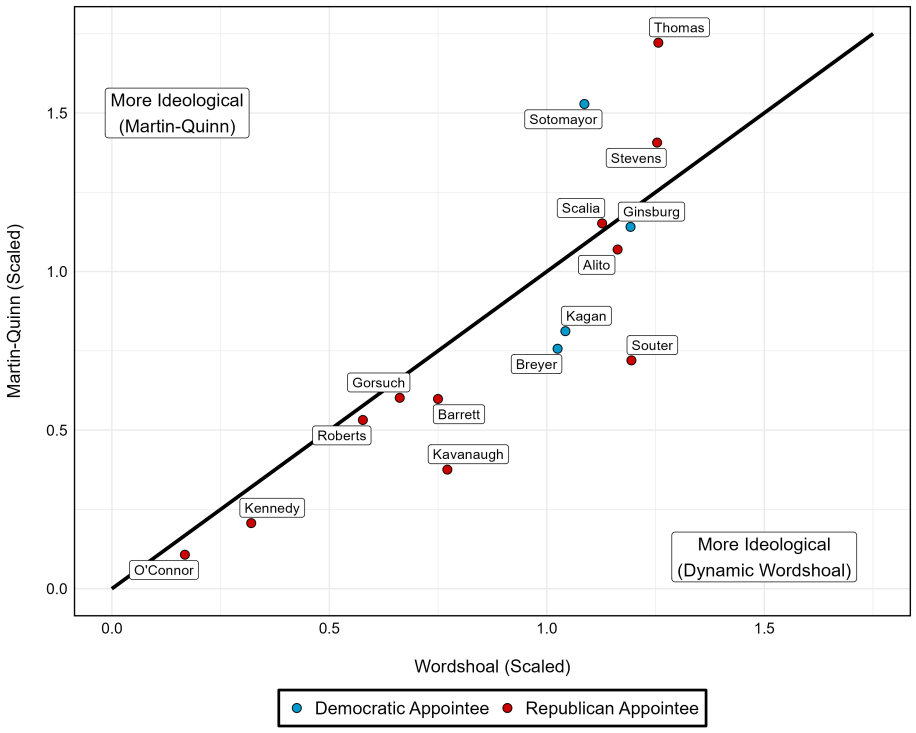
Author	Martin-Quinn	Dynamic Wordshoal	Static Wordshoal
Stevens	-1.81	-1.648	-3.178
Souter	-0.774	-1.571	-2.946
Ginsburg	-1.759	-1.568	-3.422
Sotomayor	-3.127	-1.43	-3.394
Kagan	-1.713	-1.373	-2.837
Breyer	-1.317	-1.35	-2.808
O'Connor	1.016	0.204	0.341
Kennedy	0.678	0.403	0.973
Roberts	1.062	0.737	1.822
Gorsuch	1.027	0.848	1.554
Barrett	0.949	0.962	1.737
Kavanaugh	0.559	0.99	1.915
Rehnquist	2.959	1.07	0.886
Scalia	2.503	1.454	2.887
Alito	1.95	1.5	3.075
Thomas	3.347	1.622	3.07

Note: Values for Martin-Quinn derived using each Justice's respective means from `post_mn` for observations during 2005 to 2021 terms, while Dynamic Wordshoal values represent the same methodology by retrieving the each Justice's average across $\theta_{i,t}$. Both Wordshoal estimates represent values retrieved using the `High Weight` scheme.

Figure A4: Term-Level Variance in Dynamic Ideal Points by Justice

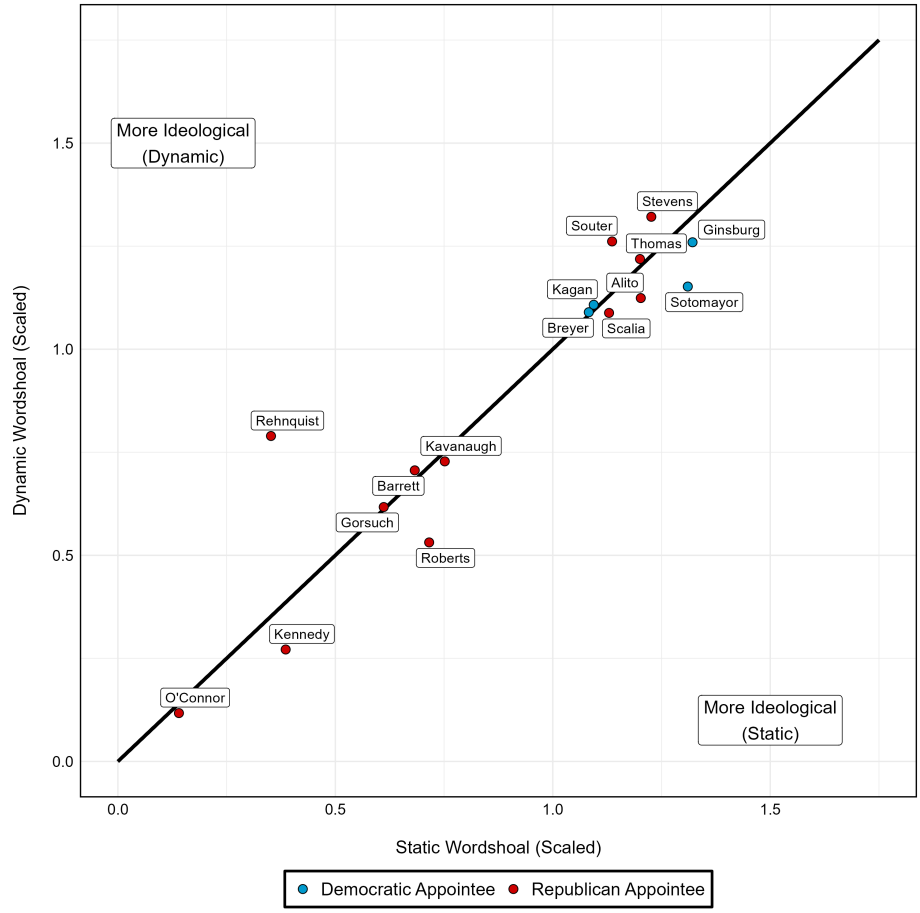
Note: Points represent the estimated value of θ_t for Justice$_i$, while bands represent 95% confidence intervals. With rare exception, both the point estimates and associated bands align with the individual Justice's expected ideological leanings. Circumstances where bands unexpectedly and appreciably surpass zero – e.g., Justices Sotomayor (2009, 2016), Roberts (2005), and Scalia (2016) – are likely (some combination of) freshman effects or, in the case of Scalia, unforeseen death significantly reducing the scope of available data in term$_t$. Otherwise, point estimates and associated margins of error align with expected ideological leanings and placement.

Figure A5: Comparison of Dynamic `Wordshoal` versus Martin-Quinn



Note: Both axes represent the absolute values of each Justice's estimated ideal point using Martin-Quinn and Dynamic `Wordshoal`, where both scales are standardized using z-score normalization. Values for Martin-Quinn (Dynamic `Wordshoal`) measured using the average of `post_mn` (θ) across the observation period. Points nearest to the diagonal segment indicate greater correlation between the relative placement of Justice$_i$ across both methodologies. Alternatively, values above (below) the diagonal indicate greater relative ideological placement in Martin-Quinn (Dynamic `Wordshoal`). Correlation = 96.4%.

Figure A6: Comparison of Static v. Dynamic `Wordshoal` Means (High Weight)



Note: Figure represents the comparative ideal points of each Justice using a static or dynamic `Wordshoal` specification. The scope of variance between static and dynamic point estimates must be contextualized given the relative difference in their associated scales – i.e., the margins of the unbounded scale with the dynamic specification is discernibly larger (-3.42, 3.07) than the static specification (-1.6, 1.6). To account for this, we conduct a similar strategy as Figure A5 to take the absolute values of each Justice's estimate given the normalization of the static and dynamic scales. Estimates nearest the diagonal line indicate lesser variance between the static and dynamic specifications, while those above (below) the diagonal indicate greater relative ideological placement from the dynamic (static) specification. Correlation = 92.8%.