Dizzying Dyadics

Differences in Assessing Dyadic Relationships with Automatic and Manual Event Classification

Tyler Ashoff

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Abstract

This study seeks to understand the level of agreement between two human and machine coded event databases, the COPDAB dataset and Cline Center Historical Phoenix dataset respectively. By investigating the dyadic relationships of six countries between 1955 and 1978 and varying the level of aggregation, we show that there are conditions where this agreement can be strong. However, this is not always the case. In many instances especially at lower levels of aggregation, we see this agreement weaken drastically.

Introduction

Dyadic relationships are important to understand in international relations. Tracking how countries respond to each other and exogenous shocks is critical to understanding what drives ~~these~~ interactions. To make this analysis possible there needs to be a consistent and reliable source for measuring these relationships. Event databases seek to fill this role by classifying events and scoring them based on the conflictual or cooperative nature of each event. Historically these events were human coded and more recently they are automated by performing text analysis on news stories.

How accurately each of these methods classify events is an ongoing topic of research. As is defining the scales ~~on~~ which the intensity of the events is measured. This study though, does not seek to compare these databases to ground truth. Rather we examine how the agreement between human coded and automatically coded datasets in measuring dyadic relationships between 6 countries between 1955 and 1978. By conducting our analysis at varying time scales we can determine the effect of granularity on this agreement. To assess this agreement we calculate the Pearson and Spearman correlations and the dynamic time warping distance to capture similarity between signals despite possible misalignment.

Ideally, this research can be used to make more informed decisions about event database usage and understand the conditions where agreement between human and automatically coded datasets largely agree.

Data

Two conflict datasets were used in this study, one manually coded and another automatically coded. These records contain more detailed information about the events than ~~we will use~~ in this study. ~~We are concerned with~~ only four fields: Actor, Target, Score and Date. The Actor and Target variables for assessing membership in dyadic relationships, Score for assessing the intensity of event, and Date to track the relationship over time.

The manually coded dataset is the COPDAB dataset developed by Edward Azar covering the years 1948 to 1978 (Azar 1948). Coding of these events and how coders were trained is discussed in greater detail in the original paper. Each event is scored on a 1 to 15 scale, with 1 representing a major governmental program and 15 representing the highest level of structural violence. These values ~~were~~ then weighted using the international weighting scale (Azar and Havener 1976). These weightings with two modifications are as shown in Table 1. These modifications from the original scale are 9-15 to negative values to indicate conflict and 8 equals 0 instead of 1 to better represent neutrality.

Table 1: Augmented International Event Weighting

Index	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Weight	92	47	31	27	14	10	6	0	-6	-16	-29	-44	-50	-65	-102

The automatically coded dataset is the Cline Center Historical Phoenix Event Data NYT 1945-2005 (Althaus et al. 2019). ~~These~~ data ~~are~~ collected using the PETRARCH-2 software to extract event information from news stories. The scoring for these events is based on the Golstein scale. A -10-8.3 scale with -10 representing a military attack, 0 representing a neutral event, and 8.3 representing military assistance (Golstein 1992).

The weighting of each of each scale ~~was~~ decided by a panel of judges asked to weight the relative intensity of events. While not discussed at length here, more information may be found in the original papers by Golstein and Azar (Golstein 1992) (Azar 1948).

Both of these datasets ~~were~~ chosen because they are well established and have a long overlapping period. While the datasets overlap from 1948-1978, we restrict this time frame slightly to 1955-1978. This period is chosen because post-war reconstruction is generally considered complete in 1955 and it is the first full year the German Democratic Republic was a sovereign country as discussed in Pollins' "Does Trade Still Follow the Flag?" (Pollins 1989).

Manipulations of the data

The score data ~~are~~ scaled and missing data is mean imputed. While the techniques discussed in subsection Statistical Techniques are invariant to scale, this manipulation made visualization of the data much cleaner. It is true that the magnitude of the dynamic time warping distance is affected by scale, however the rank order of these distances is not. Since the rank order is

of primary importance in this inquiry we are not concerned with the change in magnitude associated with this transformation.

While complete data ~~was~~ ensured in the yearly assessment of dyadic relationships, this ~~was~~ not the case for other time scales. For the Monthly and Weekly analyses, and their associated simple moving averages, there ~~were~~ instances of incomplete data. This problem ~~was~~ especially pronounced as the level of aggregation decreased. The techniques used require the same number of observations in each time series, so mean imputation was used to fill missing values. While there are significant potential issues with mean imputation, more complex methods such as MICE are left for future analysis.

Methods

Dyad Selection

This investigation focuses on six states: USA, USSR, China, Canada, East-Germany, and West-Germany. The dyadic relationships between these countries are chosen based on data availability. If both datasets have at least one observation per year for a given dyad (before imputation), this dyad is included in the analysis. It is important to clarify how an observation was defined. An observation ~~was~~ considered part of the dyad, say USA-USSR, only when the actor ~~was~~ the USA and the target ~~was~~ the USSR or vice versa. Domestic events when the target and actor are the same were not included. The selected dyads are as seen in Table 2.

Table 2: Dyads included in analysis

Dyads
USA - USSR
USA - China
USA - West-Germany
USA - Canada
USSR - China
USSR - West-Germany
USSR - Canada
East-Germany - West-Germany

These dyadic relationships are analyzed at varying levels of granularity. Each dyad in Table 2 is assessed at the levels described in Table 3.

The simple moving averages of described in Table 3 are an average of the current time step and the $n-1$ time steps preceding for window size n. For example the 2 week average is an average of the current week and the previous week, the 6 month average is an average of the current month and the 5 months preceding. The initial observations where the window could not be calculated fully use only the data available. For example while calculating the 6 month averages, the window for March 1955 only includes January, February, and March.

Table 3: Time frames included in dyadic analysis

Time.frame
Year
6 Month Simple Moving Average
3 Month Simple Moving Average
2 Month Simple Moving Average
Month
3 Week Simple Moving Average
2 Week Simple Moving Average
Week

Statistical Techniques

To assess the similarity of the time series, three metrics were employed: Pearson correlation, Spearman correlation, and Dynamic Time Warping (DTW). The traditional Pearson correlation ~~was~~ of primary interest, however Spearman correlation and DTW are included to investigate non-linearity and data shifts.

Pearson correlation is defined as follows:

$$\rho_{X,Y} = \frac{cov(X,Y)}{\sigma_X \sigma_Y}$$

where $cov()$ is the covariance and σ is the standard deviation of the respective datasets.

Spearman correlation is similar to the Pearson correlation, but instead of using the data directly, it calculates the Pearson correlation of the ranked datasets.

DTW is especially useful for comparing signals that may vary in time and speed (Anon n.d.). ~~W~~which works well for our purposes because it is not guaranteed that the events are aligned, meaning the same event might be reported later in different datasets. In contrast with the Pearson correlation, this property gives us another tool for assessing similarity in the face of non-linearity. While the algorithm is not detailed here, the distance is essentially ~~an~~ cumulative squared distance between points with optimized pairings. Importantly, this cumulative distance is dependent on the number of points in the time series. To make comparison across varying granularities, the DTW distance presented is a normalized value.

The Pearson and Spearman correlations fall in an easily interpretable range $[-1, 1]$. With 1 indicating total linear correlation, 0 no linear correlation, and -1 total negative correlation. DTW distances do not have an analogous scale, instead ~~it has~~ the range, $[0, \infty)$ with no universal thresholds. Instead we must compare the distances to each other as we look for similarity with smaller values indicating increasing agreement.

Results

Presented in this section ~~are~~ a subset of the full analysis. While analysis ~~was~~ performed on every time frame described in Table 3, only the analysis of yearly, monthly, and 6 month average data accompanied by selected plots ~~will be~~ discussed. These time frames are illustrative of the ~~over all~~ findings and will suffice in the place of an exhaustive discussion. A full accounting of the correlations and the associated time series plots can be found in Appendix A and B respectively.

Yearly Dyads

The yearly dyadic relationships are the primary interest of this study. In Table 7 ~~we see~~ the Pearson and Spearman ~~correlations~~ with their associated p-values and the normalized dynamic time warp distance. While the range of values is fairly large, there is good correlation between the datasets for a few dyads. The USA-USSR dyad shows high correlation, and the USSR-China, USSR-Canada, and USA-China dyads have good correlations as well.

Table 4: Yearly Correlations

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.813**	1.41e-06	**0.866**	4.55e-08	**0.438**
USA-China	**0.438**	3.21e-02	**0.342**	1.02e-01	**0.642**
USA-West-Germany	**0.142**	5.09e-01	**0.129**	5.49e-01	**0.647**
USA-Canada	**0.190**	3.74e-01	**0.338**	1.06e-01	**0.790**
USSR-China	**0.681**	2.49e-04	**0.705**	1.22e-04	**0.492**
USSR-West-Germany	**0.406**	4.91e-02	**0.410**	4.69e-02	**0.585**
USSR-Canada	**0.591**	2.38e-03	**0.503**	1.21e-02	**0.603**
East-Germany-West-Germany	**0.069**	7.50e-01	**0.118**	5.82e-01	**0.684**

Figures 1 and 2 are the time series of the dyads with the highest and lowest correlations respectively. In Figure 1, the time series of the USA-USSR dyad, we see the high correlation clearly. The COPDAB and Phoenix datasets are largely in agreement for these two superpowers in the heat of the Cold War. Being able to track this highly visible and contentious relationship is a good sign that under the right conditions, these datasets capture similar dynamics.

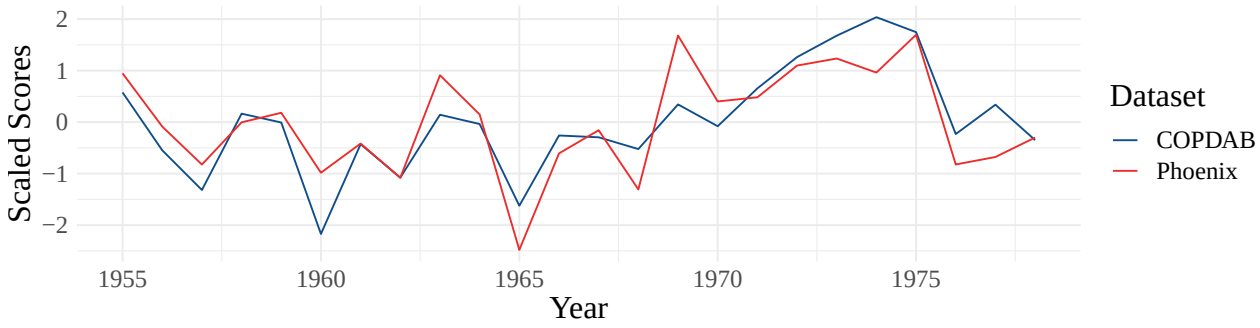


Figure 1: Yearly values for USA and USSR

Figure 2 shows the time series of the East and West Germany dyad which has a correlation near 0. However, when examining the graph it appears that the datasets largely agree. Interestingly ~~we can see that~~ the relationship follows a similar trend as the USA-USSR relationship. This should be expected since the two states were highly aligned with the two superpowers.

Figure 2 highlights a short coming of the correlation coefficients. Some points are shifted between the two datasets, yet the measured relationship exhibited by the time series appear similar. In combination with Figure 3 we see motivation for the use of dynamic time warping as a useful metric

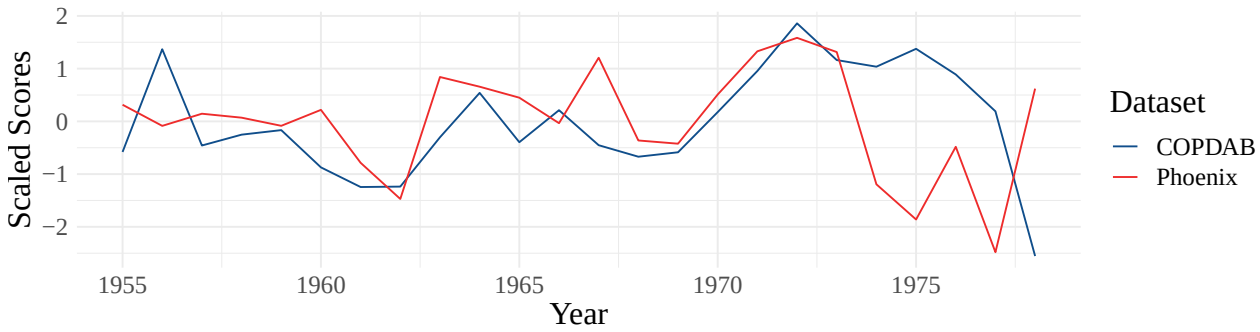


Figure 2: Yearly values for East and West Germany

Figure 3 shows the time series of the USA-Canada dyad. The datasets appear to disagree more for this dyad than the German dyad, yet ~~we see~~ a much higher correlation. The DTW distance reflects this intuition, the value is smaller for the German dyad than the USA-Canada dyad, indicating greater similarity. While this certainly does not prove that DTW is a better measure in all situations, it does highlight potential short comings of analysis of correlations alone.

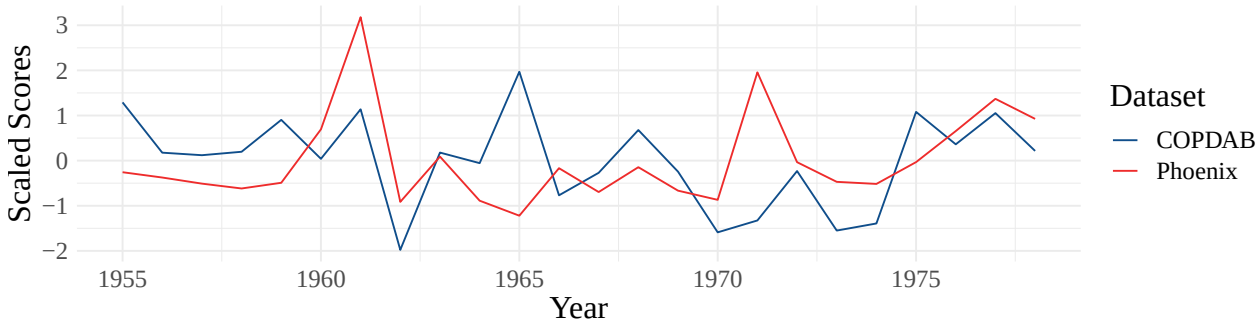


Figure 3: Yearly value for USA and Canada

Monthly Dyads

While levels of aggregation below one month ~~were~~ examined, the results become increasingly less reliable. At the Monthly level of aggregation we begin to see the adverse effects of missing data for dyads with lower data density.

Table 8 shows a similar ordering of correlation coefficients with the larger dyads recording higher correlations as before. Figure 4 shows that while there is significantly more noise in the signal than at yearly aggregation, the signal is still visible for the two superpowers. It is in Figures 5 and 6 that we see the effects of missing values. Due to the mean imputation approach, missing values will be filled with 0, the mean for scaled data. In these figures we can see a flat lining effect as missing values become more prevalent. Due to this, more advanced imputation techniques are required for reliable results across all dyads.

These examples also serve to highlight the short comings of dynamic time warping. At this monthly aggregation level, it appears that the USSR-Canada similarity far out paces the yearly values. This again is a relic of missing values. Because of the flat lining effect the curves this value does not reflect an accurately measured relationship. This stresses again how over reliance on a single metric may lead to erroneous conclusions.

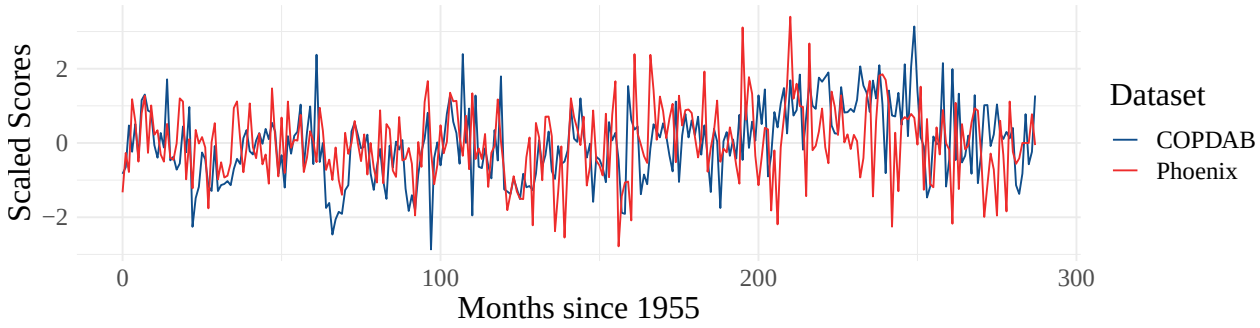


Figure 4: Monthly values for USA and USSR

Table 5: Monthly Correlations

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.249**	1.87e-05	**0.272**	2.72e-06	**0.589**
USA-China	**0.182**	1.90e-03	**0.210**	3.22e-04	**0.587**
USA-West-Germany	**0.064**	2.80e-01	**0.023**	6.94e-01	**0.572**
USA-Canada	**0.001**	9.91e-01	**0.016**	7.88e-01	**0.561**
USSR-China	**0.237**	4.84e-05	**0.269**	3.51e-06	**0.494**
USSR-West-Germany	**0.139**	1.80e-02	**0.129**	2.84e-02	**0.493**
USSR-Canada	**0.223**	1.33e-04	**0.185**	1.60e-03	**0.261**
East-Germany-West-Germany	**-0.011**	8.54e-01	**0.033**	5.76e-01	**0.430**

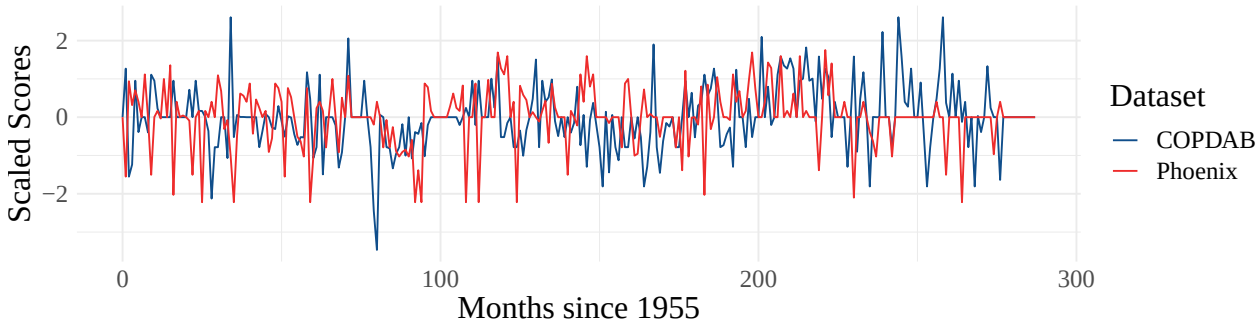


Figure 5: Monthly values for East and West Germany

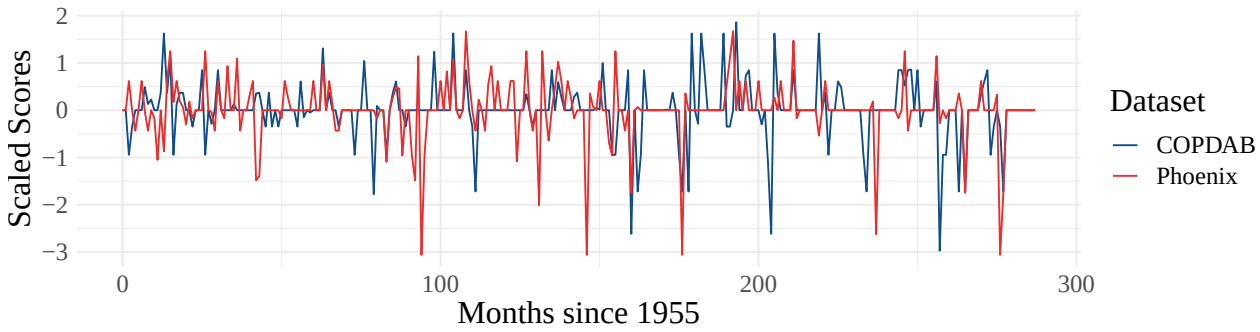


Figure 6: Monthly value for USSR and Canada

Six Month Simple Moving Average Dyads

While monthly aggregation is limited by missing values, it appears that a six month simple moving average effectively mitigates the flat line effect, while increasing granularity compared

to yearly aggregation. In Figure 7, a similar relationship as the one seen in yearly aggregation is clear. However the signal becomes much noisier with this increased granularity. And while the flat line effect is less pronounced, it is still present as ~~we can see from~~ Figure 9

The correlation ~~has increased~~ compared to the monthly aggregation, but more interestingly, ~~we see~~ a huge improvement in DTW distance across the board. From inspection of the plots it appears that the two datasets are capturing similar dyadic relationships. The discrepancy between correlation coefficients and dynamic time warping may indicate misalignment. While the datasets capture the relationships, they may be shifted or delayed compared to one another. Another explanation for this increased similarity may be a damped signal. The values from the six month aggregation are confined primarily to a single standard deviation from the mean. Whereas the monthly and yearly values exceeded two or three standard deviations. The improved DTW distance may simply be a reflection of this tighter score distribution. Further analysis is needed to determine which effect is dominant, which is not pursued here.

Table 6: Monthly Correlations - 6 Month Average

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.249**	1.87e-05	**0.272**	2.72e-06	**0.221**
USA-China	**0.361**	2.56e-10	**0.339**	3.69e-09	**0.291**
USA-West-Germany	**0.064**	2.80e-01	**0.023**	6.94e-01	**0.197**
USA-Canada	**0.126**	3.23e-02	**0.164**	5.35e-03	**0.171**
USSR-China	**0.237**	4.84e-05	**0.269**	3.51e-06	**0.202**
USSR-West-Germany	**0.228**	9.29e-05	**0.236**	5.07e-05	**0.210**
USSR-Canada	**0.223**	1.33e-04	**0.185**	1.60e-03	**0.123**
East-Germany-West-Germany	**0.192**	1.08e-03	**0.118**	4.49e-02	**0.152**

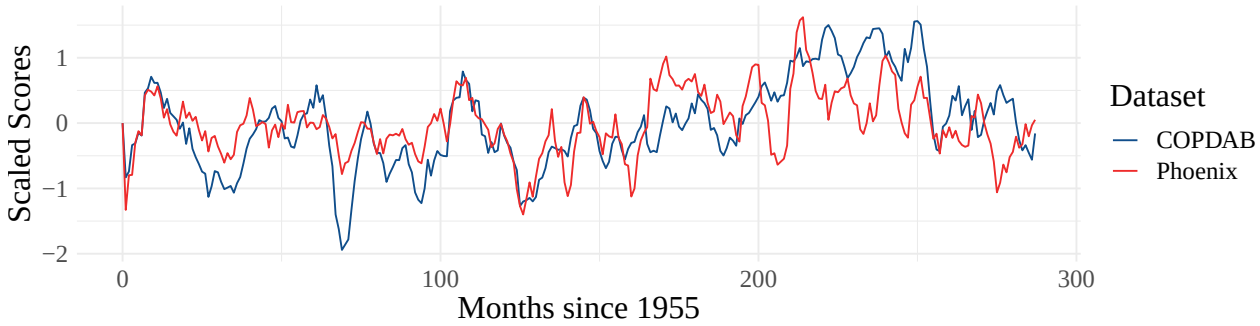


Figure 7: Six month average value for USA and USSR

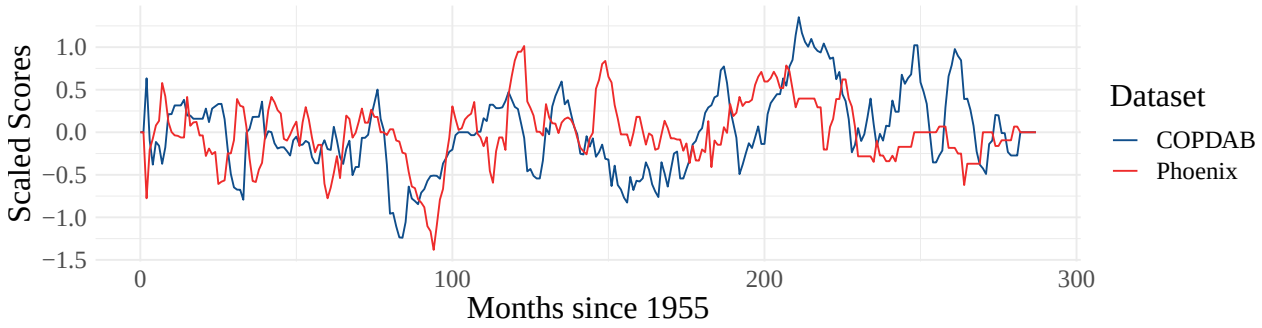


Figure 8: Six month average value for East and West Germany

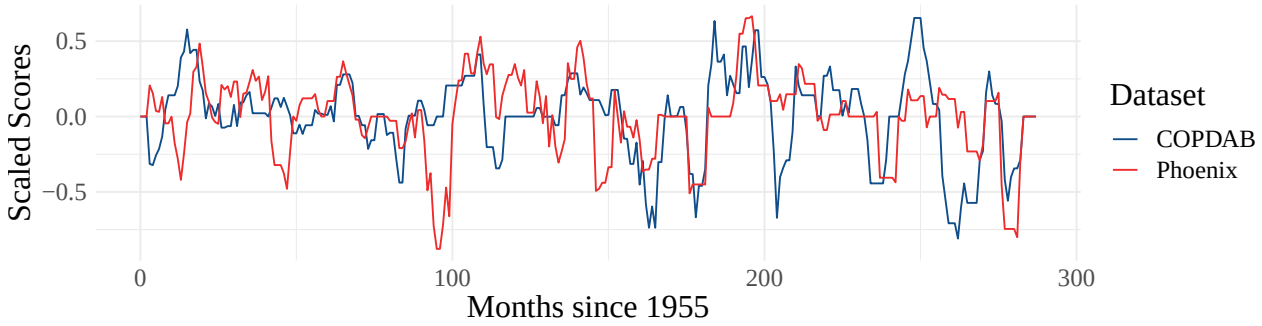


Figure 9: Six month average value for USSR and Canada

Conclusion

The yearly dyadic relationships showed that there is significant agreement between the COPDAB and Phoenix datasets. While efforts to investigate smaller time frames ~~were~~ inconclusive, the moving average approach shows promise for achieving increased signal clarity and mitigating the effect of missing data. In all cases though, it is apparent that the datasets have higher agreement when more data is available. Recall from the Dyad Selection Section that our dyads ~~were~~ selected with the criteria that they must have at least one observation per year. This is a low bar to clear but still some dyads were not included in analysis. It is not a surprise that all but one dyad includes either the USA or USSR during the cold war period. ~~We have seen that~~ with highly observed dyads like the USA-USSR dyad, high levels of agreement are possible. However, given the variety of results from the dyads clearing our low bar, that these datasets agree in all circumstances is not guaranteed.

Note to Prof. Greico

I am sorry about blowing the 20 page limit out of the water with my appendices. I kept the body of the paper to 10 pages as you suggested for potential publication. But I wanted to

include the other figures in case you feel they might be good additions or substitutions for the figures included.

References

Althaus, Scott, Joseph Bajjalieh, John F. Carter, Buddy Peyton, and Dan A. Shalmon. 2019. "Cline Center Historical Phoenix Event Data." *Cline Center for Advanced Social Research* v.1.2.0(University of Illinois Urbana-Champaign).

Anon. n.d. "Dynamic Time Warping with Time Series - Shachia Kyaagba - Medium."

Azar, Edward E. 1948. "Conflict and Peace Data Bank (COPDAB)."

Azar, Edward E., and Thomas N. Havener. 1976. "Discontinuities in the Symbolic Environment: A Problem in Scaling." *INTERNATIONAL INTERACTIONS* Vol. 2:231–46.

Golstein, Joshua S. 1992. "A Conflict-Cooperation Scale for WEIS Events Data." *The Journal of Conflict Resolution* 36(2):369–85.

Pollins, Brian M. 1989. "Does Trade Still Follow the Flag?" *The American Political Science Review* 83(2):465–80.

Appendix

A: Correlations

Table 7: Yearly Correlations

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.813**	1.41e-06	**0.866**	4.55e-08	**0.438**
USA-China	**0.438**	3.21e-02	**0.342**	1.02e-01	**0.642**
USA-West-Germany	**0.142**	5.09e-01	**0.129**	5.49e-01	**0.647**
USA-Canada	**0.190**	3.74e-01	**0.338**	1.06e-01	**0.790**
USSR-China	**0.681**	2.49e-04	**0.705**	1.22e-04	**0.492**
USSR-West-Germany	**0.406**	4.91e-02	**0.410**	4.69e-02	**0.585**
USSR-Canada	**0.591**	2.38e-03	**0.503**	1.21e-02	**0.603**
East-Germany-West-Germany	**0.069**	7.50e-01	**0.118**	5.82e-01	**0.684**

Table 8: Monthly Correlations

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.249**	1.87e-05	**0.272**	2.72e-06	**0.589**
USA-China	**0.182**	1.90e-03	**0.210**	3.22e-04	**0.587**
USA-West-Germany	**0.064**	2.80e-01	**0.023**	6.94e-01	**0.572**
USA-Canada	**0.001**	9.91e-01	**0.016**	7.88e-01	**0.561**
USSR-China	**0.237**	4.84e-05	**0.269**	3.51e-06	**0.494**
USSR-West-Germany	**0.139**	1.80e-02	**0.129**	2.84e-02	**0.493**
USSR-Canada	**0.223**	1.33e-04	**0.185**	1.60e-03	**0.261**
East-Germany-West-Germany	**-0.011**	8.54e-01	**0.033**	5.76e-01	**0.430**

Table 9: Monthly Correlations - 2 Month Average

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.249**	1.87e-05	**0.272**	2.72e-06	**0.391**
USA-China	**0.226**	1.07e-04	**0.242**	3.36e-05	**0.447**
USA-West-Germany	**0.064**	2.80e-01	**0.023**	6.94e-01	**0.392**
USA-Canada	**-0.004**	9.47e-01	**0.022**	7.11e-01	**0.375**
USSR-China	**0.237**	4.84e-05	**0.269**	3.51e-06	**0.385**
USSR-West-Germany	**0.209**	3.47e-04	**0.237**	4.84e-05	**0.379**
USSR-Canada	**0.223**	1.33e-04	**0.185**	1.60e-03	**0.204**
East-Germany-West-Germany	**0.045**	4.44e-01	**0.057**	3.39e-01	**0.326**

Table 10: Monthly Correlations - 3 Month Average

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.249**	1.87e-05	**0.272**	2.72e-06	**0.316**
USA-China	**0.280**	1.33e-06	**0.277**	1.74e-06	**0.397**
USA-West-Germany	**0.064**	2.80e-01	**0.023**	6.94e-01	**0.289**
USA-Canada	**0.042**	4.83e-01	**0.045**	4.45e-01	**0.283**
USSR-China	**0.237**	4.84e-05	**0.269**	3.51e-06	**0.306**
USSR-West-Germany	**0.232**	6.96e-05	**0.254**	1.24e-05	**0.316**
USSR-Canada	**0.223**	1.33e-04	**0.185**	1.60e-03	**0.175**
East-Germany-West-Germany	**0.068**	2.52e-01	**0.070**	2.33e-01	**0.263**

Table 11: Monthly Correlations - 6 Month Average

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.249**	1.87e-05	**0.272**	2.72e-06	**0.221**
USA-China	**0.361**	2.56e-10	**0.339**	3.69e-09	**0.291**
USA-West-Germany	**0.064**	2.80e-01	**0.023**	6.94e-01	**0.197**
USA-Canada	**0.126**	3.23e-02	**0.164**	5.35e-03	**0.171**
USSR-China	**0.237**	4.84e-05	**0.269**	3.51e-06	**0.202**
USSR-West-Germany	**0.228**	9.29e-05	**0.236**	5.07e-05	**0.210**
USSR-Canada	**0.223**	1.33e-04	**0.185**	1.60e-03	**0.123**
East-Germany-West-Germany	**0.192**	1.08e-03	**0.118**	4.49e-02	**0.152**

Table 12: Weekly Correlations

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.072**	1.13e-02	**0.106**	1.73e-04	**0.5492**
USA-China	**0.123**	1.17e-05	**0.146**	2.28e-07	**0.3453**
USA-West-Germany	**0.027**	3.38e-01	**0.017**	5.42e-01	**0.3122**
USA-Canada	**0.016**	5.68e-01	**-0.010**	7.19e-01	**0.3552**
USSR-China	**0.144**	3.24e-07	**0.146**	1.99e-07	**0.3009**
USSR-West-Germany	**0.048**	9.07e-02	**0.019**	5.01e-01	**0.2570**
USSR-Canada	**0.090**	1.49e-03	**0.069**	1.46e-02	**0.0744**
East-Germany-West-Germany	**0.033**	2.42e-01	**0.028**	3.14e-01	**0.1875**

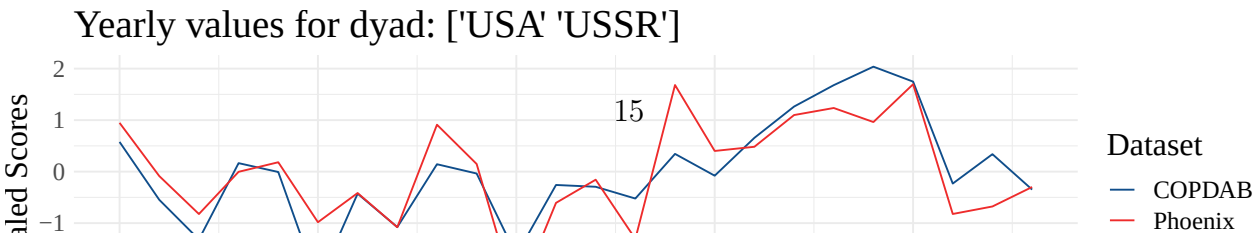
Table 13: Weekly Correlations - 2 Week Average

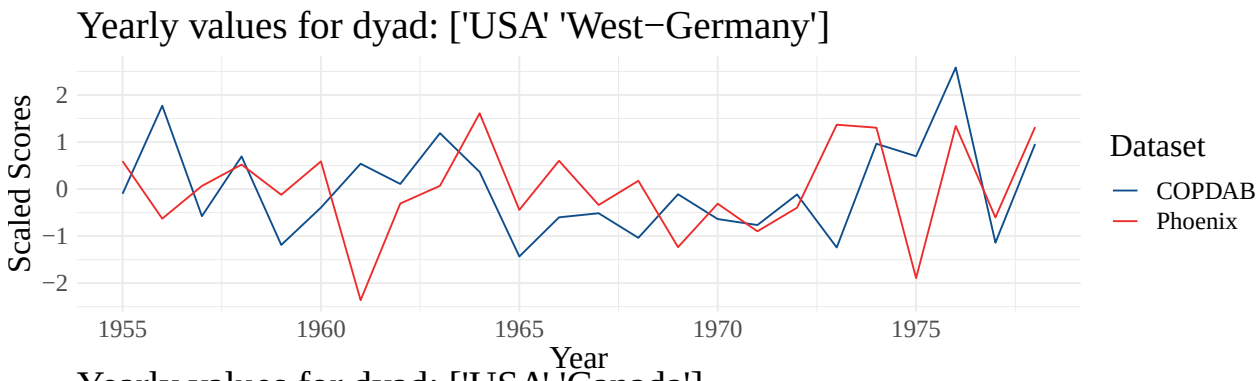
	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.072**	1.13e-02	**0.106**	1.73e-04	**0.3757**
USA-China	**0.130**	3.96e-06	**0.160**	1.21e-08	**0.2854**
USA-West-Germany	**0.027**	3.38e-01	**0.017**	5.42e-01	**0.2642**
USA-Canada	**0.012**	6.64e-01	**-0.022**	4.31e-01	**0.2799**
USSR-China	**0.144**	3.24e-07	**0.146**	1.99e-07	**0.2493**
USSR-West-Germany	**0.105**	1.94e-04	**0.079**	5.39e-03	**0.2147**
USSR-Canada	**0.090**	1.49e-03	**0.069**	1.46e-02	**0.0715**
East-Germany-West-Germany	**0.056**	4.91e-02	**0.050**	7.66e-02	**0.1655**

Table 14: Weekly Correlations - 3 Week Average

	Pearson		Spearman		DTW
Dyad	**rho**	p-value	**rho**	p-value	**normalized**
USA-USSR	**0.072**	1.13e-02	**0.106**	1.73e-04	**0.2932**
USA-China	**0.145**	2.54e-07	**0.158**	2.08e-08	**0.2425**
USA-West-Germany	**0.027**	3.38e-01	**0.017**	5.42e-01	**0.2150**
USA-Canada	**-0.008**	7.90e-01	**-0.026**	3.52e-01	**0.2381**
USSR-China	**0.144**	3.24e-07	**0.146**	1.99e-07	**0.2142**
USSR-West-Germany	**0.134**	2.08e-06	**0.113**	5.77e-05	**0.1789**
USSR-Canada	**0.090**	1.49e-03	**0.069**	1.46e-02	**0.0696**
East-Germany-West-Germany	**0.079**	5.30e-03	**0.057**	4.29e-02	**0.1467**

B: Plots




Yearly values for dyad: ['USA' 'West−Germany']
Scaled Scores
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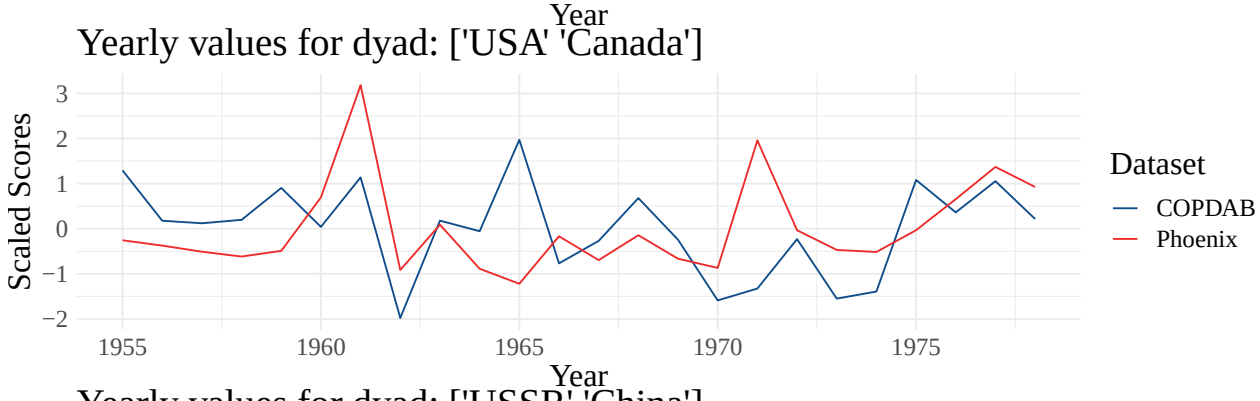
1
0
−1
−2
1955
1960
1965
1970
1975
Year
Dataset
COPDAB
Phoenix


Yearly values for dyad: ['USA' 'Canada']
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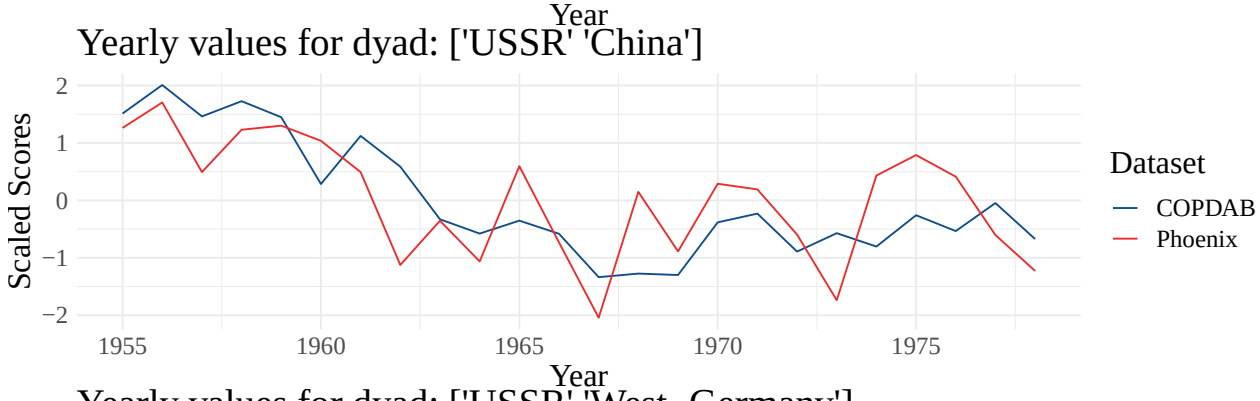
1960
1965
1970
1975
Year
Dataset
COPDAB
Phoenix


Yearly values for dyad: ['USSR' 'China']
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−1
−2
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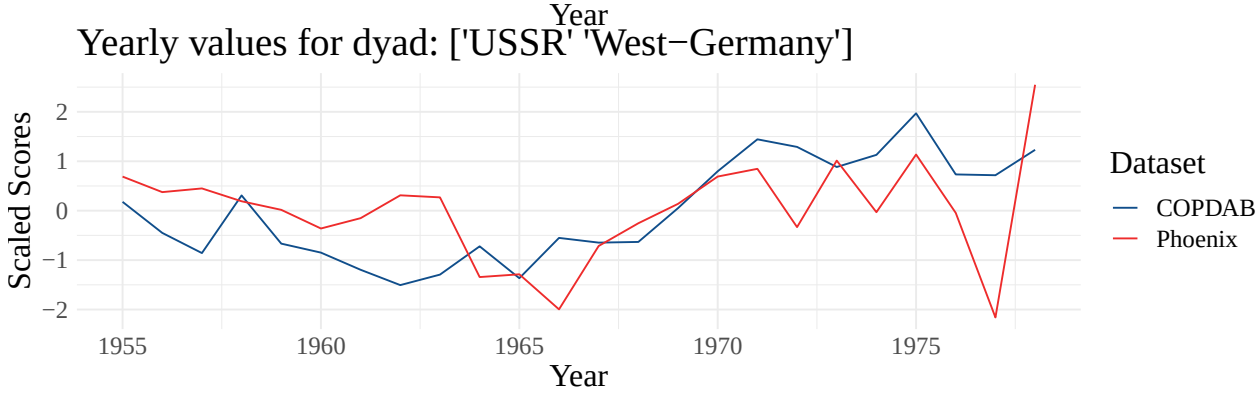
1960
1965
1970
1975
Year
Dataset
COPDAB
Phoenix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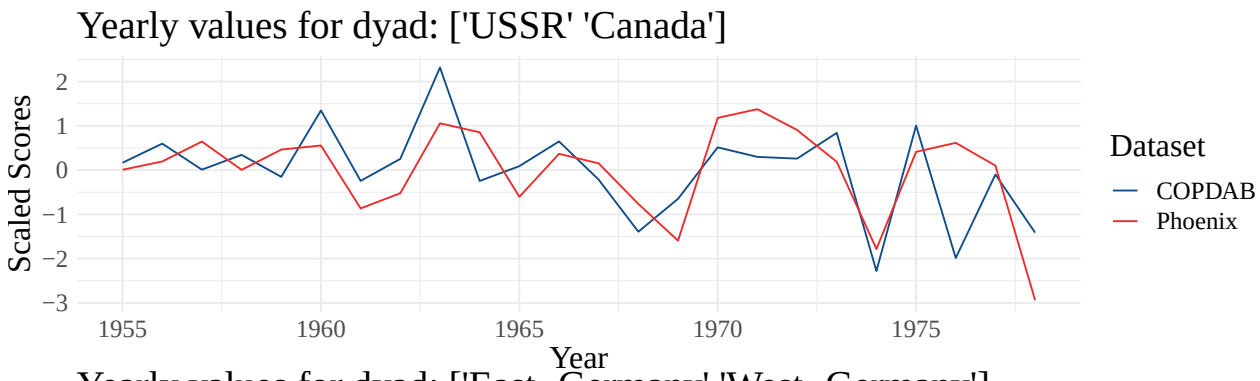
1965
1970
1975
Year
Dataset
COPDAB
Phoenix


Yearly values for dyad: ['USSR' 'Canada']
Scaled Scores
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−1
−2
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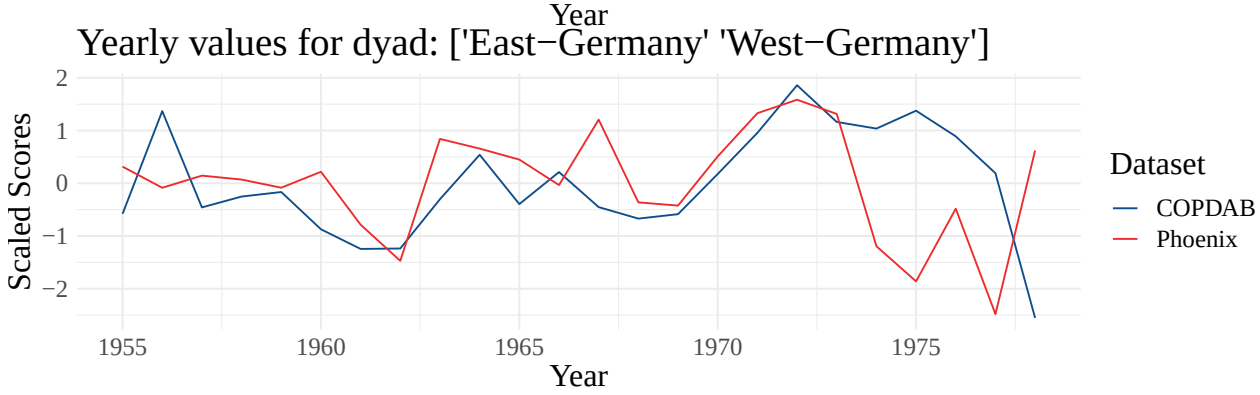
1955
1960
1965
1970
1975
Year
Dataset
COPDAB
Phoenix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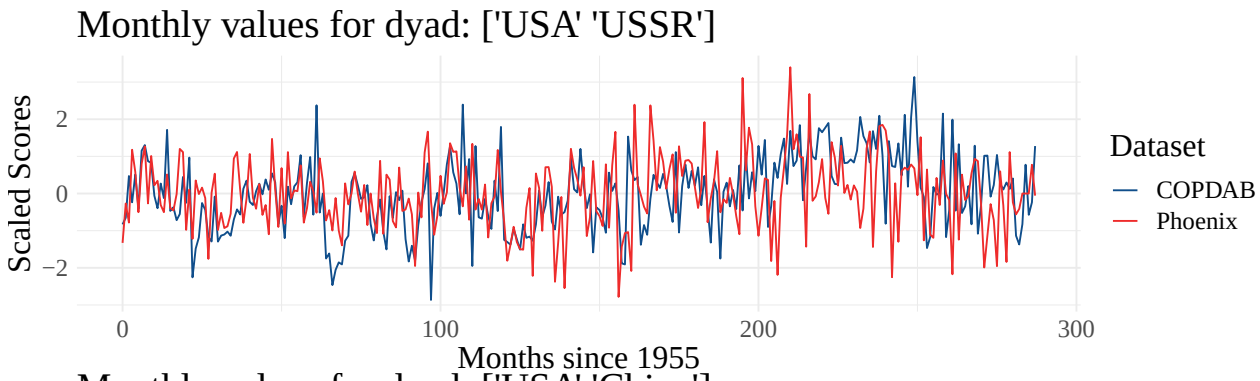
1955
1960
1965
1970
1975
Year
Dataset
COPDAB
Phoenix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−2
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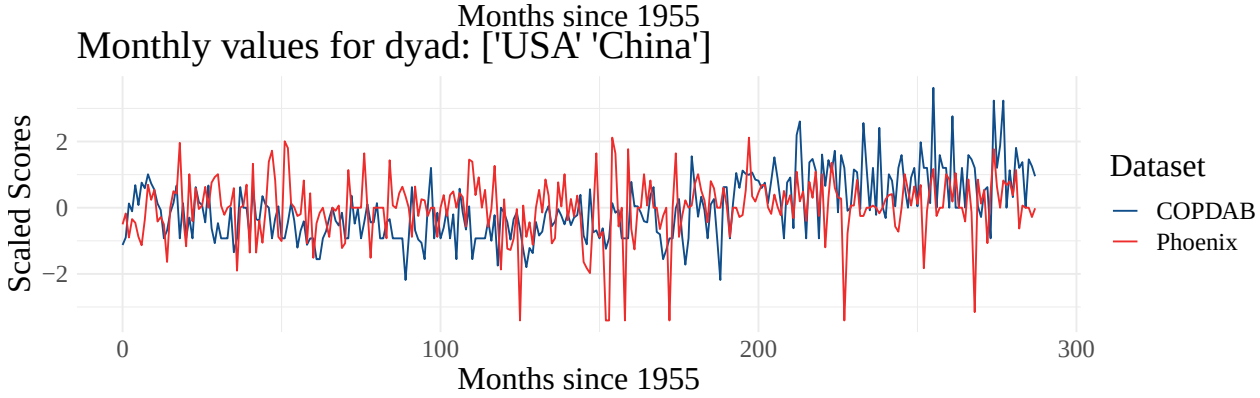
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'China']
Scaled Scores
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−2
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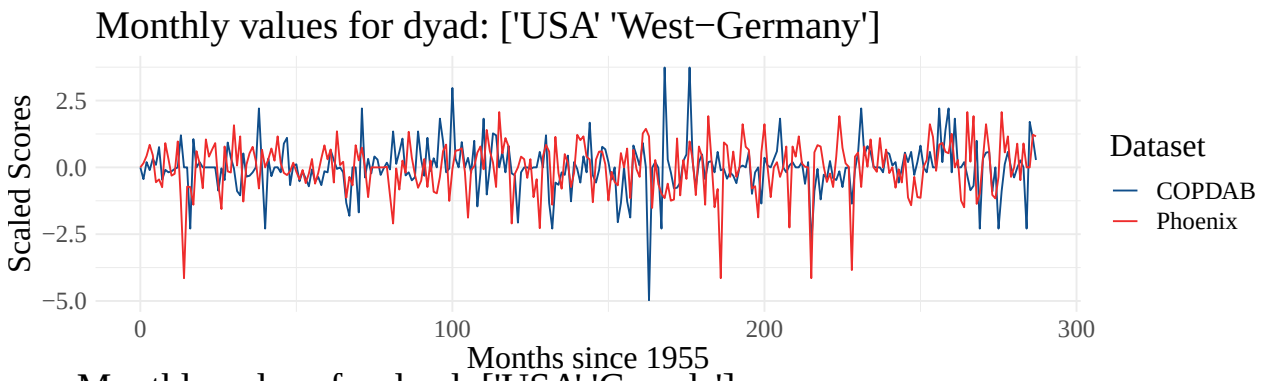
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'West−Germany']
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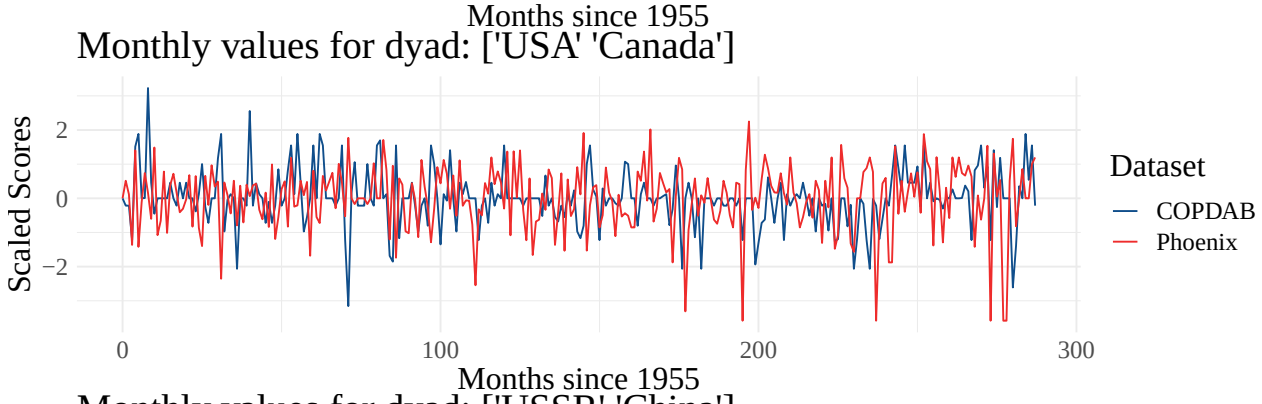
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix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Scaled Scores
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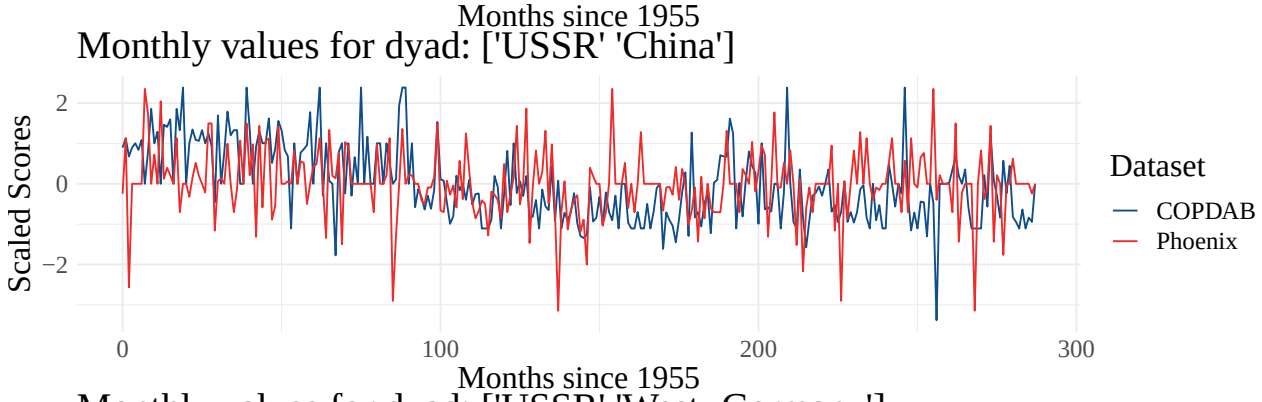
0
−2
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'China']
Scaled Scores
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−2
0
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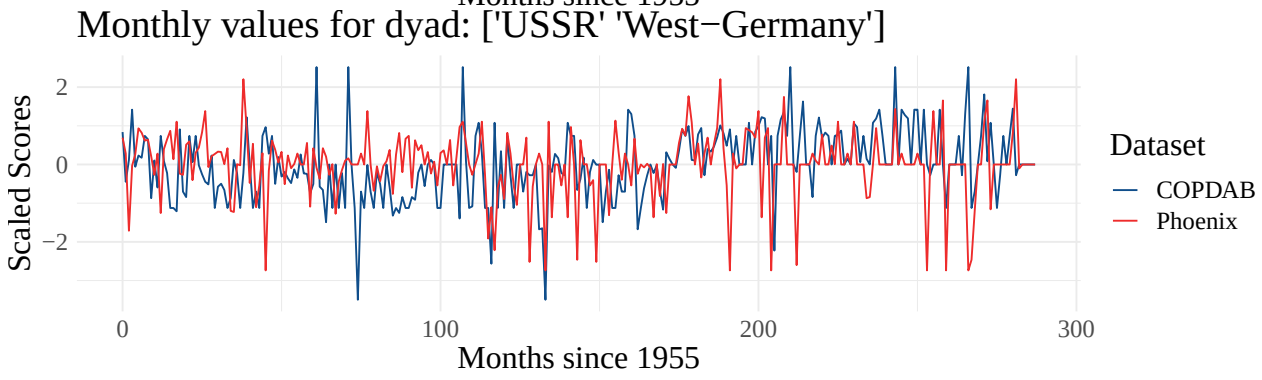
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'West−Germany']
Scaled Scores
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300
Months since 1955
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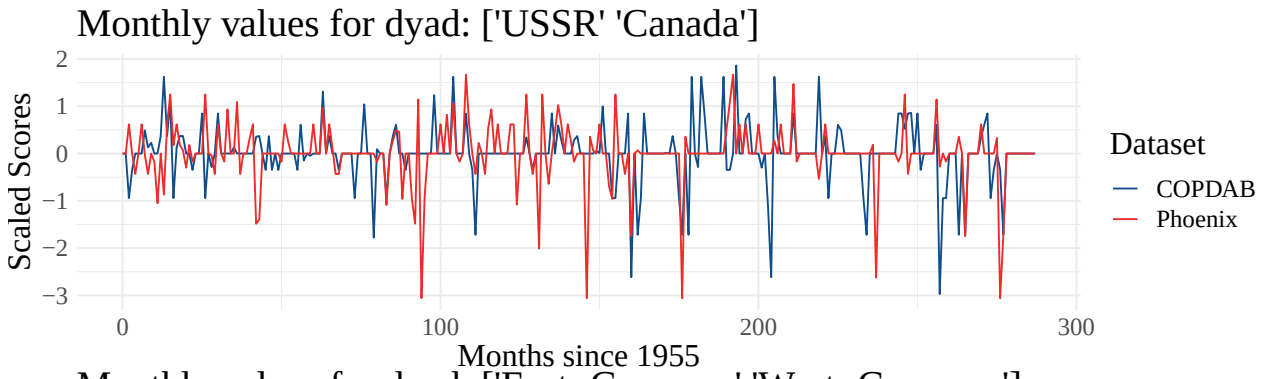
Phoenix


Monthly values for dyad: ['USSR' 'Canada']
Scaled Scores
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Months since 1955
Dataset
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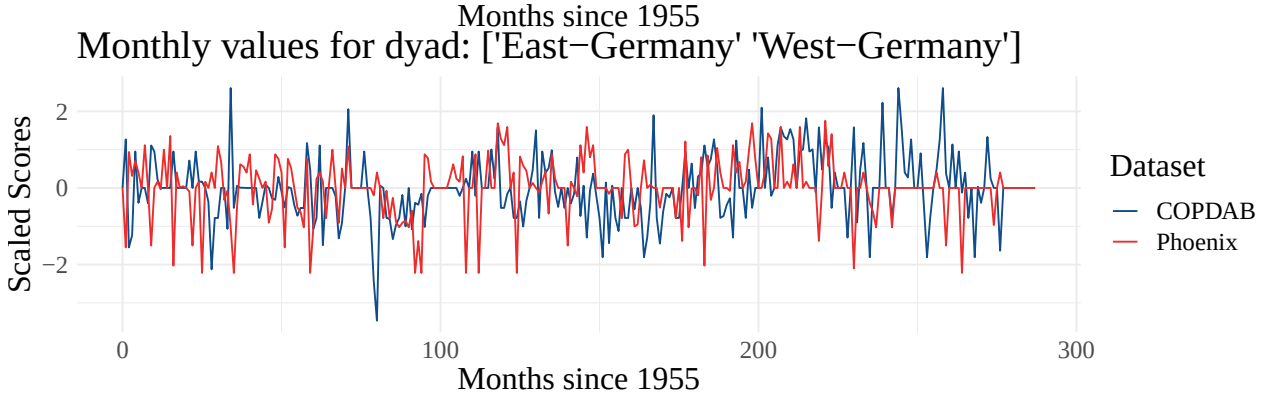
Monthly values for dyad: ['East−Germany' 'West−Germany']
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Months since 1955
Dataset
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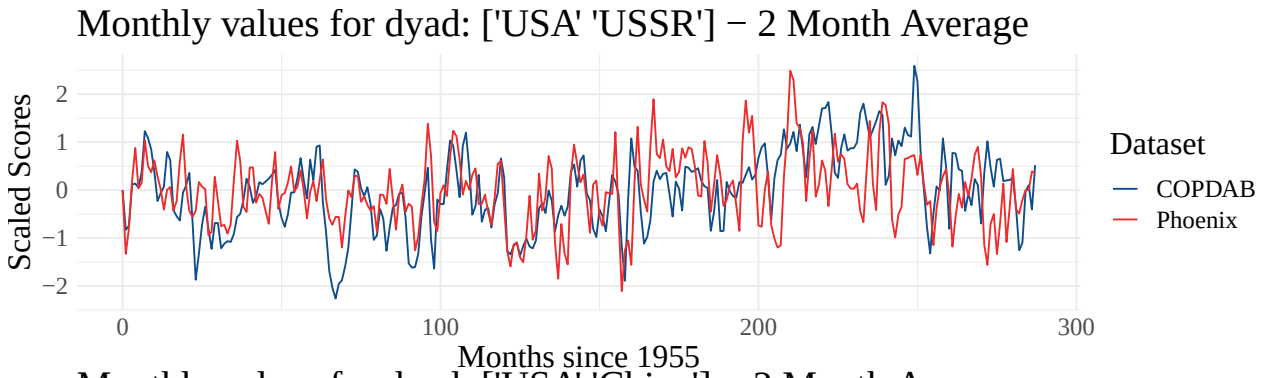
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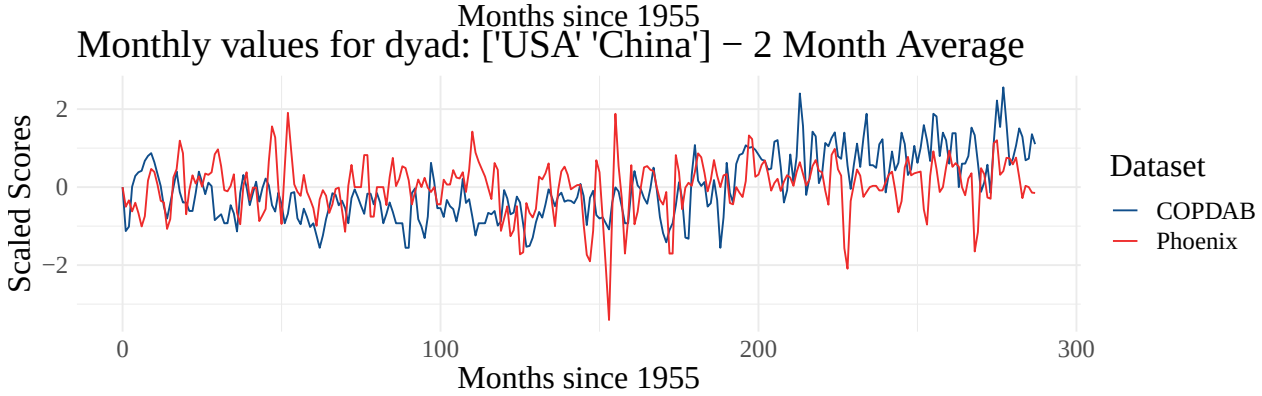
Months since 1955
Dataset
COPDAB
Phoenix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Months since 1955
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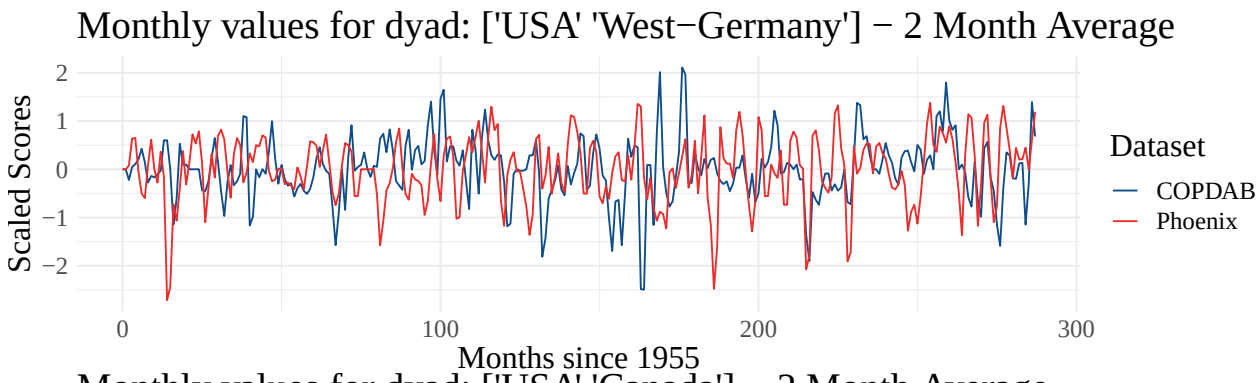
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Months since 1955
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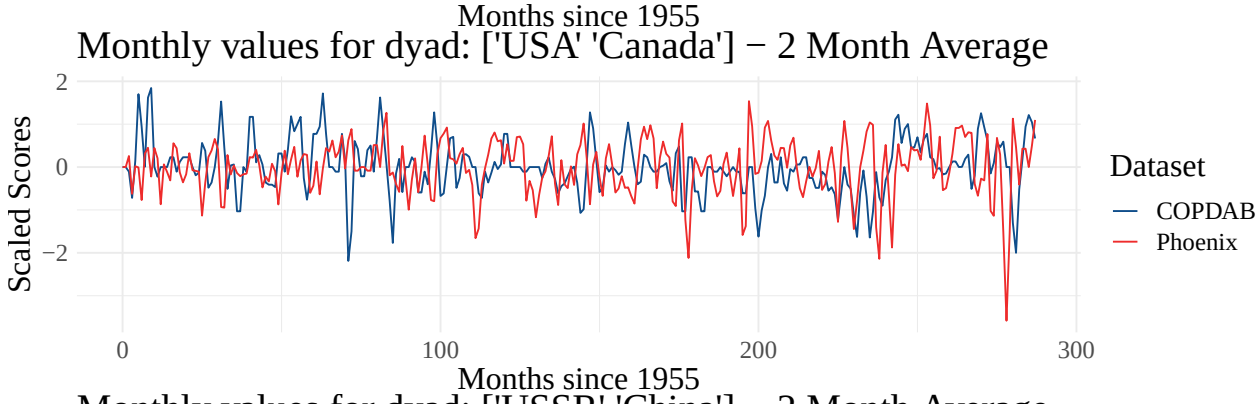
Monthly values for dyad: ['USA' 'Canada'] − 2 Month Average
Scaled Scores
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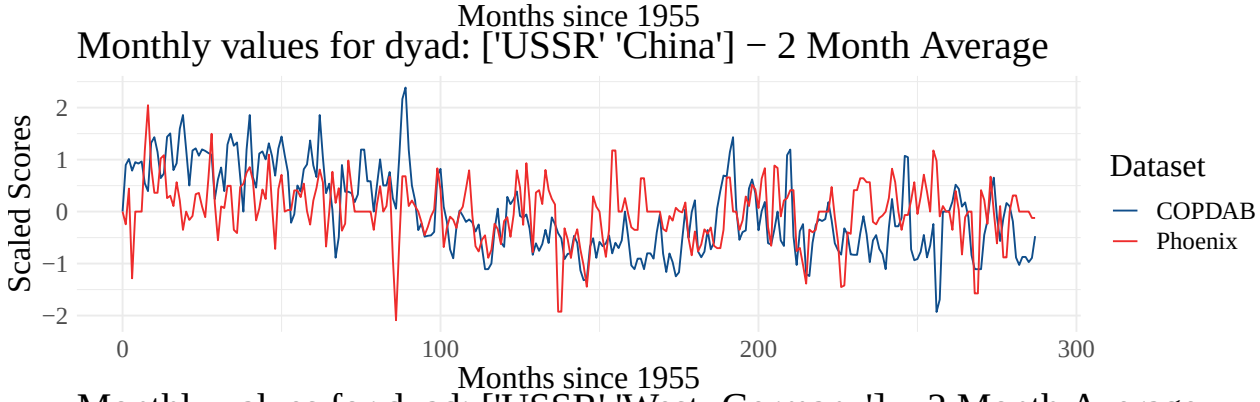
−2
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix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−2
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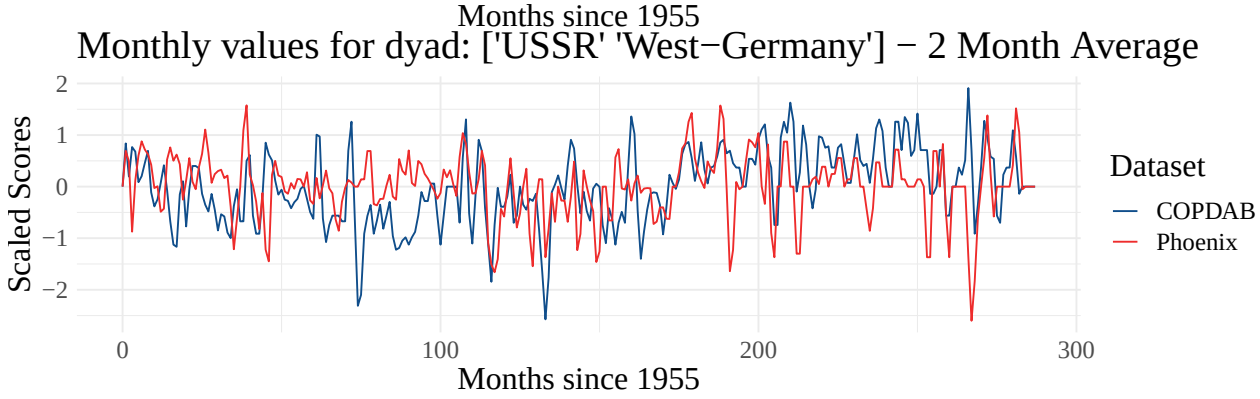
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'West−Germany'] − 2 Month Average
Scaled Scores
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1
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−1
−2
0
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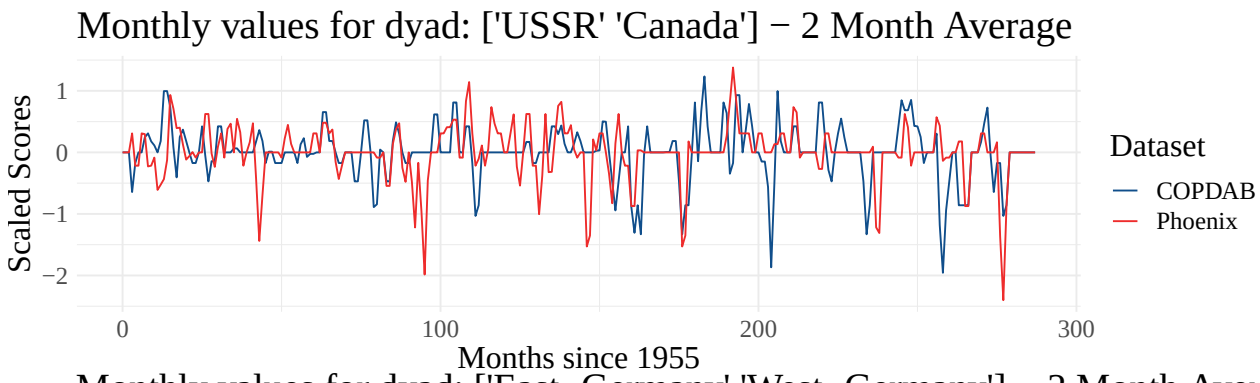
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'Canada'] − 2 Month Average
Scaled Scores
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0
−1
−2
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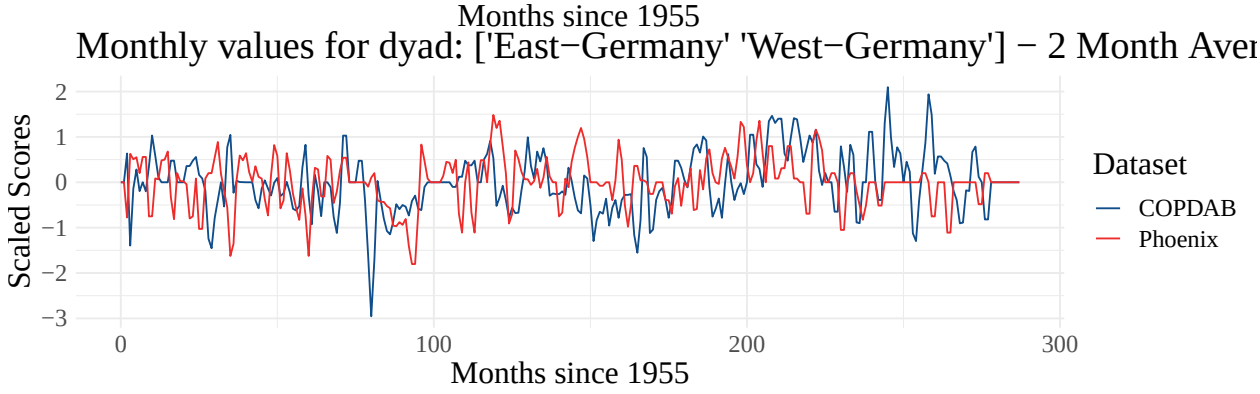
200
300
Months since 1955
Dataset
COPDAB
Phoenix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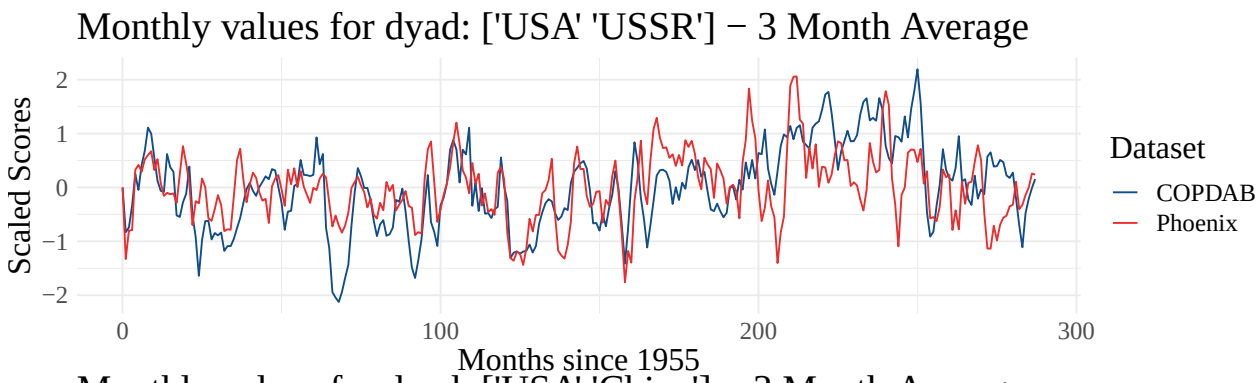
0
−1
−2
−3
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'USSR'] − 3 Month Average
Scaled Scores
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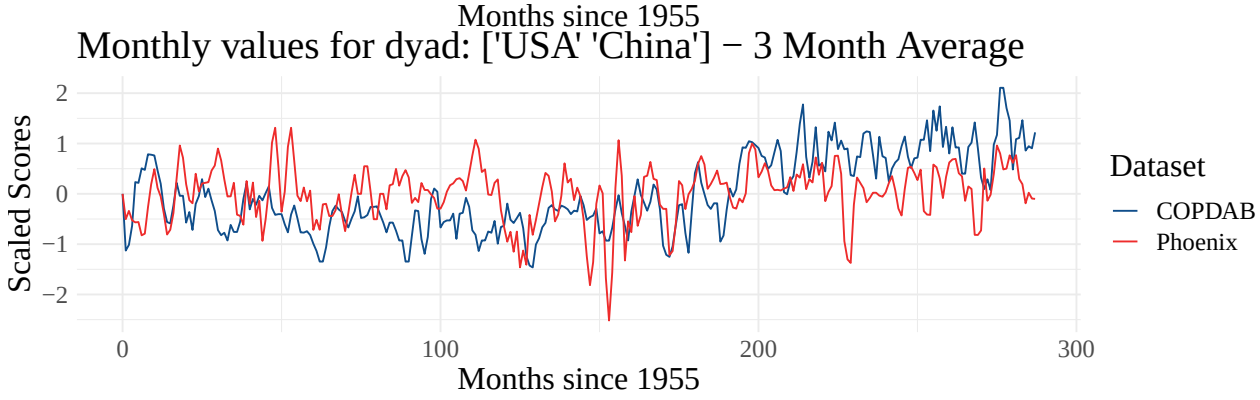
1
0
−1
−2
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix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−2
0
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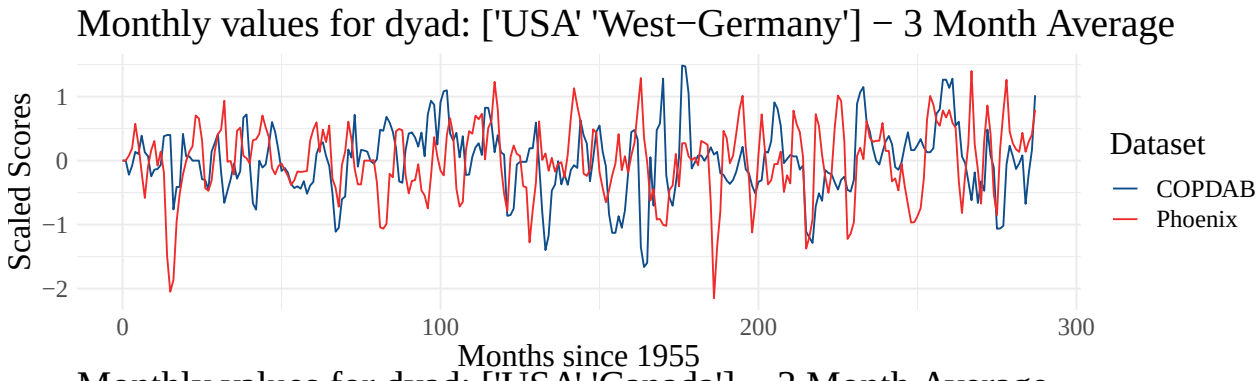
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'West−Germany'] − 3 Month Average
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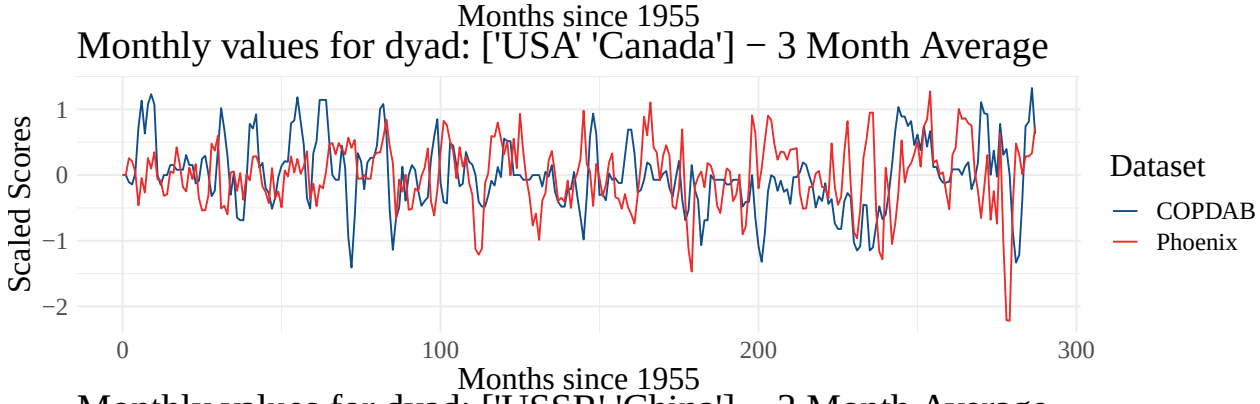
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'Canada'] − 3 Month Average
Scaled Scores
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0
−1
−2
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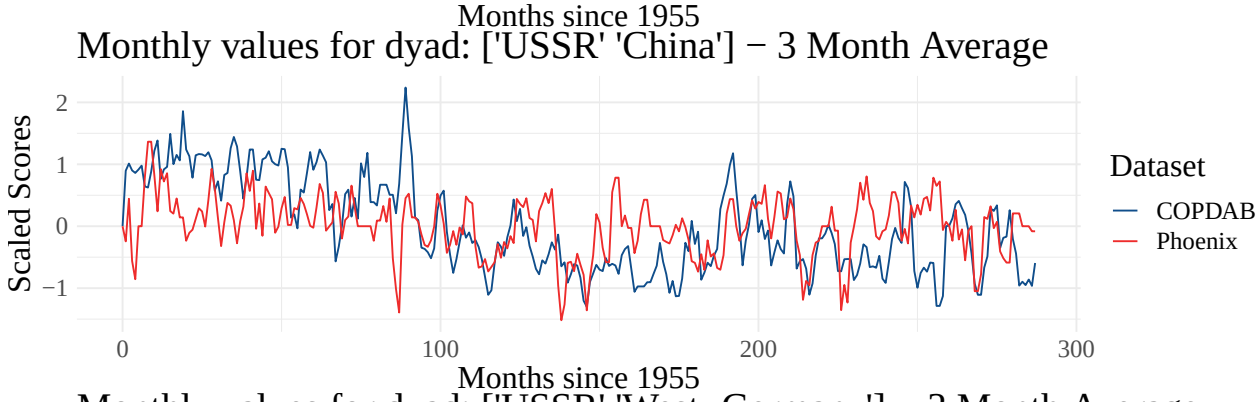
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'China'] − 3 Month Average
Scaled Scores
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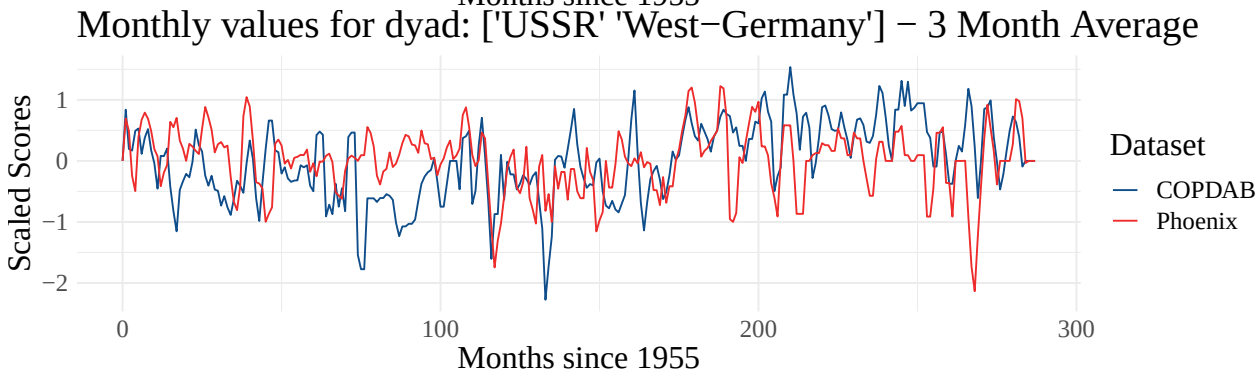
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'West−Germany'] − 3 Month Average
Scaled Scores
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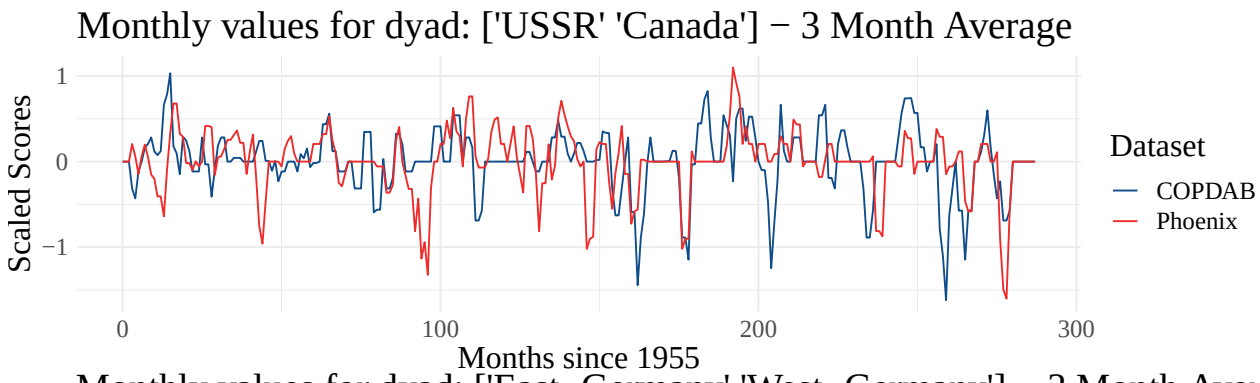
0
−1
−2
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'Canada'] − 3 Month Average
Scaled Scores
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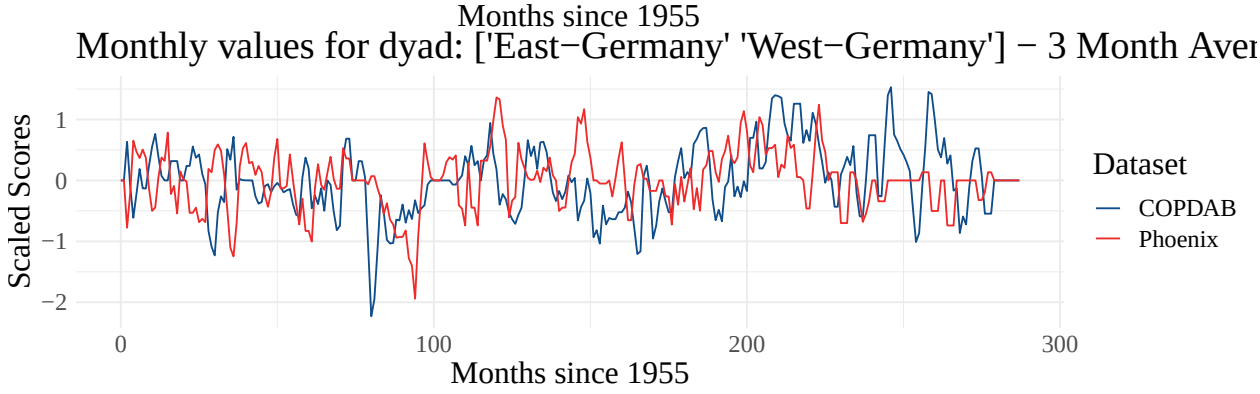
0
−1
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['East−Germany' 'West−Germany'] − 3 Month Aver
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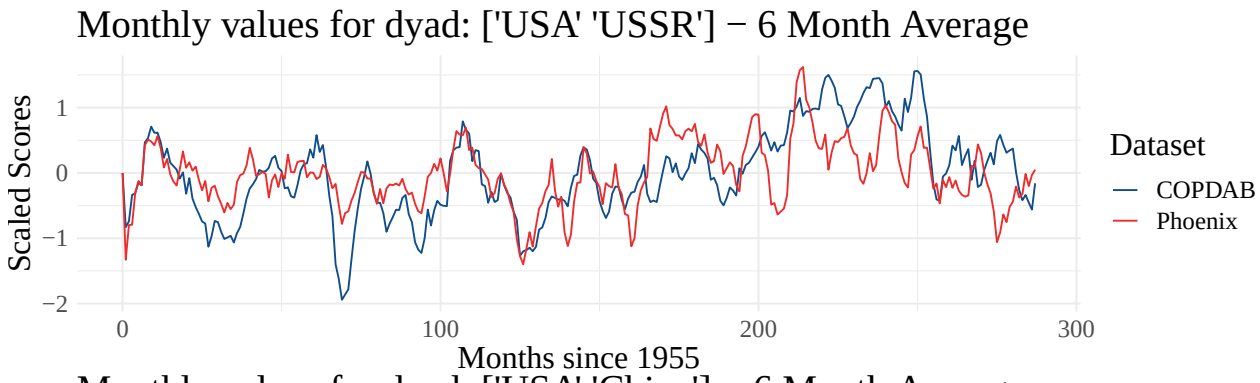
0
−1
−2
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'USSR'] − 6 Month Average
Scaled Scores
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−1
−2
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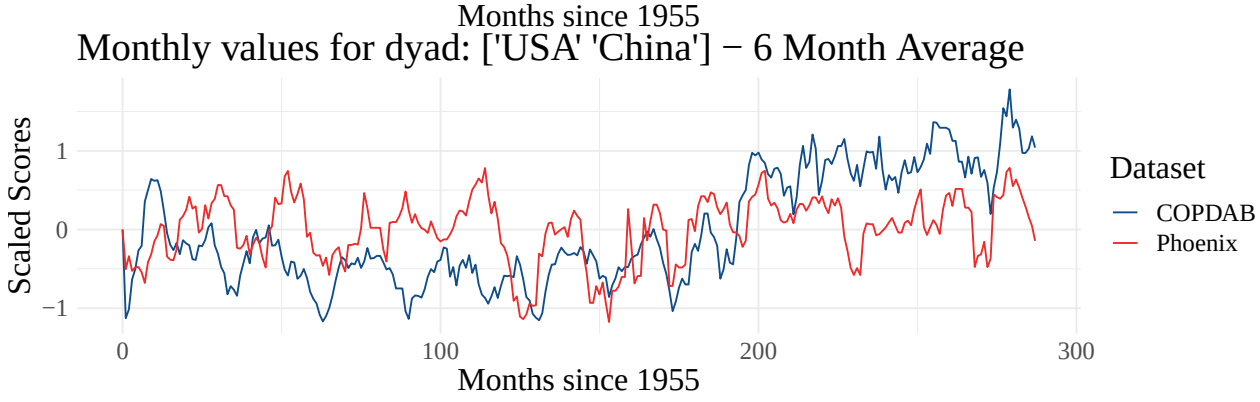
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'China'] − 6 Month Average
Scaled Scores
1
0
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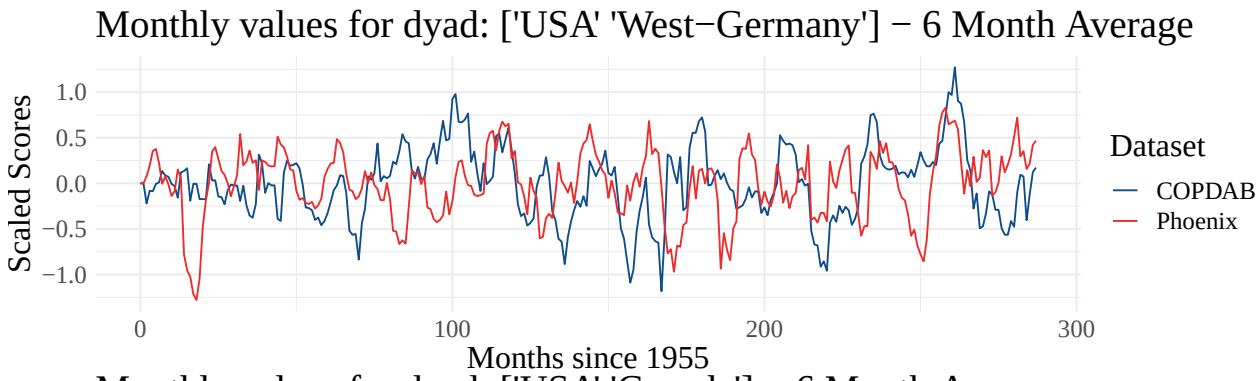
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'West−Germany'] − 6 Month Average
Scaled Scores
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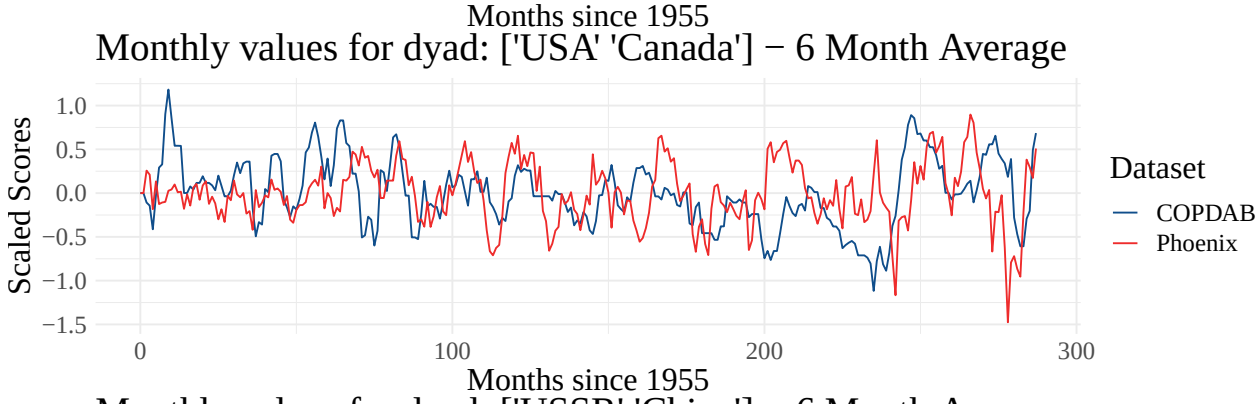
0.0
−0.5
−1.0
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USA' 'Canada'] − 6 Month Average
Scaled Scores
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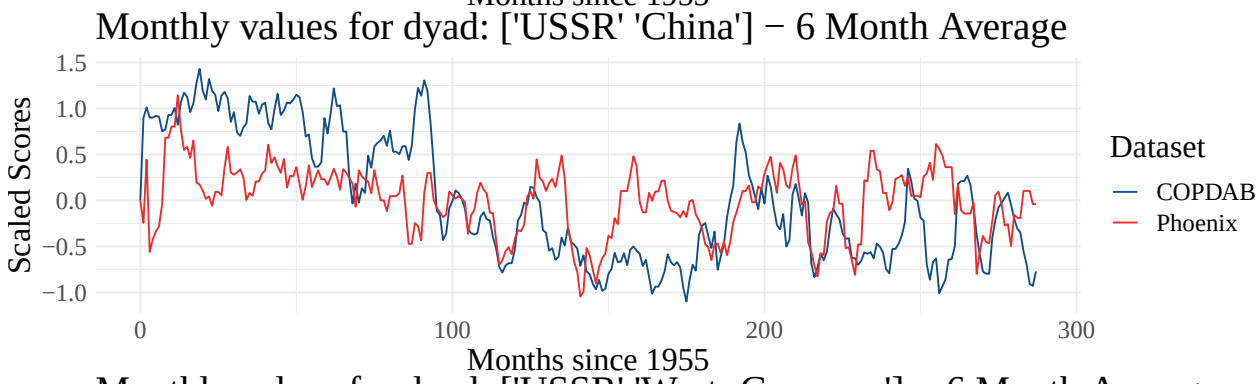
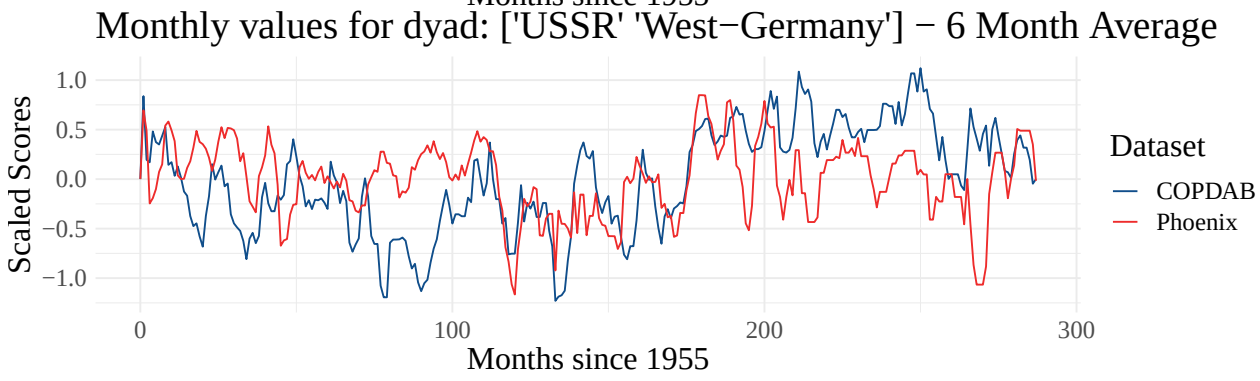
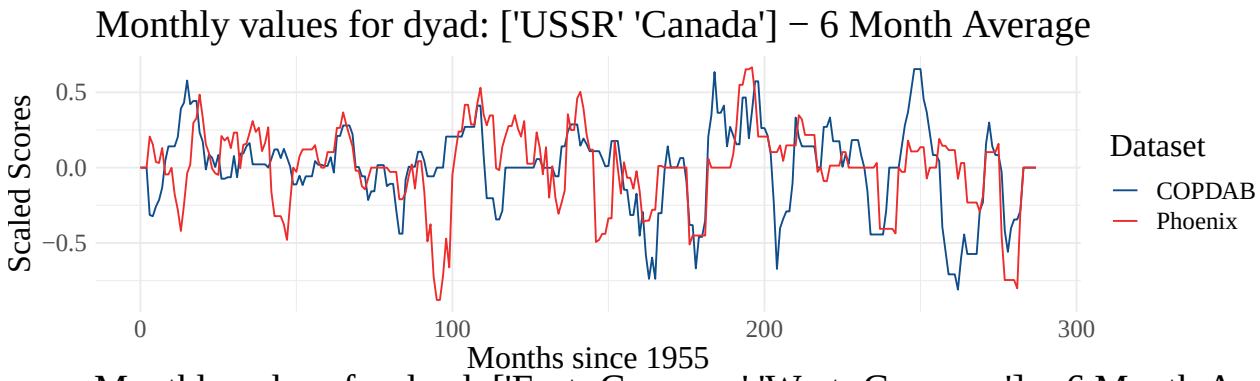
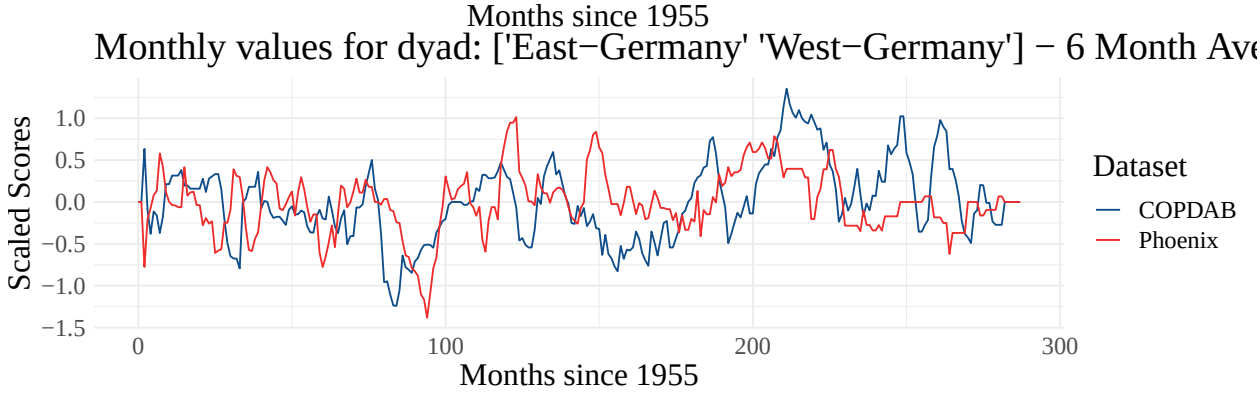
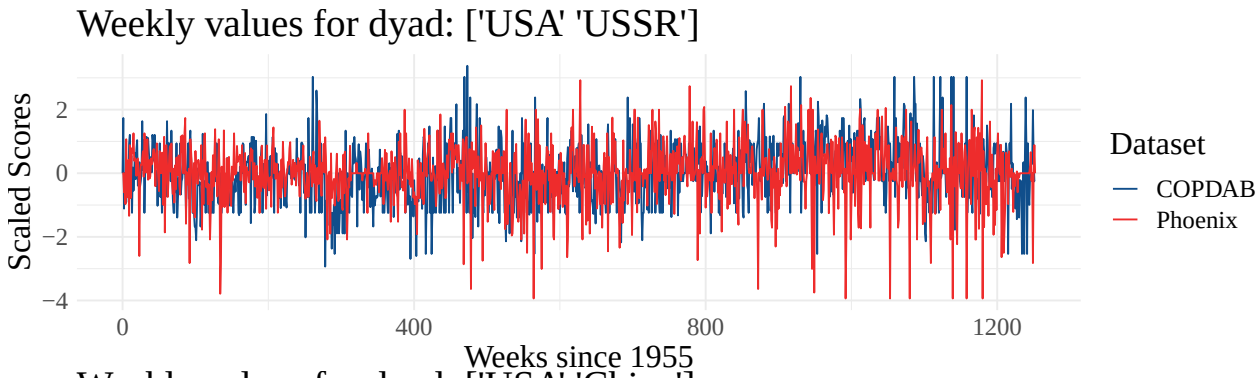
0.0
−0.5
−1.0
−1.5
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix

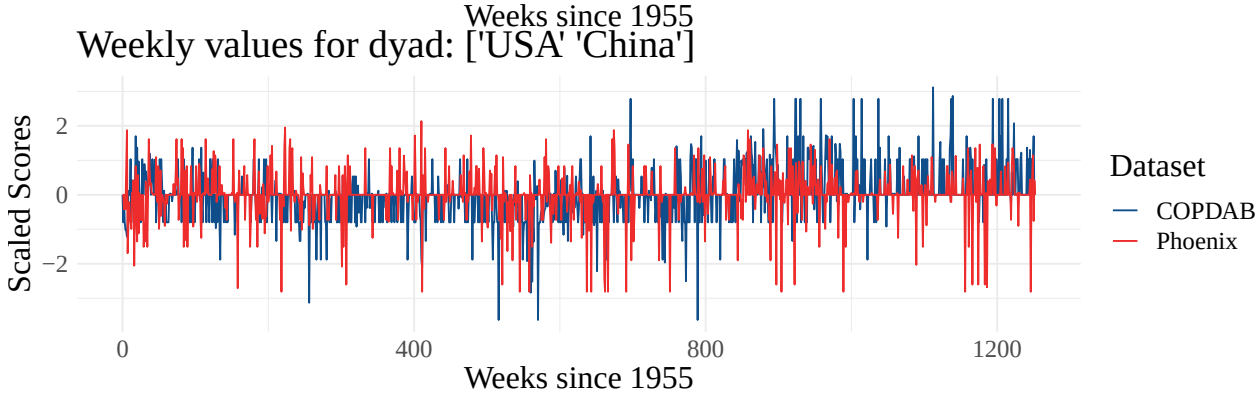

Monthly values for dyad: ['USSR' 'China'] − 6 Month Average
Scaled Scores
1.5
1.0
0.5
0.0
−0.5
−1.0
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix

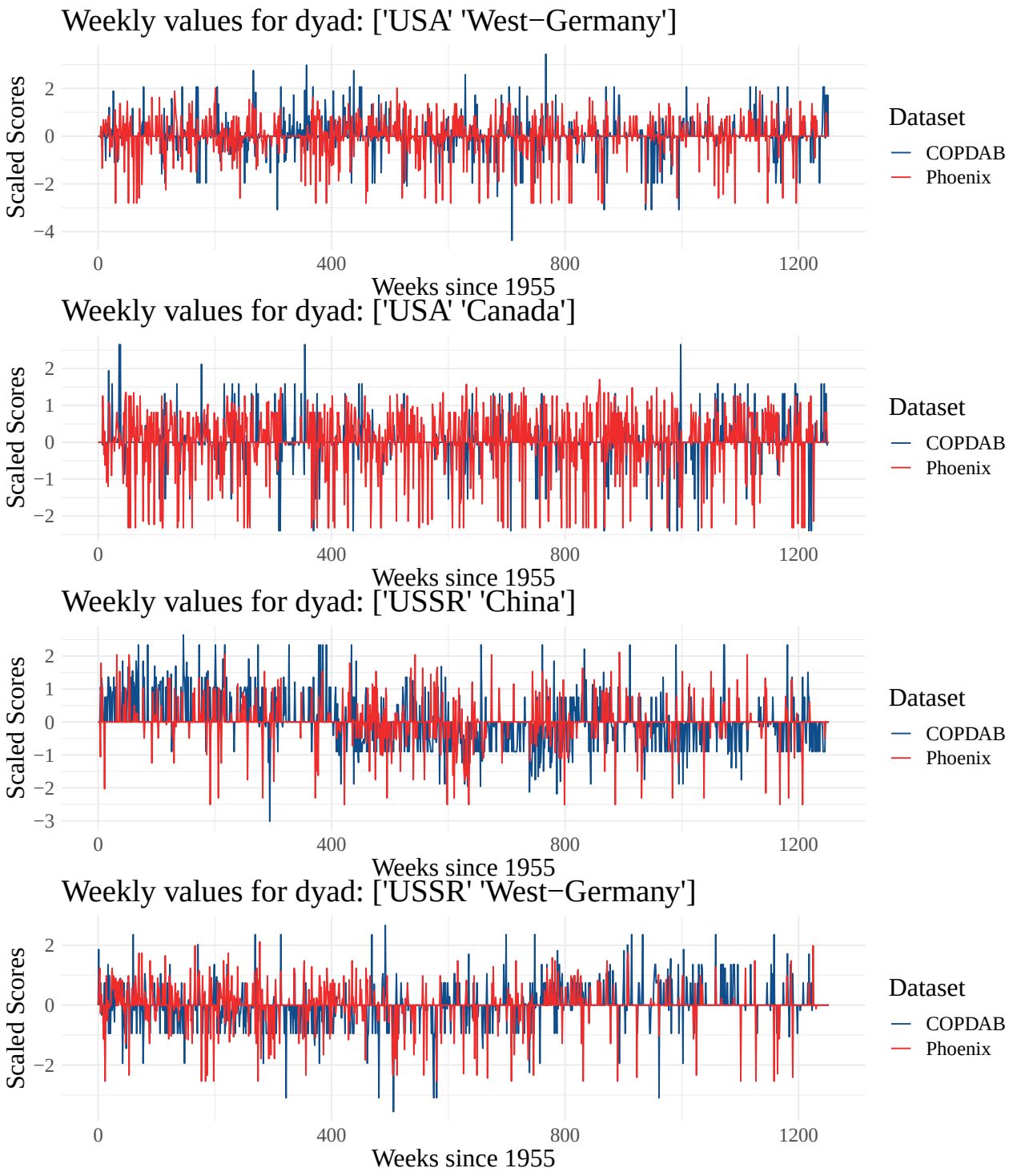

Monthly values for dyad: ['USSR' 'West−Germany'] − 6 Month Average
Scaled Scores
1.0
0.5
0.0
−0.5
−1.0
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['USSR' 'Canada'] − 6 Month Average
Scaled Scores
0.5
0.0
−0.5
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Monthly values for dyad: ['East−Germany' 'West−Germany'] − 6 Month Ave
Scaled Scores
1.0
0.5
0.0
−0.5
−1.0
−1.5
0
100
200
300
Months since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'USSR']
Scaled Scores
2
0
−2
−4
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'China']
Scaled Scores
2
0
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'West−Germany']
Scaled Scores
2
0
−2
−4
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix
Weekly values for dyad: ['USA' 'Canada']
Scaled Scores
2
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix
Weekly values for dyad: ['USSR' 'China']
Scaled Scores
2
1
0
−1
−2
−3
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix
Weekly values for dyad: ['USSR' 'West−Germany']
Scaled Scores
2
0
−2
0
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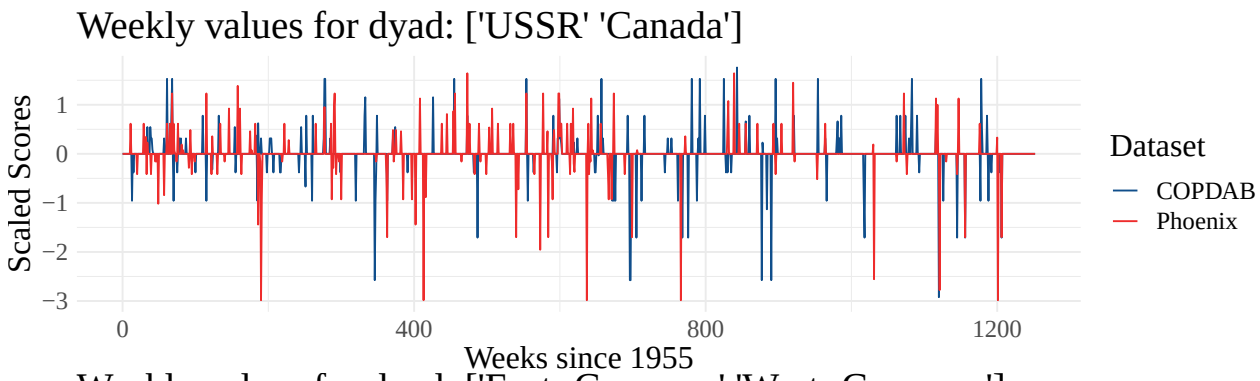
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USSR' 'Canada']
Scaled Scores
1
0
−1
−2
−3
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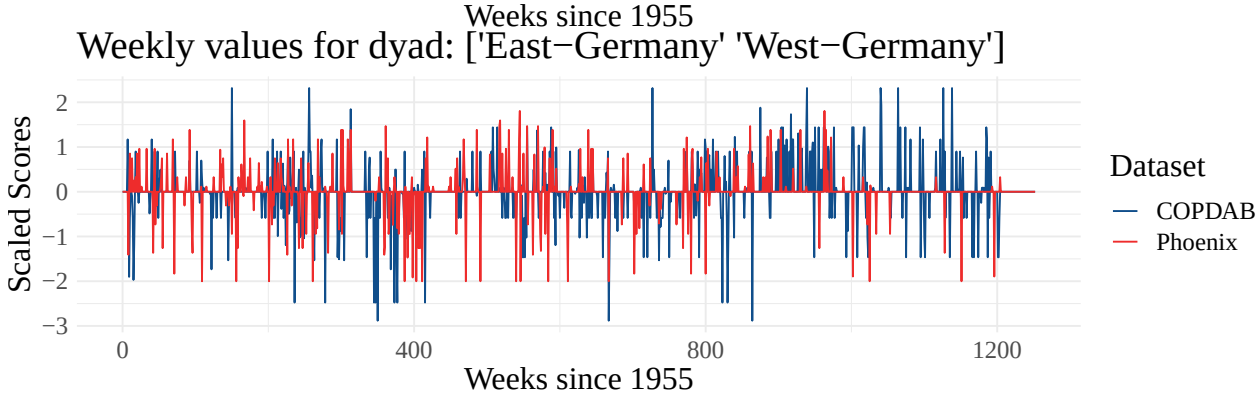
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['East−Germany' 'West−Germany']
Scaled Scores
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1
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−1
−2
−3
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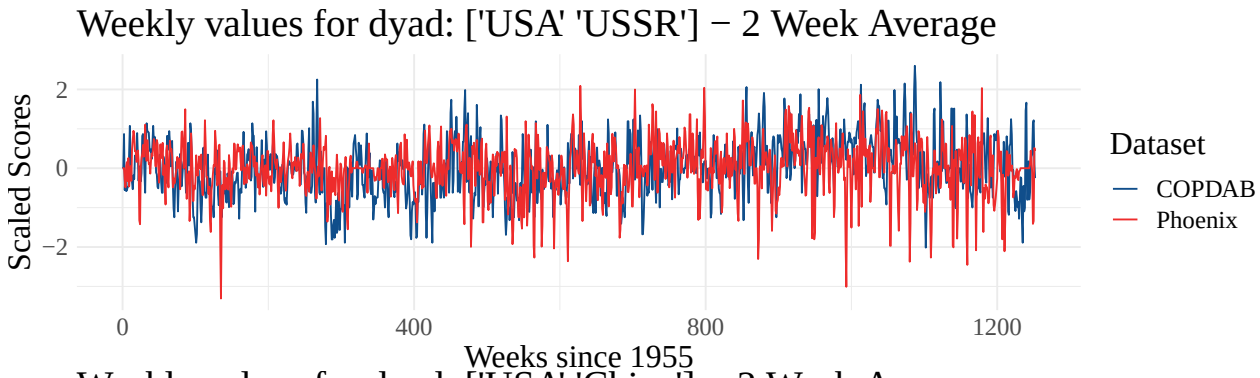
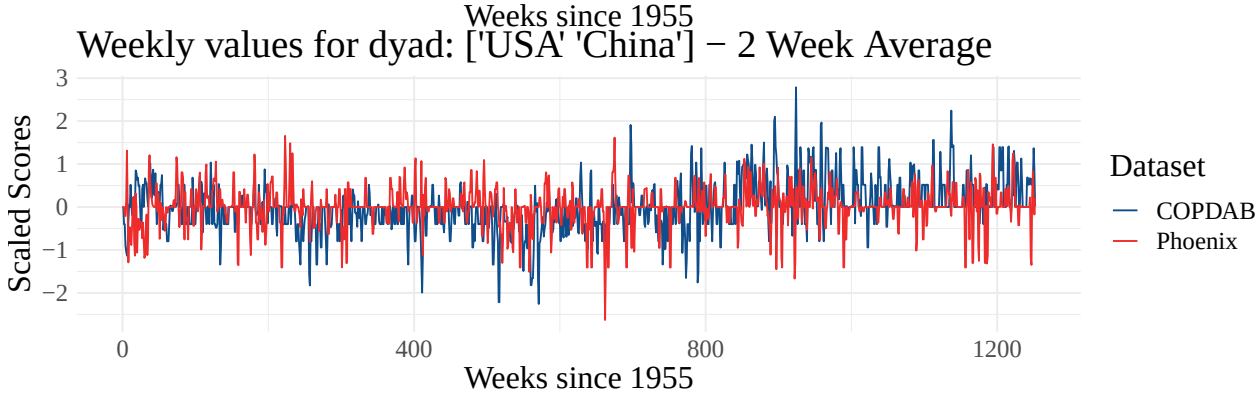
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'USSR'] − 2 Week Average
Scaled Scores
2
0
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'China'] − 2 Week Average
Scaled Scores
3
2
1
0
−1
−2
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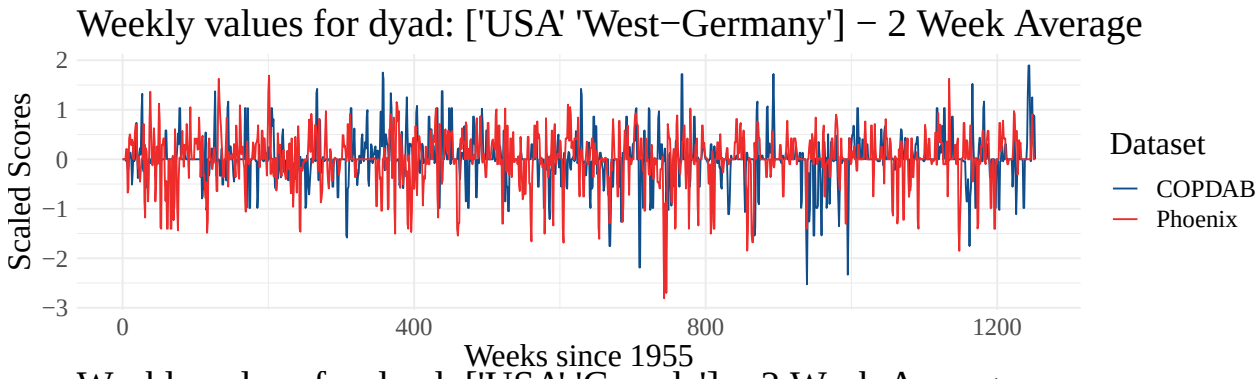
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'West−Germany'] − 2 Week Average
Scaled Scores
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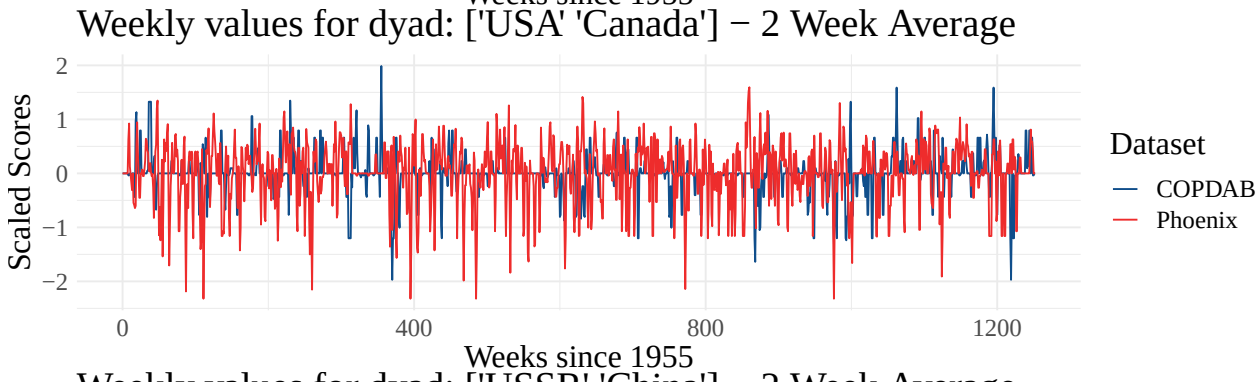
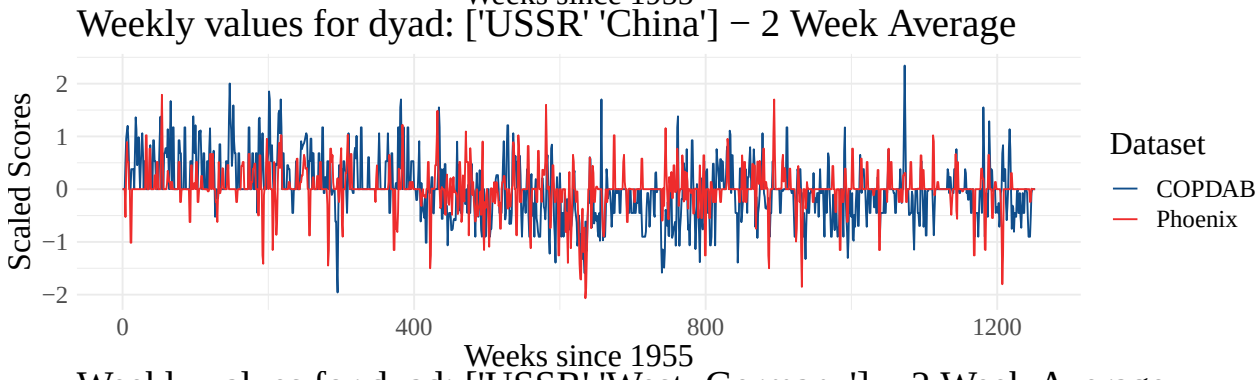
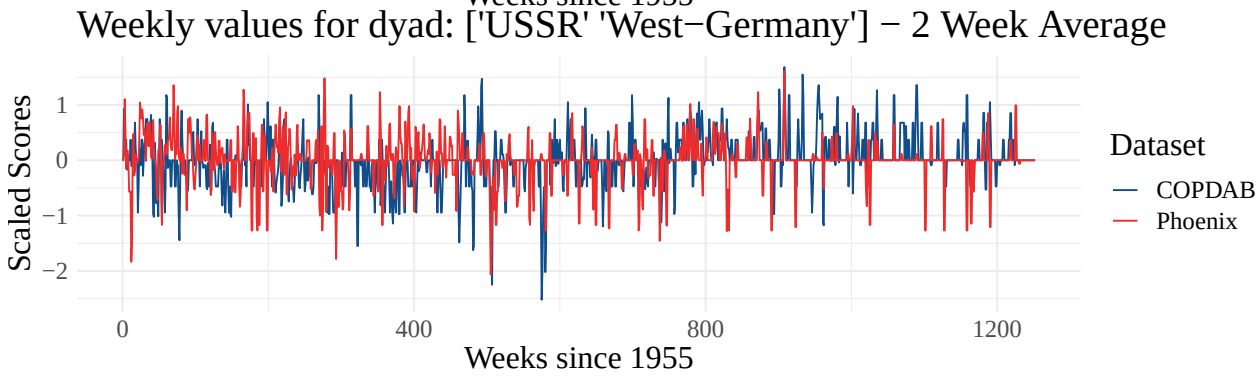
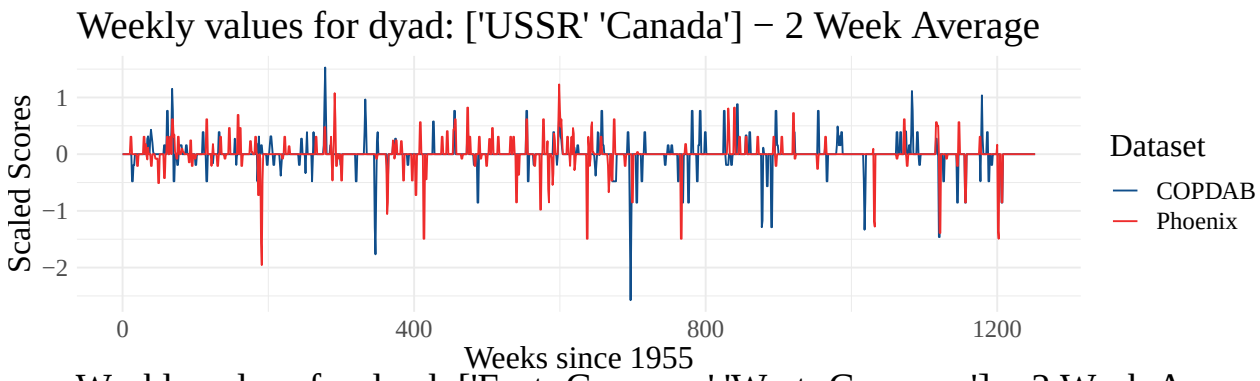
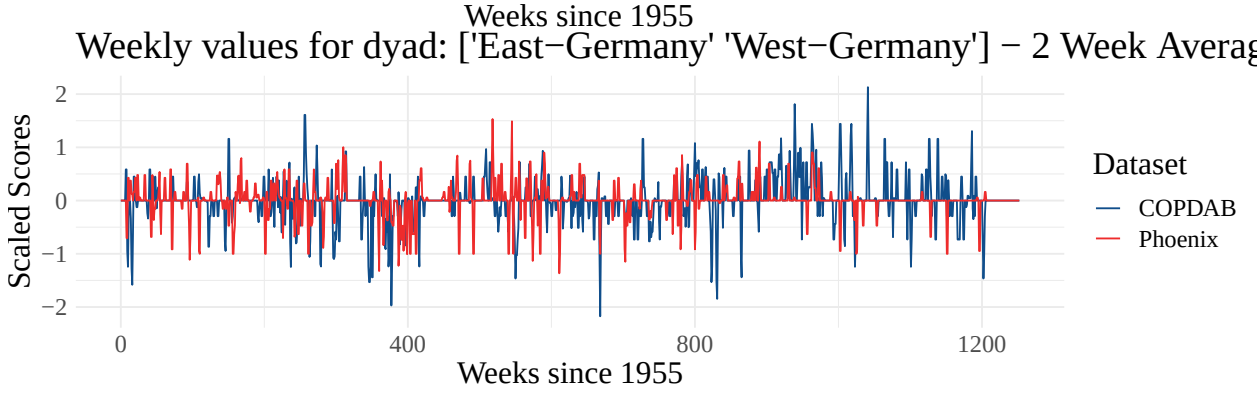
0
−1
−2
−3
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix

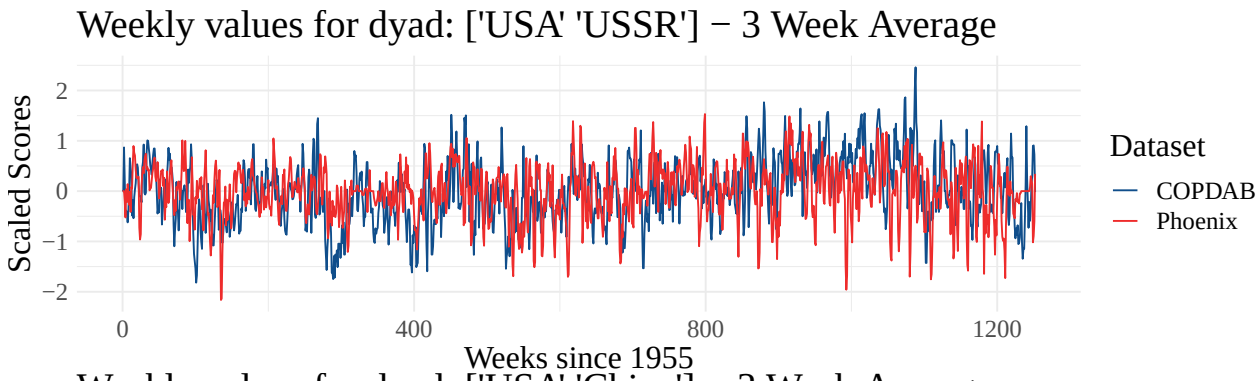

Weekly values for dyad: ['USA' 'Canada'] − 2 Week Average
Scaled Scores
2
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix

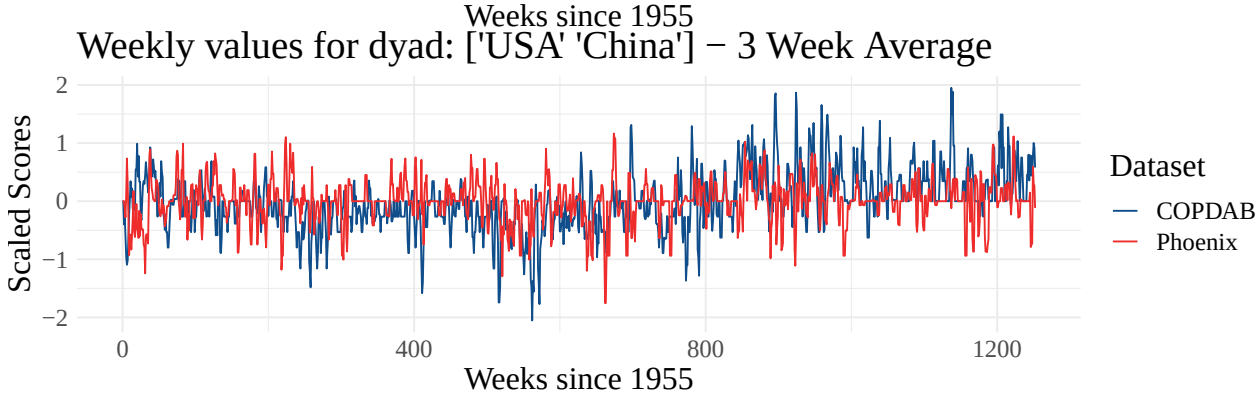

Weekly values for dyad: ['USSR' 'China'] − 2 Week Average
Scaled Scores
2
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USSR' 'West−Germany'] − 2 Week Average
Scaled Scores
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USSR' 'Canada'] − 2 Week Average
Scaled Scores
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['East−Germany' 'West−Germany'] − 2 Week Averag
Scaled Scores
2
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'USSR'] − 3 Week Average
Scaled Scores
2
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'China'] − 3 Week Average
Scaled Scores
2
1
0
−1
−2
0
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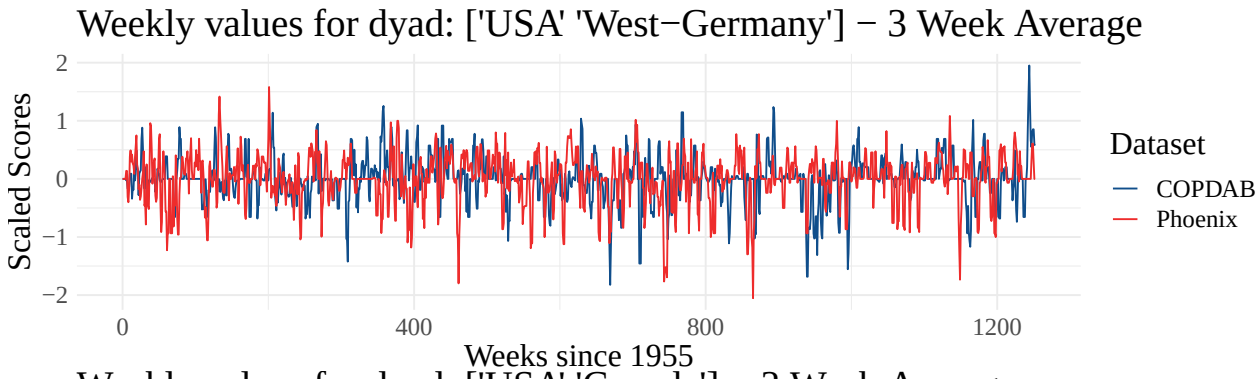
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'West−Germany'] − 3 Week Average
Scaled Scores
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−1
−2
0
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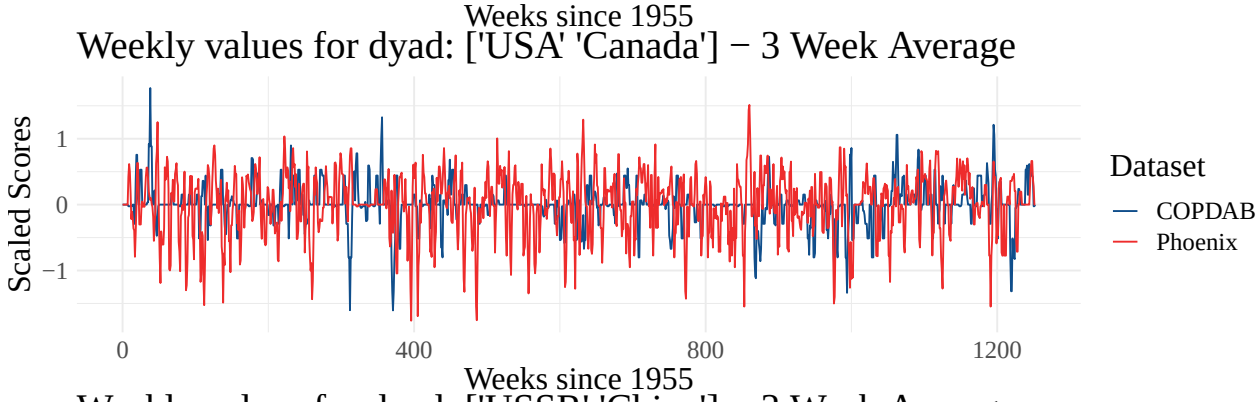
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USA' 'Canada'] − 3 Week Average
Scaled Scores
1
0
−1
0
400
800
1200
Weeks since 1955
Dataset
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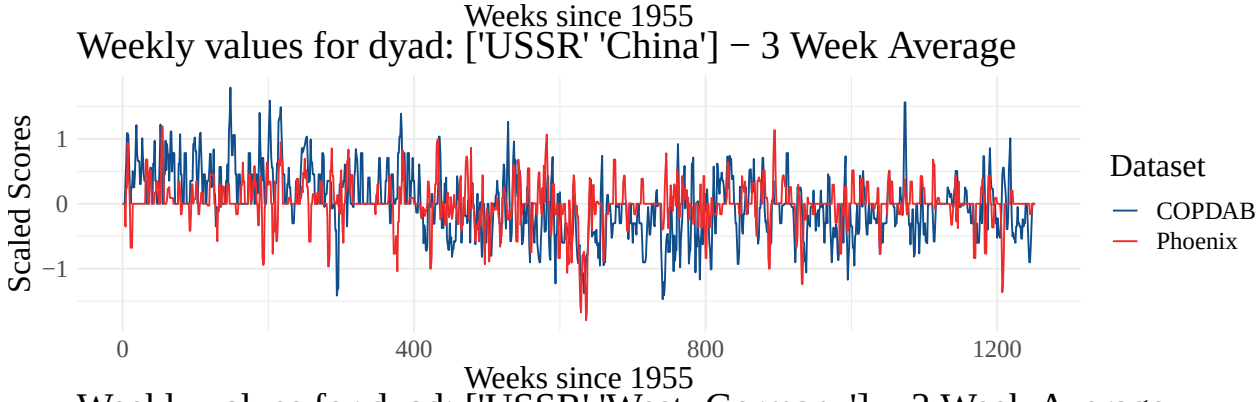
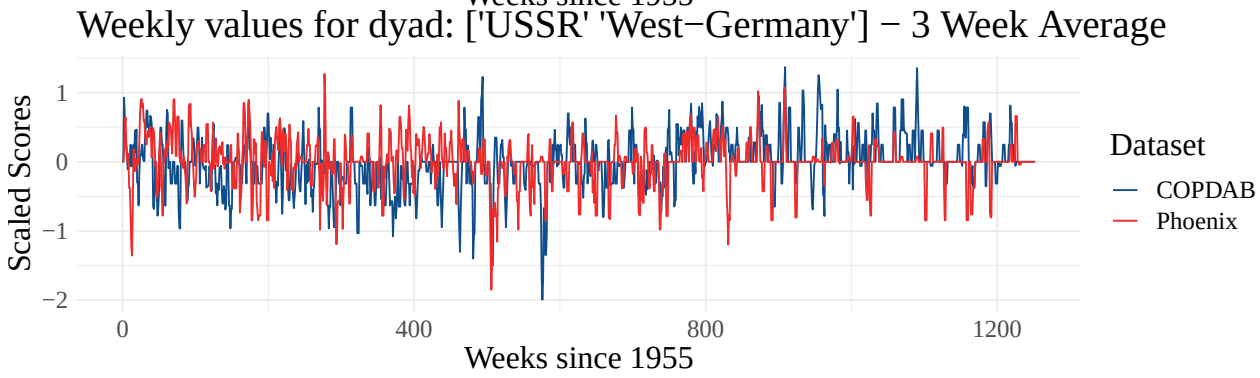
Phoenix


Weekly values for dyad: ['USSR' 'China'] − 3 Week Average
Scaled Scores
1
0
−1
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USSR' 'West−Germany'] − 3 Week Average
Scaled Scores
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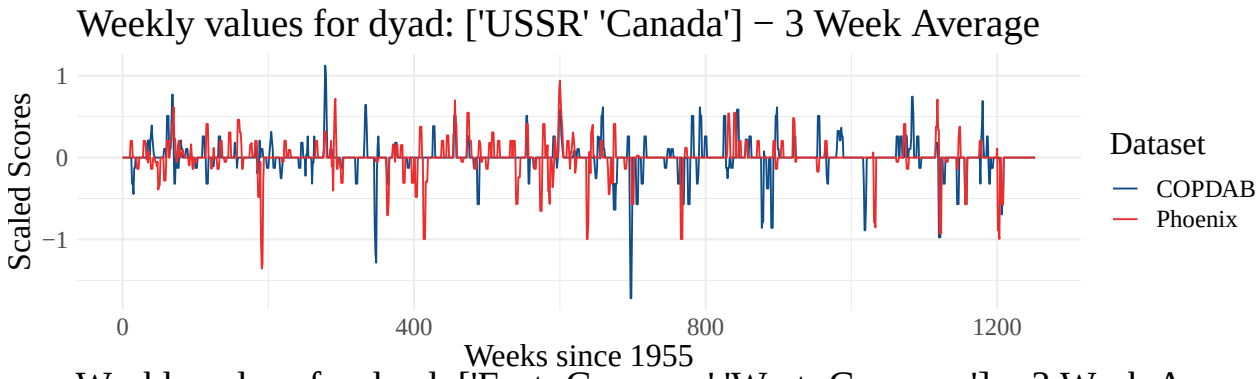
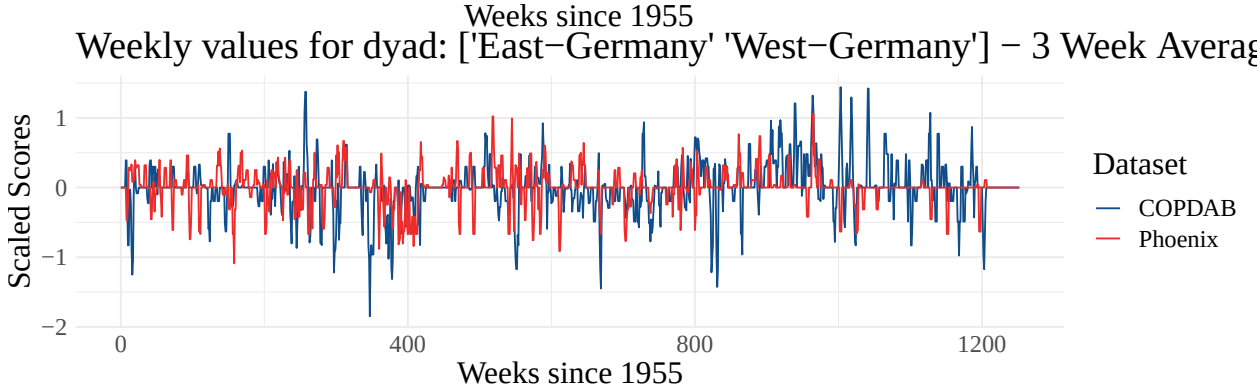
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['USSR' 'Canada'] − 3 Week Average
Scaled Scores
1
0
−1
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix


Weekly values for dyad: ['East−Germany' 'West−Germany'] − 3 Week Averag
Scaled Scores
1
0
−1
−2
0
400
800
1200
Weeks since 1955
Dataset
COPDAB
Phoenix