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**APPLICATION OF MULTIDIMENSIONAL  
POLARIZATION INDEX  
TO AN ANALYSIS OF THE UNITED STATES  
HOUSE OF REPRESENTATIVES  
(1879–2015)**

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The multidimensional polarization index based on the first central moment of a system of forces is applied to an analysis of the United States House of Representatives (1879–2015).

A brief outline of the existing relevant literature is given as well as an overview of the multidimensional polarization index model. The structure of the United States Congress and the turning points in its history are described.

Two-dimensional DW-NOMINATE scores are used as a numerical representation of the U.S. House of Representatives in the analysis. Polarization of the U.S. House of Representatives is estimated by means of different versions of the multidimensional polarization index. The results obtained turned out to be consistent with corresponding political situation.

The findings show that the U.S. House of Representatives was the least polarized during the period from 1930s to 1970s and the most polarized in the last available for the analysis 113th U.S. Congress (2011–2015).

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# 1. Introduction

The growing ideological gap between Republicans and Democrats along with increasing partisan animosity has been recognized as the defining features of the American politics during the last two decades [see, e.g., McCarty et al. (2006), Fiorina and Abrams (2008), Waugh et al. (2011), Andris et al. (2015)]. The increased political polarization manifests in a variety of ways, both in big politics and in daily life. The recent political survey of more than 10,000 American adults conducted by the Pew Research Center (2014) shows that the Americans are further apart ideologically than at any point of the early 21<sup>st</sup> century. At the same time, Congressmen representing a polarized public have become more ideologically separated than ever before which resulted into scarcer compromises and even policy inaction.

This recent trend in the American politics has fostered the interest of researchers to examine congressional polarization in a rigorous way, no matter how obvious the evidence of growing division between Democrats and Republicans might be.

During the last two decades a large corpus of studies emerged dealt with the analysis of polarization in societies and, especially, to the approaches of polarization measurement. In this respect, two main directions can be mentioned.

The first direction based on the *identification-alienation* framework suggested by Esteban and Ray (1991, 1994) considers polarization in terms of intra-group identification and inter-group alienation. Within this framework, polarization rises if the groups become more homogeneous internally, more separated externally, and more equal in size. Polarization indices elaborated within identification-alienation approach can be found in Esteban and Ray (1991, 1994), Gradin (2000), Zhang and Kanbur (2001), Duclos et al. (2004), Esteban et al. (2007).

The second governing direction often called as “bi-polarization” was mapped out by Wolfson (1994). It associates polarization as dispersion of the income distribution from the median (or alternatively defined center of the distribution) towards the extreme points. Bi-polarization indices are presented in Wolfson (1997), Wang and Tsui (2000), Chakravarty and Majumder (2001), Rodriguez and Salas (2003), Chakravarty et al. (2007), Chakravarty and Ambrosio (2010), Gigilarano et al. (2011).

The aforementioned studies consider the measurement of polarization in the one-dimensional case, i.e. the case when society is split into groups according to a single characteristic. However, disagreement in societies often arises over multiple issues. Thus, it is necessary to develop the techniques which allow to measure polarization in multidimensional cases. Even though moderate success has been achieved in this field, some studies of multidimensional polarization can be found in the literature, e.g. Gigliarano and Mosler (2009), Sheicher (2010), Bossert, Chakravarty and D'Ambrosio (2013), Nolan and Whelan (2007), Atkinson (2003).

Notwithstanding the abundance of research dealt with measurement of social polarization, the indices presented in these studies alone can hardly be used to measure congressional polarization. To the best of our knowledge, the only study which systematically examines polarization in the U.S. Congress dates back to 1984, when K. Poole and H. Rosenthal developed their widely accepted metric DW-NOMINATE and used it to quantify congressional polarization.

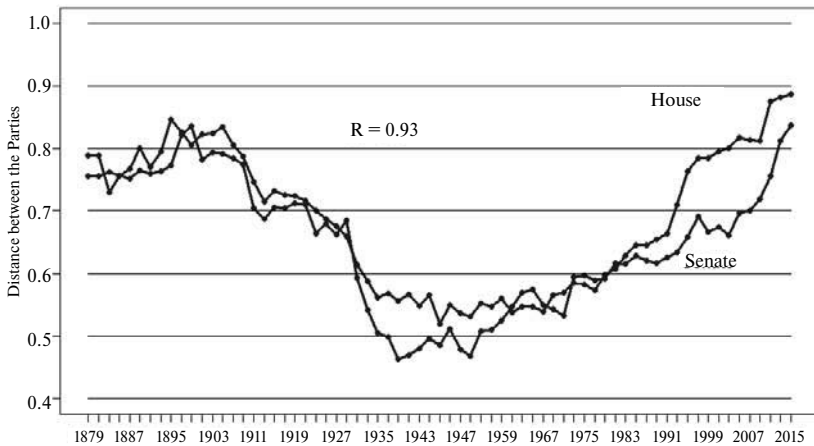
DW-NOMINATE scores are based on the roll-call votes and correspond to the latent two-dimensional coordinates of the Congressmen in the joint political space. Both houses were scaled as if they were one body using 650 Congressmen who served in both the House and the Senate as bridge observations. A single ideal point for each Legislator based on her entire record of service in the Congress. It turned out that two latent dimensions were enough to describe the political positions of Congressmen. The first coordinate explained most variation in voting patterns; moreover, the second dimension became less significant over time. The first dimension is interpreted as “liberal – conservative” dimension, while the second dimension picks up regional dissimilarities, attitudes on cross-cutting, salient issues of the day (e.g., slavery, civil rights, lifestyle issues, etc.) (see Poole and Rosenthal (1997)).

In Poole and Rosenthal (1984) the original version of NOMINATE scores, D-NOMINATE scores, was used to estimate polarization in the Congress. They measured polarization as distance between average positions of the Republicans and the along the first dimension coordinate. In McCarty et al. (2006) the same approach was applied for newly developed joint scale DW-NOMINATE scores. The most recent results of estimation of polarization in the U.S. Congress are publically available on *Voteview* website. Polarization measured as described above, was the lowest from roughly 1930s until World War II. It was fairly stable until late 1970s, and has been constantly increas-

ing during the beginning of the 21<sup>st</sup> century reaching its maximum in the last observed 113<sup>th</sup> House (2013–2015). Furthermore, Houses 100<sup>th</sup> to 113<sup>th</sup> exhibit an acceleration of the trend. Fig. 1 (reprinted from *Voteview* website, by Poole and Rosenthal) provides the latest findings of K. Poole, H. Rosenthal and their colleagues.

The major shortcoming of the approach suggested by K. Poole and H. Rosenthal is the fact that by averaging the coordinates of the Congressmen we are losing the information about how scattered or dense are the clusters representing the Legislators, which, evidentially, has an impact on polarization in the Congress.

In our study of congressional polarization, we apply the multidimensional index presented in Aleskerov and Oleynik (2016) which is based on the central moment of a system of forces and lacks such a flaw.



**Fig. 1.** Polarization in the U.S. Congress measured as distance between average first coordinate of Common Space DW-NOMINATE scores (reprinted from *Voteview* website)

## 2. The Model

The following model is an extension of the one-dimensional model presented in Aleskerov and Golubenko (2003) to the multidimensional case. Aleskerov-Golubenko polarization index (AG-index) was inspired by the notion of central moment of a system of forces coming from physics.

Suppose, a society is split into  $n$  groups according to particular criteria. Each group is described by a number  $v_i, i = \overline{1, n}$ , and a vector  $\overline{p}_i = (p_{i1}, \dots, p_{im})$ ,  $i = \overline{1, n}$ , in a multidimensional unit cube in  $\mathbb{R}^m$ , where  $m$  is a number of group's features,  $v_i, i = \overline{1, n}$ , is the share of group's members in the whole society and  $\overline{p}_i, i = \overline{1, n}$ , is a point in  $[0; 1]^m$  representing normalized positions of the group in respective dimensions. Hence, each group may be seen as a *weighted point* in the multidimensional unit cube; together all the groups form a system of weighted points.

A *center of mass*  $\overline{c} = (c_1, c_2, \dots, c_m)$  of the system of points  $\overline{p}_i, i = \overline{1, n}$ , in which weights  $v_i, i = \overline{1, n}$ , are concentrated respectively, is defined as

$$\overline{c} = \frac{\sum_{i=1}^n v_i \overline{p}_i}{\sum_{i=1}^n v_i} = \sum_{i=1}^n v_i \overline{p}_i.$$

Then, the multidimensional polarization index of a society under consideration is

$$P = \sum_{i=1}^n v_i \cdot d(\overline{p}_i, \overline{c}),$$

where  $d: \mathbb{R}^m \times \mathbb{R}^m \rightarrow \mathbb{R}$  is some distance function and  $k$  is a normalizing coefficient. For definiteness, let us consider Euclidean, Manhattan and Chebychev distances. The normalizing coefficient  $k$  is selected in such a way that the maximal value of  $P$  index being equal to 1.

Hence, the corresponding indices take the form

$$P_{Euc} = \frac{2}{\sqrt{m}} \sum_{i=1}^n v_i \cdot \sqrt{\sum_{j=1}^m (p_{ij} - c_j)^2},$$

$$P_{Man} = \frac{2}{m} \sum_{i=1}^n v_i \cdot \sum_{j=1}^m |p_{ij} - c_j|,$$

$$P_{Cheb} = 2 \sum_{i=1}^n v_i \cdot \max_{j=\overline{1, m}} |p_{ij} - c_j|.$$

For the other versions of the  $P$  index and study of its basic properties the interested reader is to referred to Aleskerov and Oleynik (2016).

### **3. Polarization of the United States House of Representatives (1879–2015)**

#### ***3.1. Structure and Brief History of the United States Congress***

The historical remarks and Congress profiles are drawn from Remini (2006), Schickler and Frances (2011). Interpretation of results and comments on political background are based on Polsby (1968), Brady and McCubbins (2002), Schickler and Frances (2011).

The United States Constitution provides that all legislative power is concentrated in the Congress of the United States, a bicameral parliament comprising the Senate and the House of Representatives. The history of the United States Congress dates back over 200 years, and the modern face of the American parliament is the result of a continuous process of disputes and compromises.

Current thinking argued that the Second Continental Congress was the true predecessor of the U.S. Congress. Unlike the First Continental Congress which was just a meeting of delegates representing twelve of Great Britain's American colonies, the Second Continental Congress turned into the first *de facto* governing body of the United States. On July 4, 1776, about a year after it was established, the Second Continental Congress adopted the United States Declaration of Independence, referring to the new nation as "the United States of America".

In 1781 the Articles of Confederation established a new governing body of the United States, the Congress of the Confederation. It was a unicameral body in which every state had equal representation and a veto power over most actions. However, the Congress of Confederation was limited in powers, and the system of government did not work well. The Philadelphia Convention which took place in 1787 was aimed at confronting powerlessness of the government and resulted in the creation of the United States Constitution.

The new structure of the Congress was the most divisive and thorny issue that the Convention faced. Two plans of the Congress were suggested – one calling for a unicameral structure with equal representation for the states, and another calling for bicameral structure with representation based on population. Ultimately, a compromise plan, known as the Connecticut Compromise, was adopted with one house – the House of Representatives – providing proportional representation based on population, and the other house – the Sen-

ate – providing equal representation (exactly two senators from each state). Such a parliament structure allowed to balance the interests of both small and large states. The newly organized Congress referred to as “The 1<sup>st</sup> United States Congress” became active in 1789.

Since then, the role of Congress has been changing as well as its relations with other branches of power; however, the fundamental principles of the U.S. Congress design laid by Founding Fathers remained constant over time.

The end of the 18<sup>th</sup> century and the beginning of the 19<sup>th</sup> century were marked by the emergence of political parties; particularly, opposition Jefferson’s Democratic-Republican Party and Federalists. At the same time, the Congress was characterized by antagonism and frequent conflicts between the House and the Senate. Since the more populous North dominated the House, but did not have such an advantage in the Senate, the clashes between two chambers were mostly caused by regional issues, including slavery. The Civil War resolved the slavery and other regional issues. During the years of Reconstruction that followed, the Republican and the Democratic Parties became the main political players and were usually associated with the Northern and the Southern states, respectively. The second half of the 19<sup>th</sup> century was marked by sharp political divisions in the electorate, and both the Democrats and the Republicans held majorities in the House at various time.

Currently, the Senate consists of 100 members (two from each of 50 states regardless of population) chosen through direct popular elections. Until 1913, when the 17<sup>th</sup> Amendment of the United States Constitution established general election of the Senate, senators were elected by the legislatures of their respective state. The senators serve six-year terms. By design, the Senate meant to represent individual states and to be less sensitive to mass sentiments.

Representation in the House of Representatives is proportional to the population of each individual state, as determined by the census; however, every state is entitled to at least one representative. Throughout history, as population has been growing at high rates, the House has been growing in size too, since the Constitution limited the number of representatives to not more than one for every 30 000 citizens. In 1911 the fixed upper limit of 435 members of the House was established, and now a Congressperson can represent 600 000 or more citizens.

Since its inception, the House of Representatives, viewed by architects of American federal government as body most responsive to the popular will,



has been elected directly by the people. The members of the House serve two-years terms. In accordance with a federal statutory requirement, the states entitled to more than one Representative are divided into single-member constituencies, or districts. District boundaries are determined by each state through legislation or non-partisan panels. The elections to the House of Representatives are held in every even-numbered on Election day after the first Monday of November.

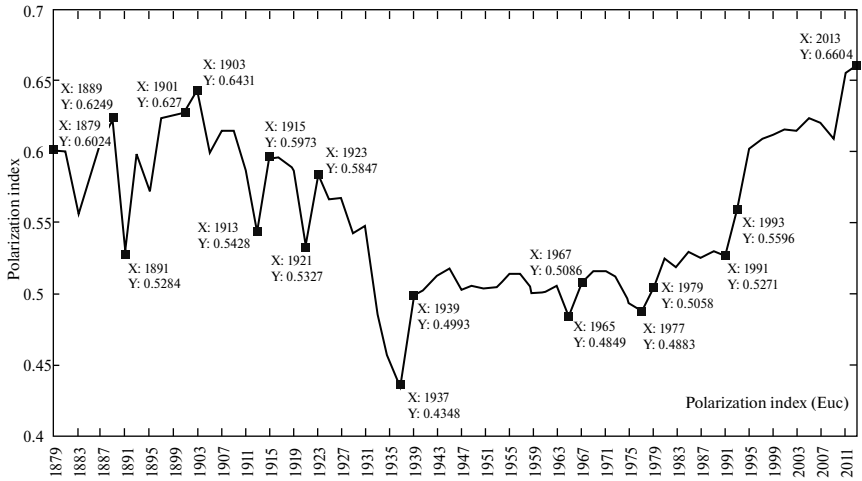
Members of both chambers are normally affiliated to the Democratic Party or to the Republican Party, and only rarely to a third-party or independents. Even though each chamber has its unique powers granted by the Constitution, the consent of both of them is needed in order to enact legislation. Simple majority rule is used to make decisions in both houses.

### ***3.2. Application of the multidimensional polarization index to an analysis of the United States House of Representatives (1879–2015)***

In what follows we present the results of the application of our methodology outlined in *Section 2* to the U.S. House of Representatives (1879–2015). For our analysis, we exploit Common Space DW-NOMINATE scores with bootstrapped standard errors (see Carroll et al. (2009)). The overall results are shown in Fig. 2. Polarization in the U.S. House measured within our approach reveals general trends which are fairly consistent with those discovered by K. Poole and H. Rosenthal. Some minor trends, missed when applying methodology of Poole and Rosenthal, were detected by our methodology.

For the sake of convenience, the period under consideration is divided into 9 parts according to tendencies in American politics and the Congress. Each of these 9 parts is examined in detail, figures of unnormalized DW-NOMINATE coordinates of Congressmen of the Houses are provided as well as exact values of polarization indices based on different distance functions. Political interpretation is given for each case.

The Republicans are portrayed as light grey crosses on the figures representing the spatial model of the House, whereas the Democrats are represented by black dots. During the late 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century, there were a few Legislators affiliated to neither the Democrats, nor the Republicans. For the sake of clarity, these Congressmen are presented as grey triangles on the figures of DW-NOMIATE scores. The Appendix I provides exact number of these Representatives and their party affiliation.



**Fig. 2.** Polarization in the United States House of Representatives 1879–2013 (values of polarization index  $P_{Euc}$ )

### *46<sup>th</sup> House – 51<sup>st</sup> House (1879–1891)*

The period from 1877 to 1891 is often referred to as “Gilded Age” and was marked by sharp political division in the electorate, divided-party government and much tension within the Congress. The Republicans dominated the Senate – and the Presidency, while the House have been mostly controlled by the Democratic Party.

The Democrats controlled the 46<sup>th</sup> House (1879–1881) of Representatives with narrow majority, and the Republicans won the next, 47<sup>th</sup> House (1881–1883) – only to lose it in the next congressional elections. In 1883 the Democratic party regained control over the House with even stronger majority. Then, after six years of dominance, Democratic majority declined, and the Republicans won control of both houses. Gilded Age political impasse was coming to its end.

During this period the Congress shifted away from civil rights legislation which was at the forefront of Congress’ priorities during the preceding Reconstruction Era followed the Civil War, and concentrated on the issues of the America’s emerging industrial economy and immigration.

As Fig. 3 demonstrates, the Congressmen’s positions slightly changed over time, and were the least remote from each other in the 48<sup>th</sup> House (1883–

1885). The values of the polarization index are much in line with political configuration in the Congress described above.

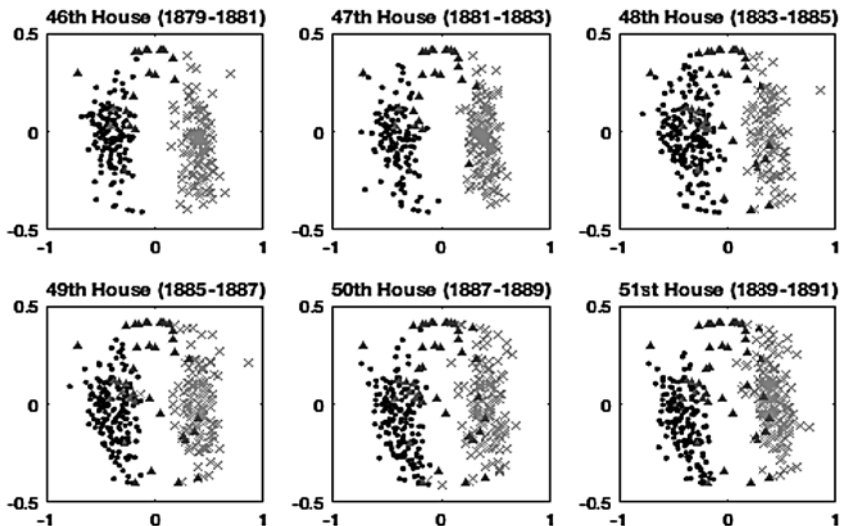


Fig. 3. Spatial model of the U.S. House of Representatives in 1879–1891

Every time when the Democrats’ majority eroded and the Republicans consolidated to win the next House, polarization increased. At the same time, the stronger the dominance of Democrats was, the lower the polarization in the House was. Local minimum was attained in the 48<sup>th</sup> House, when the Democrats controlled over 60% of seats. Table 1 provides the exact numbers of the polarization index calculated with different distance functions.

Table 1. Polarization in the U.S. House of Representatives in 1879–1891

House	Years	$P_{Euc}$	$P_{Man}$	$P_{Cheb}$
46 <sup>th</sup>	1879–1881	0,6024	0,5172	0,8002
47 <sup>th</sup>	1881–1883	0,5999	0,5163	0,7942
48 <sup>th</sup>	1883–1885	0,5558	0,4863	0,7276
49 <sup>th</sup>	1885–1887	0,5841	0,5068	0,7712
50 <sup>th</sup>	1887–1889	0,6110	0,5339	0,8016
51 <sup>st</sup>	1889–1891	0,6249	0,5400	0,8238

### *52<sup>nd</sup> House–57<sup>th</sup> House (1891–1903)*

In the 1890 elections the Democrats won firm majority over the 52<sup>nd</sup> House (1891–1893) – 238 Democrats against 86 Republicans – which they managed to keep only for two terms. At the beginning of 1890s American economy deeply and sharply went down, and the Democrats failed to effectively address the country’s mounting financial crises splitting over numerous issues (see Schickler and Frances 2011). As a result, support for the Democratic Party substantially declined. Even though it managed to retain the control over the House during the next two-years term, the Republicans resoundingly won the 54<sup>th</sup> Congress (1895 – 1897) remaining in the majority during the following 16 years. It should be noted, however, that the Republican’s majority has been constantly eroding during 1895–1901.

The period from the 1890s to 1920s is often called the “Progressive Era”. It was marked by the rise of strong party leadership and call for reforms. In 1890s, during tenure of Republican Thomas Bracket Reed, the position of the Speaker of the House became extremely powerful. Approximately at the same time the leadership structure of the House was also developed, and positions of Majority Leader and Minority Leader were created in 1899.

Such tendencies resulted in the growing strain within the House of Representatives. Polarization in the House has been constantly growing which is reflected in the values of the polarization index. From 1891 to 1903 polarization in the House increased by approximately 20%. At the same time, as can be seen on Fig. 4, beginning with the 54<sup>th</sup> House (1895–1897) the opposition parties were getting more equal in size while staying remote from each other.

*Table 2.* Polarization in the U.S. House of Representatives in 1891–1903

<b>House</b>	<b>Years</b>	<b><math>P_{Euc}</math></b>	<b><math>P_{Man}</math></b>	<b><math>P_{Cheb}</math></b>
52 <sup>nd</sup>	1891–1893	0,5284	0,4565	0,6975
53 <sup>rd</sup>	1893–1895	0,5995	0,5238	0,7889
54 <sup>th</sup>	1895–1897	0,5702	0,4997	0,7432
55 <sup>th</sup>	1897–1899	0,6241	0,5479	0,8142
56 <sup>th</sup>	1899–1901	0,6264	0,5508	0,8189
57 <sup>th</sup>	1901–1903	0,6270	0,5502	0,8215

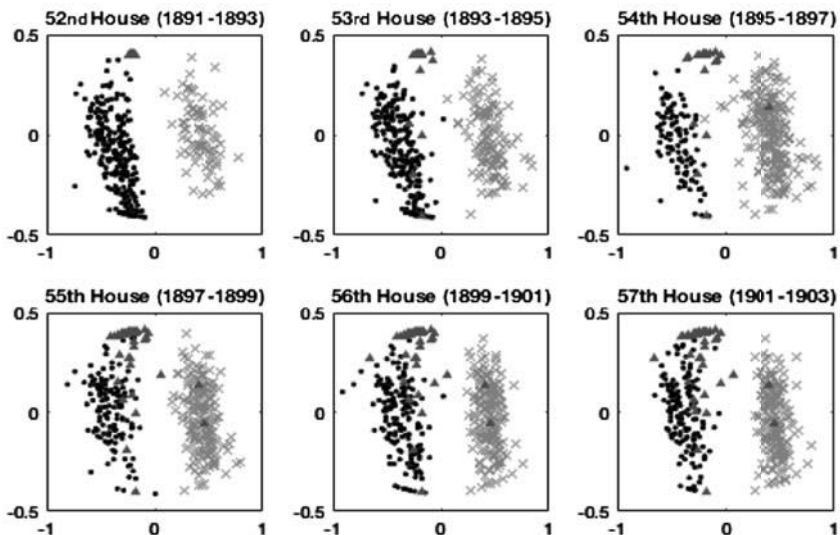


Fig. 4. Spatial model of the U.S. House of Representatives in 1891–190358<sup>th</sup>

#### *House – 63<sup>rd</sup> House (1903–1915)*

From 1903 to 1909 the Republican party has been increasing its control in the House. Nevertheless, since 1909 it has been suffering from internal issues, and therefore constantly losing its dominant position. Republican infightings disrupted the 61<sup>st</sup> Congress (1909–1911), and it was the last term of their exceptionally long dominance in the House which lasted 16 years.

The internal conflicts of the Republicans greatly helped the Democratic candidate Woodrow Wilson to win the 1912 Presidential Election and aided the Democratic party to regain control of the House. The strong popularity the President Wilson acquired with his New Freedom policy reflected in the increased margins of the Democrats' majority in the 63<sup>rd</sup> House (1913–1915). Thus, the period from 1903 to 1915 was marked by fairly high tension which decreased by the end of the period, when the Democrats gained firm control of the House.

Furthermore, two specific phenomena had an impact on degree of tension within the U.S. House during this period.

The first phenomenon was the institution of the Speakership which emerged in the 1890s during the term of Thomas Brackett Reed and attained

its zenith during the tenure of the Republican Speaker Joseph Gurney Cannon in 1903–1911. Heavy-handed tactics of Cannon and his growing power in the House instigated strong opposition of the Democrats (and dissatisfied Republicans) which resulted in their revolt in 1910. This enhanced a strain in the House at the beginning of the 20th century.

The second tendency which affected polarization trend in the House was a so called seniority system. According to this system, long-serving members of Congress became more and more powerful, and, consequently, more and more independent of party. As Fig. 5 shows, from 1903 to 1915 the positions of the Representatives became less remote from each other, whereas clusters of the Democrats and the Republicans became more scattered. Such a tendency also resulted in the overall trend of decreasing polarization in the House from 1907 to 1915.

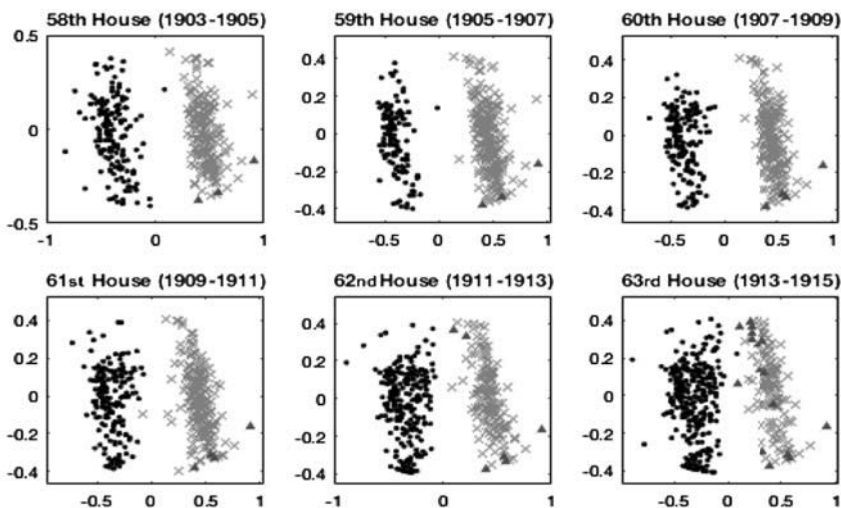


Fig. 5. Spatial model of the U.S. House of Representatives in 1903–1915

The values of polarization index presented in Table 3 are completely consistent with aforementioned trends. Indeed, the peaks of polarization correspond to the situations when majority in the House – either Democratic or Republican – eroded, and the numerical representation of parties was close to equal. On the other hand, the Houses characterized by the presence of majority with high margins exhibited less polarization. Moreover, polarization in-

dices attain local maximum in the 60<sup>th</sup> – 61<sup>st</sup> Houses (1907–1911) – when Speaker Cannon infuriated the Democrats – and decreases afterwards when Congressmen’s positions became closer and more scattered.

*Table 3. Polarization in the U.S. House of Representatives in 1903–1915*

House	Years	$P_{Euc}$	$P_{Man}$	$P_{Cheb}$
58 <sup>th</sup>	1903–1905	0,6431	0,5640	0,8439
59 <sup>th</sup>	1905–1907	0,5989	0,5250	0,7849
60 <sup>th</sup>	1907–1909	0,6157	0,5372	0,8121
61 <sup>st</sup>	1909–1911	0,6151	0,5375	0,8079
62 <sup>nd</sup>	1911–1913	0,5866	0,5158	0,7639
63 <sup>rd</sup>	1913–1915	0,5428	0,4801	0,7039

*64<sup>th</sup> House–67<sup>th</sup> House (1915–1923)*

The Democrats retained their control of the 64<sup>th</sup> – 65<sup>th</sup> Houses (1915–1919) with reduced margins, and it was their last majority before the next 16-years dominance of the Republicans in the House. Meanwhile, the Great War (later known as World War I) broke out in Europe. In 1917 Democratic President Woodrow Wilson delivered his war message, and the 65<sup>th</sup> Congress (1917–1919) declared war on Germany.

The Americans desired the war to end and blamed the Democratic President and the Democratic Party for failing to protect American people’s neutrality. Consequently, the popularity of the Democrats decreased, which helped the Republicans to easily win the majority in both the House and the Senate in the 1918 congressional elections.

After the end of the war, the Republican Congress encountered numerous problems, including strong opposition toward the U.S. membership in the League of Nations, the massive Steel Strike of 1919, the increasing support to reduce immigration (as a result of public fear of Communism), race riots spinning out of control.

As a result, the Republicans would gain a firmer majority control of both the House and the Senate in the 1920 congressional election. They were the most numerous in the 67<sup>th</sup> House (1921–1923) controlling almost 70% of the seats.

The values of polarization index presented in the Table 4 are consistent with political events and balance of powers in the House described above. Again, as the majority of the Republican Party became firmer, polarization in

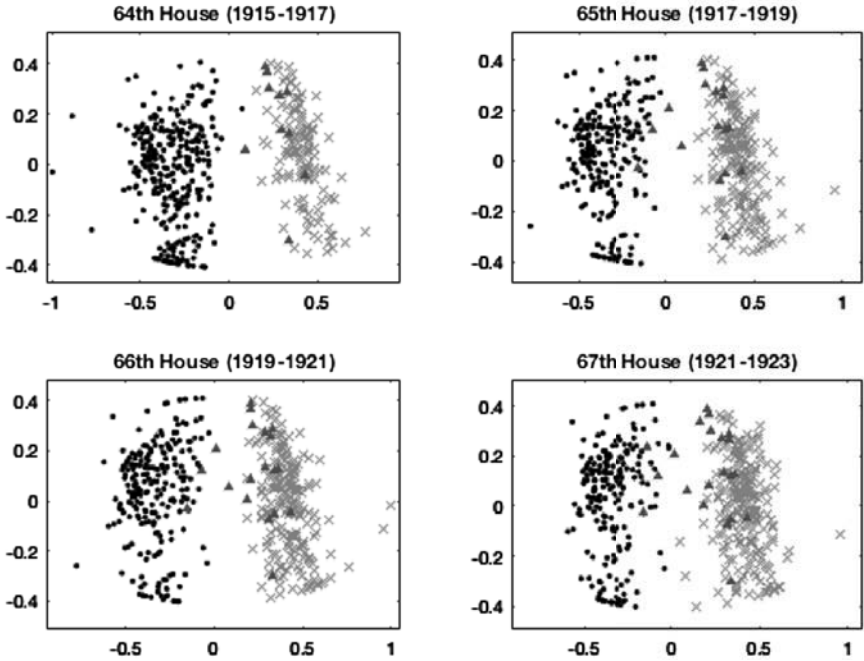


Fig. 6. Spatial model of the U.S. House of Representatives in 1915–1923

Table 4. Polarization in the U.S. House of Representatives in 1915–1923

House	Years	$P_{Euc}$	$P_{Man}$	$P_{Cheb}$
64 <sup>th</sup>	1915–1917	0,5973	0,5303	0,7711
65 <sup>th</sup>	1917–1919	0,5959	0,5300	0,7666
66 <sup>th</sup>	1919–1921	0,5880	0,5256	0,7529
67 <sup>th</sup>	1921–1923	0,5327	0,4743	0,6852

the House decreased. Even though the Republicans retained control over both the House and the Senate until 1931, the public support of their electorate was not sustained. It was the lowest in 1923, since the Republicans failed to bring the economy back to normal and effectively resolve the whole bunch of social problems the government encountered with. Under new Republican President, Calvin Coolidge, the American economy revived, which helped



the Republican Party to regain public support and get stronger majority in the House.

### *68<sup>th</sup> House – 76<sup>th</sup> House (1923–1941)*

Nevertheless, the economic upturn did not last long. The 71<sup>st</sup> Congress (1929–1931) confronted the worst economic situation in the American history. The 29<sup>th</sup> October, 1929, the notorious “Black Tuesday”, marked the beginning of the severe financial crisis in the U.S. and most of the world. The U.S. economy entered a major recession. To respond the 1929 stock market crash, the Republican-controlled Congress adopted the Smoot-Hawley Tariff Act which raised the prices of imported goods. However, as international trade collapsed, this tariff only exacerbated economic downturn.

In such unfavorable conditions the Republicans could barely maintain control of the House. Furthermore, after 14 Representatives-elect died between Election Day 1930 and the start of the 72<sup>nd</sup> Congress (1931–1933), special elections were held to replace these members. The Democrats managed to win enough special elections to gain a four-seat majority in the narrowly divided House.

The 72<sup>nd</sup> Congress tried to respond to the Great Depression. Particularly, it established the Reconstruction Finance Corporation to provide loans to industry and banks, but the Republican President Herbert Hoover vetoed regional public works projects. Furthermore, the President Hoover ordered the Army to expel wrathful unemployed World War I veterans who marched on the Capital to fight for their rights. These unpopular actions ultimately undermined the voters’ confidence in the Republicans.

Against the background of worsening economic condition and the Republicans constantly failing to refine it, the Democrats easily gained the majority in both houses in the 1932 congressional election. The 73<sup>rd</sup> House (1933–1935) was marked by the Democratic super-majority – the Democrats controlled more than 70% of the seats in the House. Moreover, the candidate from the Democratic Party, Franklin D. Roosevelt, was elected in the 1932 presidential elections. It was the beginning of the new period in the American government marked by the long and effective administration of President Roosevelt (lasted from 1933 to 1945) and 14-years long dominance of Democrats in both houses of the Congress.

During the Roosevelt’s presidency there was a shift in power towards the executive branch. The President Roosevelt initiated historic New Deal poli-

cies through the Democratic-controlled Congress. The 73<sup>rd</sup> Congress (1933–1935) passed an exceptional surge of legislation to combat the immediate economic chaos of the Great Depression. The 73<sup>rd</sup> Congress (1933–1935), approving the New Deal policies coming from the White House, regulated commercial banking, initiated ambitious infrastructure and construction projects, provided aid for farmers.

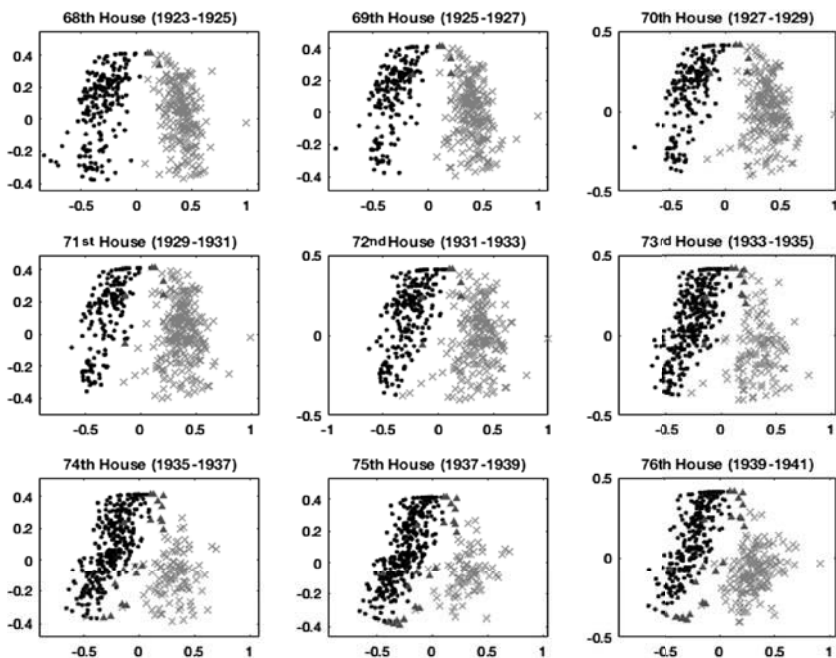


Fig. 7. Spatial model of the U.S. House of Representatives in 1923–1941

The 74<sup>th</sup> Congress (1935–1937), controlled by even larger Democratic majority, continued the New Deal reforms. The Congress encouraged collective bargaining, launched long-term Social Security program, provided for rural electrification. The efforts aimed at emerging from the crisis were not in vain and helped to bring the U.S. out of the crisis. The public support for the Democrats was exceptionally high. The President Roosevelt easily won re-election in the 1936 election, and Democratic Party maintained large congressional majority in the 75<sup>th</sup> House (1937–1939).

The 75<sup>th</sup> Congress was marked by emerged and strengthened “conservative coalition”, an unofficial coalition bringing together a conservative majority of the Republican Party and the Southern Democrats. In terms of congressional roll call votes, conservative coalition primarily appeared on the votes dealing with labor unions. Indeed, Fig. 7 demonstrates that two cluster of Congressmen “move” towards each other.

Table 5. Polarization in the U.S. House of Representatives in 1923–1941

House	Years	$P_{Euc}$	$P_{Man}$	$P_{Cheb}$
68 <sup>th</sup>	1923–1925	0,5847	0,5259	0,7453
69 <sup>th</sup>	1925–1927	0,5669	0,5102	0,7231
70 <sup>th</sup>	1927–1929	0,5682	0,5114	0,7258
71 <sup>st</sup>	1929–1931	0,5433	0,4906	0,6932
72 <sup>nd</sup>	1931–1933	0,5488	0,4954	0,6990
73 <sup>rd</sup>	1933–1935	0,4855	0,4401	0,6124
74 <sup>th</sup>	1935–1937	0,4541	0,4088	0,5791
75 <sup>th</sup>	1937–1939	0,4348	0,3883	0,5581
76 <sup>th</sup>	1939–1941	0,4993	0,4459	0,6418

As the Democratic Party gained firmer majority in the House from 1931 to 1939, polarization demonstrated downward trend achieving its historical minimum in the 75<sup>th</sup> House (1937–1939). The convergence of Party’s positions against the background of the unprecedented Democratic super-majority (accounting for almost 80% of seats in the House) in 1937–1939 reflected in the lowest polarization during the whole period from 1879 to 2015. It should be noted that this extraordinary configuration which led to extremely low polarization in the House was missed when applying approach suggested by K. Poole and H. Rosenthal.

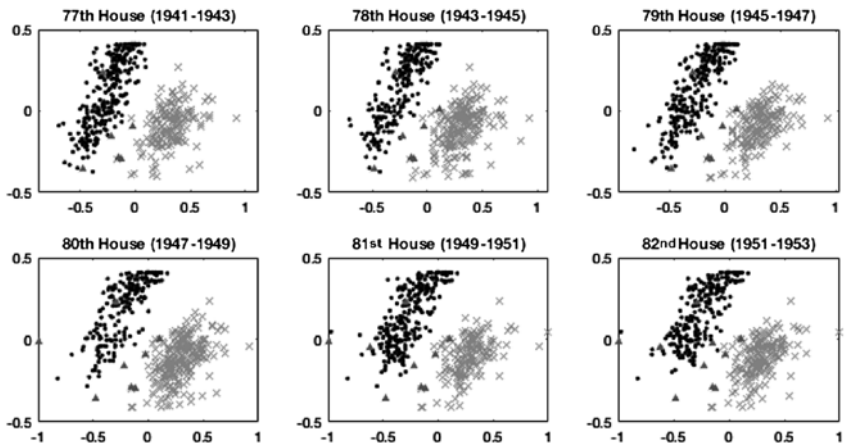
However, after the 1938 congressional election, the Republicans were able to take advantage of the 1937 Recession and gained 81 additional seats in the House of Representatives, so that the Democrats controlled “only” 60% of seats in the 76<sup>th</sup> House (1939–1941). Consequently, polarization in the House of Representatives increased as Republicans’ presence in the House became more pronounced.

*77<sup>th</sup> House – 83<sup>rd</sup> House (1941–1955)*

Although the Democratic congressional dominance weakened, the Democratic Party continued to maintain their majority in the House until 1947. The Democratic President Roosevelt was re-elected for the unprecedented third term. The European War, later became known as World War II, monopolized Congress's attention. The Lend-Lease Act permitted the U.S. to provide supplies to the Great Britain, whereas the peacetime draft was extended by just one vote in the House. The tension in the House had been slightly increasing. After the Japan bombarded Pearl Harbor in 1941, the 77<sup>th</sup> Congress (1941–1943) declared war on the Axis Powers.

In 1942 the voter turnout significantly decreased, and the Republicans managed to acquire significant gains in the congressional election that year. In the 78<sup>th</sup> Congress (1943–1945) the Democrats had only 13-seats majority in the House. Nonetheless, by the next, 1944 congressional election President Roosevelt was a glorified wartime hero, and the pro-Roosevelt Democrats were able to take advantage of extraordinary popularity of their informal leader gaining firm majority in the 79<sup>th</sup> House (1945–1947).

During 1947–1955 postwar time period both the Democrats and the Republicans controlled the House more or less successfully. Even though their numerical representation was not far from equal, positions of Congressmen in the House were quite close, which resulted in relatively low degree of polarization during this time.



**Fig. 8.** Spatial model of the U.S. House of Representatives in 1941–1953

Table 6. Polarization in the U.S. House of Representatives in 1941–1955

House	Years	$P_{Euc}$	$P_{Man}$	$P_{Cheb}$
77 <sup>th</sup>	1941–1943	0,5029	0,4445	0,6528
78 <sup>th</sup>	1943–1945	0,5130	0,4522	0,6657
79 <sup>th</sup>	1945–1947	0,5184	0,4524	0,6795
80 <sup>th</sup>	1947–1949	0,5035	0,4423	0,6540
81 <sup>st</sup>	1949–1951	0,5057	0,4417	0,6610
82 <sup>nd</sup>	1951–1953	0,5038	0,4385	0,6597
83 <sup>rd</sup>	1953–1955	0,5053	0,4404	0,6609

*84<sup>th</sup> House – 92<sup>th</sup> House (1955–1973)*

As a result of increased unemployment that spread throughout the U.S., the Democrats standing for larger support of jobless, won the 1954 election and regained majority in the 84<sup>th</sup> House. It was the beginning of the 40-years long Democratic dominance of the U.S. House of Representatives which lasted from 1955 to 1995.

As the response to increased unemployment, the Democrats in the 84<sup>th</sup> House (1955–1957) focused on public-works projects and increased Social Security benefits. These actions resulted in the reinforced public support for the Democrats. However, the Members of the next, 85<sup>th</sup> House (1957–1959) had to concentrate on the foreign challenges. The Cold War dominated the 85<sup>th</sup> Congress (1959–1961). The USSR’s success in space exploration spurred the “space race” between two superpowers, and the Congress initiated numerous policies aimed at development of space program. During the next decade the Congress faced numerous foreign and domestic challenges: an unpopular Vietnam War, race riots, economic recession and rising crime rate.

During this period the Congressmen from the Democratic and the Republican Party often managed to find common ground through compromise. The difference between average Republican and Democratic legislators became smaller and there was significant number of conservative Democrats and liberal Republicans. The lawmakers from both sides of the aisle used to meet in friendly informal setting to discuss, deal, and compromise on national problems in a bipartisan fashion. The period of 1950s and 1960s is often called “bipartisanship”.

Fig. 9 demonstrates this drift of parties towards each other, closer to the center of the political map (at least along the first dimension). In addition, the values of polarization index from 1955 to 1973 presented in Table 7 are quite low, which is much in line with aforementioned trend.

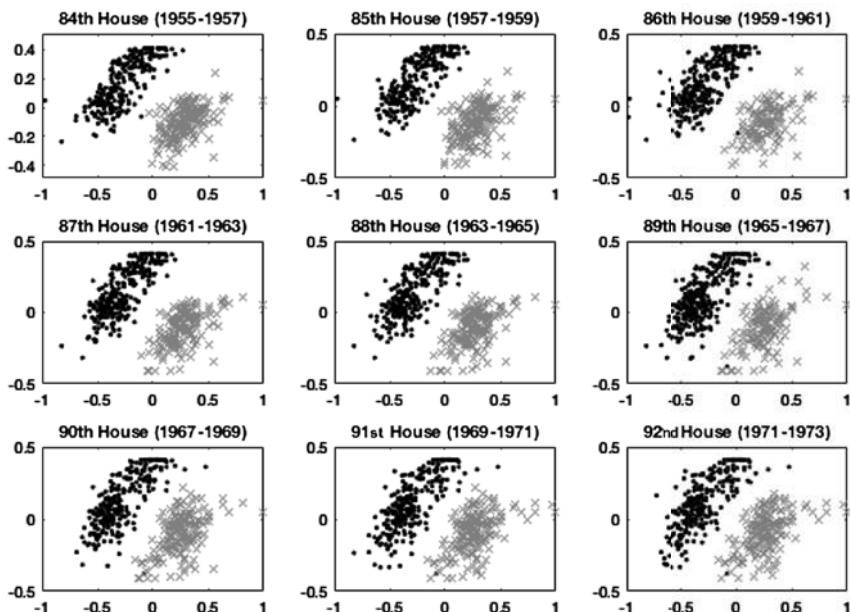


Fig. 9. Spatial model of the U.S. House of Representatives in 1955–1973

Table 7. Polarization in the U.S. House of Representatives in 1955–1973

House	Years	$P_{Enc}$	$P_{Man}$	$P_{Cheb}$
84 <sup>th</sup>	1955–1957	0,5135	0,4447	0,6747
85 <sup>th</sup>	1957–1959	0,5145	0,4477	0,6734
86 <sup>th</sup>	1959–1961	0,5004	0,4379	0,6531
87 <sup>th</sup>	1961–1963	0,5017	0,4347	0,6586
88 <sup>th</sup>	1963–1965	0,5062	0,4385	0,6650
89 <sup>th</sup>	1965–1967	0,4849	0,4254	0,6342
90 <sup>th</sup>	1967–1969	0,5086	0,4384	0,6729
91 <sup>st</sup>	1969–1969	0,5159	0,4440	0,6826
92 <sup>nd</sup>	1971–1973	0,5159	0,4460	0,6810

### 93<sup>th</sup> House – 101<sup>th</sup> House (1973–1991)

The period from 1970s to 1990s was marked by slim Democrats majorities in the House, which amplified the tension between the parties, discouraged friendly gatherings, which led to slowly increasing partisanship. In late

1970s and 1980s legislators voted increasingly in line with their party, and tended to be reluctant to compromise with their opponents. Fig. 10 exhibits the trend of alienation observed in the House from late 1980s.

The Watergate Scandal in early 1970s galvanized the Congress which investigated President Nixon's wrongdoing and concealment. The impeachment process and the whole scandal profoundly reshaped relations between the branches of power, the Congress began to reassert its authority.

In the aftermath of the Watergate Scandal and the President Nixon's resignation, the Democrats made huge electoral gains in the 94<sup>th</sup> House (1975–1977) following the 1974 congressional election. However, the American economy was in depression, and Democratic majority substantially eroded after the 1978 election. The Congress continued to struggle with heavy inflation, but it could barely get the country out of the prolonged recession.

Early 1990s were the last years of the long-lasting Democratic dominance in the House. Against the background of the weakening Democratic majority, the tension between the parties increased. Table 8 providing polarization index values for the period under consideration supports this tendency.

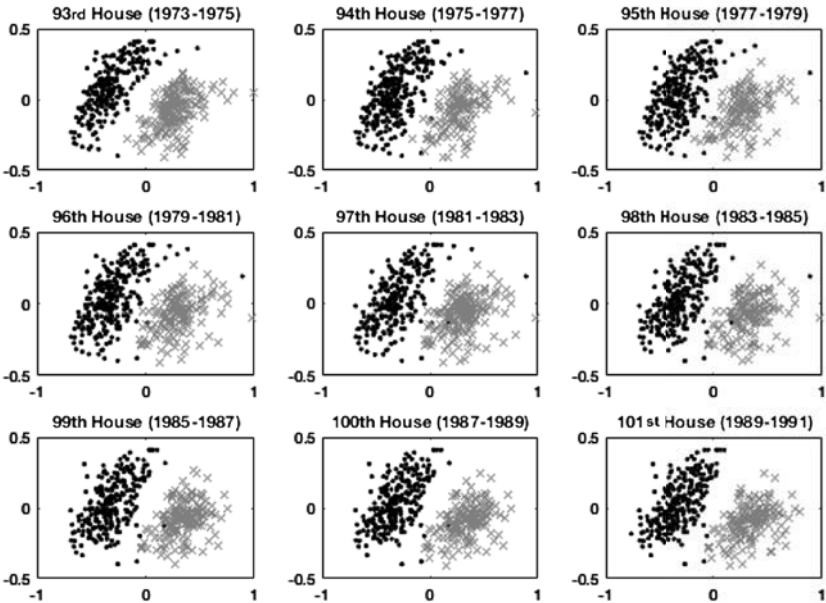


Fig. 10. Spatial model of the U.S. House of Representatives in 1973–1991

The balance of power shifted in favor of the Democrats for the last time in their 40-years dominance in the House after the Democratic candidate Bill Clinton won the 1992 presidential election. The Democrats bolstered their majority in the 103<sup>rd</sup> House (1993–1995), only to lose it in the next, 104<sup>th</sup> House (1995–1997). In 1994 the Republicans swept the congressional election and won the House for the first time in 40 years. This victory was partly conditioned by heavily promoted ambitious course “Contract with America” developed by the Republican Congressman Newt Gingrich. In addition, the universal health care program launched by Democratic President Clinton was coolly received by the public, which also improved the Republicans’ chances. The Republicans retained control of the House until 2007, when the Democrats gained the majority keeping it from 2007 to 2011.

*Table 8.* Polarization in the U.S. House of Representatives in 1973–1991

House	Years	$P_{Euc}$	$P_{Man}$	$P_{Cheb}$
93 <sup>rd</sup>	1973–1975	0,5123	0,4426	0,6767
94 <sup>th</sup>	1975–1977	0,4922	0,4286	0,6449
95 <sup>th</sup>	1977–1979	0,4883	0,4260	0,6389
96 <sup>th</sup>	1979–1981	0,5058	0,4386	0,6657
97 <sup>th</sup>	1981–1983	0,5257	0,4499	0,6989
98 <sup>th</sup>	1983–1985	0,5191	0,4451	0,6904
99 <sup>th</sup>	1985–1986	0,5296	0,4541	0,7040
100 <sup>th</sup>	1987–1989	0,5258	0,4488	0,7013
101 <sup>st</sup>	1989–1991	0,5306	0,4512	0,7096

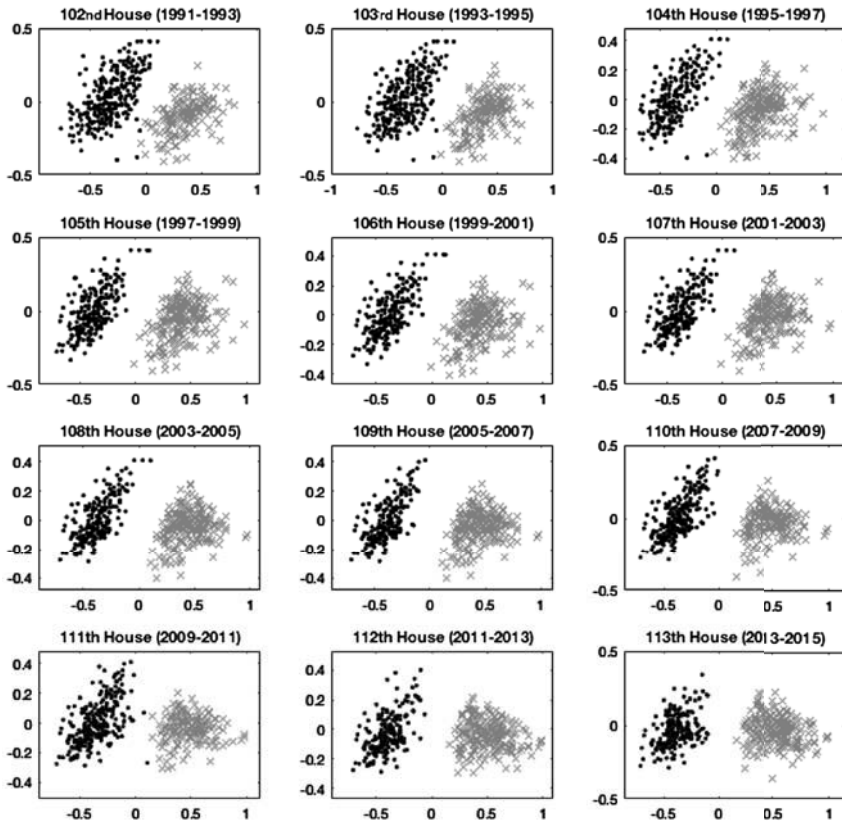
### *102<sup>nd</sup> House – 113<sup>th</sup> House (1991–2015)*

As we mentioned at the very beginning of the paper, the period from 1990s to the present day is marked by extremely increased partisanship in the House of the Representatives, with many votes split exactly on party lines. Fig. 11 demonstrates that the Republicans and the Democrats become more and more remote from each other.

The increasing political infighting between Democrats and Republicans during the beginning of the 21<sup>st</sup> is seen by some political scientists as one of the most pressing issues in the American political agenda. According to Mann and Ornstein (2012), hyperpolarization might expose the whole country to serious economic, political and even military threats, and “is undeniably the central and most problematic feature of contemporary American politics”.



The values of polarization index presented in Table 9 are fully consistent with political situation described above. The maximal value of polarization during the whole period under consideration (1879–2015) corresponds to the 113<sup>th</sup> House (2013–2015). To date, the trend of an increase in polarization in the U.S. House of Representatives continues.



**Fig. 11.** Spatial model of the U.S. House of Representatives in 1991–2015

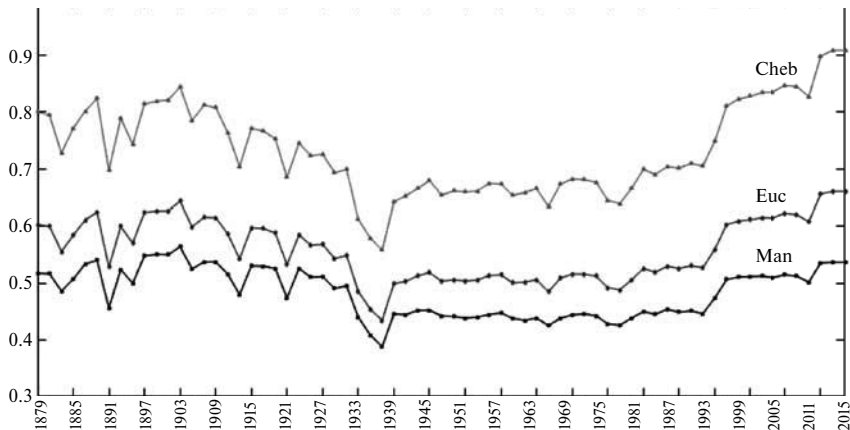
Fig. 12 exhibits the dynamics of polarization indices based on different distance functions during the whole period under consideration.

Again, as can be easily seen, polarization in the U.S. House was the lowest from 1930s until 1970s and the highest at the beginning of the 21<sup>st</sup> century. The whole bunch of literature exists exploring this trend in polarization

of the U.S. House of Representatives, its underlying causes and consequences (see Jacobson (1990), McCarty et al. (2006), Theriault (2008), Fiorina and Abrams (2008), Garand (2010)).

*Table 9.* Polarization in the U.S. House of Representatives in 1991–2015

House	Years	$P_{Euc}$	$P_{Man}$	$P_{Cheb}$
102 <sup>nd</sup>	1991–1993	0,5271	0,4463	0,7050
103 <sup>rd</sup>	1993–1993	0,5596	0,4737	0,7482
104 <sup>th</sup>	1995–1993	0,6027	0,5064	0,8104
105 <sup>th</sup>	1997–1995	0,6093	0,5106	0,8231
106 <sup>th</sup>	1999–1997	0,6114	0,5117	0,8275
107 <sup>th</sup>	2001–2003	0,6152	0,5123	0,8345
108 <sup>th</sup>	2003–2005	0,6147	0,5095	0,8351
109 <sup>th</sup>	2005–2007	0,6227	0,5148	0,8466
110 <sup>th</sup>	2007–2009	0,6205	0,5122	0,8450
111 <sup>th</sup>	2009–2011	0,6079	0,5018	0,8272
112 <sup>th</sup>	2011–2013	0,6560	0,5358	0,8982
113 <sup>th</sup>	2013–2015	0,6604	0,5367	0,9086



**Fig. 12.** Polarization in the United States House of Representatives 1879–2015

## 4. Conclusions

Application of the multidimensional index elaborated in Aleskerov and Oleynik (2016) being an extension of one-dimensional Aleskerov-Golubenko index turned out to be an effective measure of polarization of the United States House of Representatives.

Unlike the measure suggested by Poole and Rosenthal which is used in the only systematic study of congressional polarization, it takes into account both the extent to which congressmen from different parties are alienated from each other and their unanimity within their parties.

The values of estimated multidimensional polarization index are much in line with occurring political events and respective configurations of forces in the U.S. Congress..

The results obtained for the case of the United States House of Representatives are consistent with previous findings obtained by means of quantitative and qualitative methods. Moreover, the application of multidimensional index presented in this paper allows to catch some specific effects which were missed by previously suggested approaches.

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## Appendix

### *Number of the Independent Congressmen and the Congressmen affiliated to parties other than the Republican Party and the Democratic Party in the United States House of Representatives (1879–2015)*

46 <sup>th</sup> Congress (1879–1881)	<ul style="list-style-type: none"> <li>• 13 Nationals</li> <li>• 7 Independent Democrats</li> </ul>
47 <sup>th</sup> Congress (1881–1883)	<ul style="list-style-type: none"> <li>• 2 Readjuster Democrats</li> <li>• 1 Independent</li> <li>• 1 Independent Democrat</li> </ul>
48 <sup>th</sup> Congress (1883–1885)	<ul style="list-style-type: none"> <li>• 4 Readjusters</li> <li>• 3 Independent Democrats</li> <li>• 2 Independents</li> <li>• 2 Nationals</li> <li>• 1 Independent Republican</li> </ul>
49 <sup>th</sup> Congress (1885–1887)	<ul style="list-style-type: none"> <li>• 1 Independent Democrat</li> <li>• 1 National</li> </ul>
50 <sup>th</sup> Congress (1887–1889)	<ul style="list-style-type: none"> <li>• 2 Independent Republicans</li> <li>• 2 Labors</li> <li>• 1 Independent</li> <li>• 1 National</li> </ul>
51 <sup>st</sup> Congress (1889–1891)	<ul style="list-style-type: none"> <li>• 1 Labor</li> </ul>
52 <sup>nd</sup> Congress (1891–1893)	<ul style="list-style-type: none"> <li>• 8 Populists</li> </ul>
53 <sup>rd</sup> Congress (1893–1895)	<ul style="list-style-type: none"> <li>• 11 Populists</li> <li>• 2 Independent Democrats</li> <li>• 1 Silver</li> </ul>
54 <sup>th</sup> Congress (1895–1897)	<ul style="list-style-type: none"> <li>• 9 Populists</li> <li>• 1 Silver</li> </ul>
55 <sup>th</sup> Congress (1897–1899)	<ul style="list-style-type: none"> <li>• 22 Populists</li> <li>• 3 Silver Republicans</li> <li>• 1 Independent Republican</li> <li>• 1 Silver</li> </ul>
56 <sup>th</sup> Congress (1899–1901)	<ul style="list-style-type: none"> <li>• 5 Populists</li> <li>• 2 Silver Republicans</li> <li>• 1 Independent Populist</li> <li>• 1 Silver</li> </ul>
57 <sup>th</sup> Congress (1901–1903)	<ul style="list-style-type: none"> <li>• 5 Populists</li> <li>• 1 Silver Republican</li> </ul>
58 <sup>th</sup> Congress (1903–1905)	<ul style="list-style-type: none"> <li>• 3 Independent Republicans</li> </ul>
60 <sup>th</sup> Congress (1907–1909)	<ul style="list-style-type: none"> <li>• 1 Independent Republican</li> </ul>
62 <sup>nd</sup> Congress (1911–1913)	<ul style="list-style-type: none"> <li>• 1 Progressive Republican</li> <li>• 1 Socialist</li> </ul>
63 <sup>rd</sup> Congress (1913–1915)	<ul style="list-style-type: none"> <li>• 9 Progressives</li> <li>• 1 Independent</li> </ul>

64 <sup>th</sup> Congress (1915–1917)	<ul style="list-style-type: none"> <li>• 6 Progressive</li> <li>• 1 Independent</li> <li>• 1 Prohibitionist</li> <li>• 1 Socialist</li> </ul>
65 <sup>th</sup> Congress (1917–1919)	<ul style="list-style-type: none"> <li>• 3 Progressives</li> <li>• 1 Independent Republican</li> <li>• 1 Prohibitionist</li> <li>• 1 Socialist</li> </ul>
66 <sup>th</sup> Congress (1919–1921)	<ul style="list-style-type: none"> <li>• 1 Prohibitionist</li> <li>• 1 Union-Labor</li> </ul>
67 <sup>th</sup> Congress (1921–1923)	<ul style="list-style-type: none"> <li>• 1 Independent Republican</li> <li>• 1 Socialist</li> </ul>
68 <sup>th</sup> Congress (1923–1925)	<ul style="list-style-type: none"> <li>• 2 Farmer-Labor</li> <li>• 1 Socialist</li> </ul>
69 <sup>th</sup> Congress (1925–1927)	<ul style="list-style-type: none"> <li>• 3 Farmer-Labor</li> <li>• 1 American-Labor</li> <li>• 1 Socialist</li> </ul>
70 <sup>th</sup> Congress (1927–1929)	<ul style="list-style-type: none"> <li>• 2 Farmer-Labor</li> <li>• 1 Socialist</li> </ul>
71 <sup>st</sup> Congress (1929–1931)	<ul style="list-style-type: none"> <li>• 1 Farmer-Labor</li> </ul>
72 <sup>nd</sup> Congress (1931–1933)	<ul style="list-style-type: none"> <li>• 1 Farmer-Labor</li> </ul>
73 <sup>rd</sup> Congress (1933–1935)	<ul style="list-style-type: none"> <li>• 5 Farmer-Labor</li> </ul>
74 <sup>th</sup> Congress (1935–1937)	<ul style="list-style-type: none"> <li>• 7 Progressives</li> <li>• 3 Farmer-Labor</li> </ul>
75 <sup>th</sup> Congress (1937–1939)	<ul style="list-style-type: none"> <li>• 8 Progressives</li> <li>• 5 Farmer-Labor</li> </ul>
76 <sup>th</sup> Congress (1939–1941)	<ul style="list-style-type: none"> <li>• 2 Progressives</li> <li>• 1 American-Labor</li> <li>• 1 Farmer-Labor</li> </ul>
77 <sup>th</sup> Congress (1941–1943)	<ul style="list-style-type: none"> <li>• 3 Progressives</li> <li>• 1 American-Labor</li> <li>• 1 Farmer-Labor</li> <li>• 1 Independent Democrat</li> </ul>
78 <sup>th</sup> Congress (1943–1945)	<ul style="list-style-type: none"> <li>• 2 Progressives</li> <li>• 1 American-Labor</li> <li>• 1 Farmer-Labor</li> </ul>
79 <sup>th</sup> Congress (1945–1947)	<ul style="list-style-type: none"> <li>• 1 American-Labor</li> <li>• 1 Progressive</li> </ul>
80 <sup>th</sup> Congress (1947–1949)	<ul style="list-style-type: none"> <li>• 1 American-Labor</li> </ul>
81 <sup>st</sup> Congress (1949–1951)	<ul style="list-style-type: none"> <li>• 1 American-Labor</li> </ul>
82 <sup>nd</sup> Congress (1951–1953)	<ul style="list-style-type: none"> <li>• 1 Independent</li> </ul>
83 <sup>rd</sup> Congress (1953–1955)	<ul style="list-style-type: none"> <li>• 1 Independent</li> </ul>
84 <sup>th</sup> Congress (1955–1957)	<ul style="list-style-type: none"> <li>• 1 Independent Democrat</li> </ul>
86 <sup>th</sup> Congress (1959–1961)	<ul style="list-style-type: none"> <li>• 1 Independent Democrat</li> </ul>
93 <sup>rd</sup> Congress (1973–1975)	<ul style="list-style-type: none"> <li>• 1 Independent Democrat</li> </ul>



97 <sup>th</sup> Congress (1981–1983)	• 1 Independent
102 <sup>nd</sup> Congress (1991–1993)	• 1 Independent
103 <sup>rd</sup> Congress (1993–1995)	• 1 Independent
104 <sup>th</sup> Congress (1995–1997)	• 1 Independent
105 <sup>th</sup> Congress (1997–1999)	• 1 Independent
106 <sup>th</sup> Congress (1999–2001)	• 1 Independent
107 <sup>th</sup> Congress (2001–2003)	• 2 Independents
108 <sup>th</sup> Congress (2003– 2005)	• 1 Independent
109 <sup>th</sup> Congress (2005–2007)	• 1 Independent

**Олейник, В. В.**

Анализ Палаты представителей США (1879–2015 гг.) с помощью многомерного индекса поляризованности [Текст] : препринт WP7/2016/07 / В. В. Олейник ; Нац. исслед. ун-т «Высшая школа экономики». – М. : Изд. дом Высшей школы экономики, 2016. – (Серия WP7 «Математические методы анализа решений в экономике, бизнесе и политике»). – 36 с. – 8 экз. (на англ. яз.)

Проведен анализ Палаты представителей Конгресса США (1879–2015 гг.) с помощью многомерного индекса поляризованности, основанного на первом центральном моменте системы точек.

Приведены краткий обзор соответствующей литературы и описание модели многомерного индекса поляризованности. Описана структура Конгресса США, а также важнейшие события в его истории.

При анализе Палаты представителей США была использована двумерная модель, основанная на значениях DW-NOMINATE. Поляризованность Палаты представителей США оценена с помощью различных версий многомерного индекса поляризованности. Полученные результаты хорошо согласуются с соответствующей политической ситуацией.

Согласно полученным результатам, Палата представителей США была наименее поляризованной в период с 1930-х по 1970-е годы. Наиболее поляризованной оказалась Палата Представителей 113-го Конгресса США (2011–2015 гг.).

*Препринт WP7/2016/07*

*Серия WP7*

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в экономике, бизнесе и политике

Олейник Виктория Валерьевна

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*(на английском языке)*

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