

A Social Choice Analysis of the Selection of Federal Reserve Bank Cities

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Abstract: The Federal Reserve Act (1913) established the Reserve Board Organization Committee (RBOC) to determine the number and location of Federal Reserve districts and Reserve banks. As part of their information gathering, the RBOC conducted two polls of national banks. One poll requested preferences on up to 12 cities, and the other requested a rank ordering of the top three. We analyze these votes and show that the selected cities are not wholly consistent with either poll. An aggregation based on simple plurality vote sorted by district correctly identifies 11 of the 12 selected cities; the exception being Cleveland's selection over Pittsburgh. Other aggregation methods analyzed here predict fewer of the selected cities, and we show that any other scoring rule would be inconsistent with at least one of the 12 selections.

Keywords: Federal Reserve; preference aggregation rules; monetary institutions.

1. INTRODUCTION

The central bank of the United States, officially called The Federal Reserve, was created by an act of Congress in 1913. The Federal Reserve Act of 1913 provided for a Reserve Bank Organization Committee (RBOC) to determine the number of districts, their boundaries, and particular cities to host each district's reserve bank. The RBOC was empowered "to designate not less than eight nor more than twelve ... Federal reserve cities. The determination [of the RBOC] shall not be subject to review except by the Federal Reserve Board when organized" (Sec. 2).

The RBOC subsequently conducted two polls of the 7,471 national banks in the country, all of which were required to become part of the new Federal Reserve System [1].¹ First, banks were instructed to list from 8 to 12 potential cities for selection. The range listed matches the language in the Federal Reserve Bank Act because the RBOC had not yet determined how many districts would be created. Second, banks were told to rank their first, second, and third preferences for the city with which it would be affiliated. The RBOC did not specify how they would tally the preference votes or to what extent it would influence their decisions.

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1 The Federal Reserve Act made Fed membership of the more than 19,000 state banks voluntary, and very few initially joined [2 pp. 41-45].

Over 100 cities received at least one vote in the second poll, including 60 distinct first-preference cities. Table 1 lists the twelve cities eventually selected by the RBOC. Only Missouri became a multi-Fed city state. See also Fig. (1) for a map of district boundaries and location of headquarter cities.

Table 1. Federal Reserve banks.

District	City
1	Boston, MA
2	New York, NY
3	Philadelphia, PA
4	Cleveland, OH
5	Richmond, VA
6	Atlanta, GA
7	Chicago, IL
8	St. Louis, MO
9	Minneapolis, MN
10	Kansas City, MO
11	Dallas, TX
12	San Francisco, CA

From the very beginning, several of the selections made by the RBOC were called into question [4-5] and remain controversial to this day [1, 6-8]. While there has been some prior discussion of the votes [1, 9-10], no extensive analysis has yet been undertaken.² We

2 McAvoy [11], Binder and Spindel [6], Jaremski and Wheelock [12] and Heckelman and Wood [8] included bank first-place votes from



Source: Reserve Bank Organization Committee [3]

Fig. (1). Map of original (1913) Federal Reserve districts and cities (bolded and underlined).

will do so here in an attempt to determine banker preferences from the polling results and then evaluate to what extent the RBOC followed these inferred aggregated preferences. We find, under the assumption of pre-determined district boundaries, the RBOC's selections were consistent with banker first preferences in the second poll for all districts except the fourth, where Cleveland was selected ahead of more popular Cincinnati and Pittsburgh. Yet relying on only first preference votes to determine banker preferences ignores additional information contained in their second and third preferences which were also solicited. Two alternative scoring rules which account for this information, presented here in the form of Limited Voting or the Borda Rule (both rules defined below), suggest that in addition to Cleveland being problematic, the selection of Richmond over Baltimore to host the fifth district may also not have been in alignment with banker preferences. These findings corroborate the general consensus view of critics who point to the selection of Cleveland and Richmond in particular as the most controversial selections [1].

2. POLLING DATA ON BLOCK VOTES

The first poll asked bankers to vote in a manner consistent with *Block* voting, which is a method used to select multiple winners. Block voting allows voters to indicate up to k preferences where k represents the number of winners needed. Each listed preference receives one point and the k alternatives with the most points are selected. The RBOC instructed bankers to list (unordered) 8-12 potential cities as their preferences, because at the time it was only known there would be from 8-12 cities selected but the decision to have the maximum allowable 12 districts had not yet been determined.

If the RBOC were strictly following the banker preferences, then the top 12 Block voting cities would have been selected. The Block points for the top 29 cities, taken from Elliott [13],³ are listed in order in Table 2, with the upper panel indicating the cutoff for the twelfth ranked city. This ranking is consistent with only 9 of the 12 selected cities; New Orleans, Denver, and Seattle were much more popular with the bankers overall than the selected cities of Dallas, Cleveland, and Richmond.

the second poll as an explanatory variable in RBOC selection regressions. None of these studies considered alternative forms of aggregating votes, or analyzed the rank order of votes.

³When presenting the block vote results, Elliott's [13] report only lists the top 29 cities. Any other cities receiving block votes are unknown.

Table 2. Block vote totals.

City	Total	Rank	District
Chicago*	5844	1	7
New York*	5792	2	2
San Francisco*	5320	3	12
St. Louis*	4871	4	8
New Orleans*	4576	5	6
Boston*	4341	6	1
Denver*	4098	7	10
<i>Atlanta</i>	3366	8	6
Philadelphia*	2043	9	3
Minneapolis*	2011	10	9
Seattle	1835	11	12
<i>Kansas City</i>	1399	12	10
Washington*	1148	13	5
Pittsburgh*	1107	14	4
Baltimore	1099	15	5
Cincinnati	1079	16	4
St. Paul	709	17	9
Portland	697	18	12
Dallas*	632	19	11
Omaha	557	20	10
<i>Cleveland</i>	467	21	4
Houston	382	22	11
<i>Richmond</i>	360	23	5
Louisville	232	24	8
Los Angeles	228	25	12
Salt Lake City	170	26	12
Fort Worth	162	27	11
Memphis	149	28	8
Spokane	98	29	12

Notes: * indicates top vote total in its district; italics indicates actual reserve bank city with less than the top vote in its district.

In defending its decisions to Congress, the RBOC compared selected cities against alternative cities in the same district. This would tend to suggest that districts were determined before representative cities within each district were selected. One reason for doing so might be to enable a more equitable distribution of capital across the districts, and can help explain why New York, the financial capital of the country, represents a district unto itself [14, 15]. If boundaries were established prior to viewing the polling data, then selecting the top 12 cities would be problematic, as dis-

tricts 6, 10 and 12 would have two cities each, and districts 4, 5, and 11 would have none.

Perhaps the RBOC decision would be consistent with banker preferences if rather than selecting the top 12 cities regardless of geographic location, the RBOC examined the votes in order to select the most preferred cities under the constraint of only one city per predetermined district. The asterisks next to city names indicate the top vote receiving cities in each district. Under this decision rule, Washington (district 4), Pittsburgh (district 5), and Dallas (district 11) would replace Atlanta, Seattle, and Kansas City. This procedure would still misidentify four of the unique districts (4, 5, 6, 10) and it is therefore unlikely the Block votes played much of a role in RBOC selections.

3. ANALYSIS OF PREFERENCE VOTES

The second poll indicated bankers should rank order their top three preferences for the city with which they want their own bank to be associated. It was not stated how the preference polling data would be aggregated. Most voting rules can be lumped into one of three categories. *Paired comparison* rules utilize a series of pairwise majority votes, either by setting an established single-elimination *sequential agenda* or by considering all the potential pairings. An example of the latter is the *Copeland* rule which establishes the winner as the alternative which won the most pairings. Because 12 winners are needed here, the cities could be ranked by their number of pairwise victories, and the top 12 would be selected.

Another category of voting rules consists of *iterated* procedures, where cities would be eliminated one at a time until only 12 are left, or selected one at a time until 12 winners are found. Under the *Hare* rule, for example, cities would be eliminated one at a time by fewest number of first place votes, and the votes for eliminated cities would then be transferred to the next ranked city on a banker's ballot, until there are only 12 cities remaining. Under *Single Transferable Voting*, a quota is established whereby any city having enough first place votes is selected, and any surplus of votes above the quota are reapportioned to the next ranked city on banker ballots.⁴ This process is continued until 12 cities meet the quota.

Although we have summary information from RBOC on the number of first, second, and third place votes each city received, we would need all of the actual preference ballots to simulate all the pairwise votes or to know how to transfer votes under an iterated proce-

4 There are various methods for establishing how to reapportion the surplus. See Tideman [16] for details.

Table 3. Top 30 vote totals under three different scoring rules.

City	Plurality	City	Limited Vote	City	Borda
Chicago*	908	Chicago*	2327	Chicago*	4747
New York*	673	New York*	1694	New York*	3855
Philadelphia*	509	St. Louis*	1297	St. Louis*	2482
Kansas City*	497	Philadelphia*	1064	Philadelphia*	2362
Minneapolis*	413	Kansas City*	874	Kansas City*	2080
Pittsburgh*	355	Cincinnati*	679	Minneapolis*	1659
St. Louis*	302	Minneapolis*	671	Cincinnati*	1480
Cincinnati	301	Pittsburgh	566	Pittsburgh	1381
Boston*	291	Boston*	522	Boston*	1212
San Francisco*	259	Dallas*	478	Dallas*	1117
Dallas*	247	St. Paul	470	San Francisco*	1070
Omaha	220	Omaha	439	Omaha	1006
Richmond*	170	San Francisco*	437	St. Paul	992
Baltimore	141	Baltimore*	433	Baltimore*	865
Denver	136	<i>Richmond</i>	327	<i>Richmond</i>	742
Atlanta*	124	<i>Cleveland</i>	326	<i>Cleveland</i>	660
Louisville	116	Atlanta*	275	Atlanta*	612
<i>Cleveland</i>	112	Houston	268	Louisville	559
Houston	97	Washington	267	Houston	542
St. Paul	95	Louisville	250	Denver	535
Fort Worth	85	Denver	224	Fort Worth	439
Portland	75	Fort Worth	196	Washington	422
Columbus	64	New Orleans	192	Portland	375
Birmingham	55	Portland	167	Columbus	332
New Orleans	51	Columbus	152	New Orleans	324
Seattle	40	Albany	129	Los Angeles	263
Salt Lake City	31	Los Angeles	124	Seattle	232
Spokane	30	Seattle	123	Albany	223
Washington	28	Lincoln	116	Lincoln	223
Los Angeles	26	Savannah	110	Savannah	223

Notes: * indicates top vote total in its district; italics indicates actual reserve bank city with less than the top vote in its district

discuss⁵. Thus, we are unable to analyze preferences under these voting mechanisms. Instead, we analyze the votes by considering various *scoring* rules. A scoring rule assigns points to each preference ranking such that higher ranked preferences receive at least as many points as a lower ranked preference. To aid the

discussion below, let s_i represent the weights assigned to the i th ranked alternative, with $s_i \geq s_j$ for all $i < j$, and $s_1 > s_n$, where n represents the total number of alternatives under consideration. The k alternatives with the greatest number of points are selected as winners.

We initially consider three types of scoring rules. The *Plurality* rule assigns one point to the top preference only and zero points to any others, i.e. $s_1 = 1$ and $s_i = 0$ for all $i > 1$. The *Limited Vote* assigns one point to the m top ranked preferences, where $m < k$, and zero

⁵ Given there were 116 cities receiving votes, it is unlikely iterative or round-robin methods were used.

points to the rest. Because the top 3 preferences were required for the poll, we use $m = 3$ in our analysis.⁶ Thus, $s_1 = s_2 = s_3 = 1$, $s_i = 0$ for all $i > 3$. The Borda rule assigns one point to the bottom ranked preference and one additional point to each alternative for every position it is ranked higher, i.e. $s_n = 1$ and $s_i = s_{i+1} + 1$ for all i . Under the traditional Borda rule all n alternatives must be ranked. Here, bankers were not limited to which cities they could rank and it would be infeasible to rank every city in the country. Because the RBOC limited the ranking to only 3 cities, we can only analyze a truncated version of Borda,⁷ which would be equivalent to setting $n = 3$ and thereby assign 3 points to the top rank, 2 points to the second rank, and 1 point to the third and final rank, or $s_1 = 3$, $s_2 = 2$, $s_3 = 1$, and $s_i = 0$ for all $i > 3$.

Table 3 presents calculations for Plurality votes, Limited Votes, and Borda scores. There were 60 cities that received at least one first place vote, and 116 cities that appeared on at least one preference ballot.⁸ In the table we list only the top 30 under each scoring rule. None of these voting methods are completely consistent with the 12 selected Fed cities, either by the top 12 overall (upper panel) or the top city from each district (denoted again by asterisks). Based on Plurality voting, Pittsburgh, Cincinnati and Omaha received more first place votes than the selected cities of Richmond, Atlanta, and Cleveland. Richmond and Atlanta did, however, receive more first place votes than any other city from their respective districts, although Cleveland was far behind the plurality leader Pittsburgh in its district. Thus, the RBOC selections could be consistent with banker first place preferences, except for the selection of Cleveland in the Fourth District.

In its report to the Senate [17], the committee presented a detailed breakdown of first place votes only. Yet, presumably the RBOC did not limit itself to considering only first place votes or else there would have been no point in requesting information on second and third place votes. Treating all votes equally, the Limited Vote creates the same top 12 as Plurality, except St Paul replaces San Francisco (and the specific ordering of the top 12 differs). This is because although St Paul

received 164 fewer first place votes than did San Francisco, St Paul received many more second and third place votes. Although San Francisco was not in the top 12 overall, it did receive more Limited Votes than any other 12th District city (270 more than Portland). In addition to San Francisco, sorting by district would entail Baltimore and Atlanta replacing top 12 finishers Pittsburgh, St Paul, and Omaha. Yet the selection of Richmond instead of Baltimore, and Cleveland instead of Cincinnati, suggests Limited Voting is less accurate than simple Plurality in matching the RBOC selections. Note also that, under Limited Voting, Cincinnati is more popular in the Fourth District than is Pittsburgh despite receiving fewer first place votes. This is because Cincinnati received 167 more second and third place votes than did Pittsburgh and was thus able to easily overcome its 54 vote Plurality deficit. This suggests Pittsburgh as a more polarizing choice compared to Cincinnati; bankers who did not rank Pittsburgh first were less apt to rank it at all within their top 3, than they were to rank Cincinnati within their top 3.

Although the Limited Vote takes into account more information than does Plurality, it still treats all ranked preferences equally; in essence there is no added information from ranking the top 3 in order as opposed to simply listing the cities without order as in Block voting under the first poll. Thus, we expect the RBOC was interested in treating the votes differently. We consider the (truncated) Borda rule for this purpose. Analyzing the Borda scores yields similarities to both Plurality and Limited Voting. As shown in the final column of Table 3, the Borda scores have the same overall top 12 (but different ordering) as Plurality. Sorting by district, however, yields the same city winners as under Limited Voting. Note in particular that Cincinnati is again more popular in the Fourth District than is Pittsburgh for the same reason as above. Had most of the additional Cincinnati votes under Limited Voting been exclusively third place votes its Borda score could have been lower than Pittsburgh. Rather, there were 94 more second place votes as well as 73 more third place votes than for Pittsburgh.

Thus, it appears the closest match to the RBOC selections is based on Plurality voting after sorting by district, with the lone "error" being the selection of Cleveland over the Fourth District Plurality winner Pittsburgh. Both Limited Voting and Borda would also indicate Baltimore was more popular than Richmond within the Fifth District, although Richmond received the plurality of first-preference votes.

Although we have analyzed three typical scoring rules, there are an infinite number of potential scoring rules the RBOC could have employed. We now show the RBOC selections are inconsistent with any scoring rule based on ranking just three cities. In particular, no

6 Block voting would set $m = k$, whereas Plurality sets $m = 1$.

7 An example of a truncated Borda rule used in practice is by The Associated Press which instructs sportswriters to rank their personal top 25 college basketball teams, rather than all (currently) 351 Division I schools. Points are then assigned as $s_{25} = 1$, $s_i = s_{i+1} + 1$ for all $i < 25$.

8 Altoona, Fort Smith, Fremont, Kalamazoo, Kingston, Madison, Middletown, Phoenix, Raleigh, Reading, Reno, Rock Island, Shreveport, Stamford, Stockton, Uniontown, Whittier, and Winona each received only a single third place vote.

scoring rule would be able to create more points for Cleveland than either Pittsburgh or Cincinnati. The breakdown of first, second, and third place votes for these cities are presented in Table 4. Cincinnati has more first place, more second place, and more third place votes than does Cleveland. While this is not true for Pittsburgh, Pittsburgh does have more first place votes than Cleveland has *total* votes. No matter how the scores are weighted, as long as the first place votes are assigned at least as high a score as the lowest third place votes, as required by definition for scoring rules, then both Cincinnati and Pittsburgh must end up with greater tallies than Cleveland. Because Cleveland has more second but fewer third place votes than Pittsburgh, the closest Cleveland can come to Pittsburgh is when second place votes are weighted as high as possible but third place votes are weighted as low as possible. Yet second place votes are not allowed to be counted more than first place votes, and the higher the weight assigned to first place the greater the differential between Pittsburgh and Cleveland. Thus the most beneficial scoring rule for Cleveland would entail $s_1 = s_2 = 1$ and $s_3 = 0$, which would be equivalent to Limited Voting when setting $k = 2$. This would still leave Cleveland with a deficit of 238 points. Because Cincinnati has more votes in every category than does Cleveland, assigning any non-zero weights to any preference rank will always hurt Cleveland relative to Cincinnati. Thus Cleveland is harmed least when the fewest points possible are assigned, which occurs under the Plurality rule where Cleveland received 189 fewer votes/points than Cincinnati. Any other scoring rule can only increase Cleveland's deficit relative to Cincinnati. Thus, Cleveland cannot be selected under any scoring rule.

Table 4. Preference votes for district 4 cities.

City	First	Second	Third
Pittsburgh	355	105	106
Cincinnati	301	199	179
Cleveland	112	110	104
Columbus	64	52	36

Each of the three scoring rules yields the same top 12 overall cities, except Limited Voting includes St Paul whereas Plurality and Borda include San Francisco. Thus unless all preference votes are treated the same, it appears bankers generally preferred San Francisco over St Paul. Furthermore, Chicago and New York are ranked first and second overall under all three systems. Thus, except for St Paul versus San Francisco, each of these scoring rules presents a consistent picture of overall bank preferences for the 12 reserve bank cities. Once the district boundaries are set, it is also clear as

to the aggregated bank preference within each district, except in two cases. Determining bank preferences regarding district 4 as Pittsburgh or Cincinnati depends on the scoring rule (but in no case can it ever be Cleveland) and in district 5 could be either Richmond or Baltimore. Thus although Richmond was considered a controversial selection [1], it might have been consistent with the bank preferences for that district as long as first place preference rankings were given sufficiently greater scoring weights relative to second and third place preferences. Cleveland is generally described as being selected for political reasons [18-19] and we find it cannot be justified based on any aggregation of revealed banker preferences.

CONCLUSION

We have undertaken the first formal analysis of national bank preferences for the selection of Federal Reserve Bank cities. Our findings are consistent with 12 selections made by the RBOC, with one exception, under the assumptions of disproportionate weight being assigned to top preferences over second and third ranked preferences, and district boundaries being determined prior to selecting cities. The one exception occurs in the fourth district where Cleveland was selected despite having fewer votes in every respective ranking than does Cincinnati and also fewer first preference votes than Pittsburgh, both of which are also within the fourth district boundaries. In addition, equal weighting of top 3 preferences as in a Limited Vote, or equal differential weighting of the top 3 as in a truncated Borda vote, would identify Baltimore as the preferred city over the RBOC's selection of Richmond for hosting the fifth district, although the difference was not as dramatic as for Cincinnati over Cleveland. Finally, in every method of aggregation considered, and in both polls, Chicago was revealed to be the top vote receiving city overall despite New York being the financial center of the nation.

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