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are the United States?"

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Synchronism in Electoral Cycles: How United are the United States?

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Abstract

The role of national, sectional, state, and local forces in driving electoral outcomes in the United States has remained a matter of considerable indeterminacy in the American politics literature. In what concerns House elections, different approaches and methods have yielded widely divergent results. In what concerns presidential elections, considerable doubts remain about the timing and the plausible causes of a long-term trend towards homogeneity. In this paper, we take a new look at the nationalization of politics in the United States. We are particularly interested in the dynamic nationalization in presidential elections, i.e., the extent to which swings and shifts from one election to the next have been similar across states and whether or not that similarity has increased through time. We treat this problem as one of similarity or dissimilarity – and convergence or divergence of – electoral cycles, and use wavelets analysis in order to ascertain the degree to which the national and state election cycles have been synchronized and the degree to which that synchronization has increased or decreased. We determine, first, the states where electoral change has been more in sync with the national cycle and clusters of states defined in terms of the mutual synchronization of their own electoral cycles. Second, we analyze how the degree of synchronization of electoral cycles in the states has changed through time, answering questions as to when, to what extent, and where has the tendency towards a "universality of political trends" in presidential elections been more strongly felt. We present evidence strongly in favor of an increase in the dynamic nationalization of presidential elections taking place in the 1950s, showing that alternative interpretations concerning the historical turning point in this respect are not supported by empirical evidence.

1   Introduction

In this paper, we take a new look at the nationalization of politics in the United States. We are particularly interested in dynamic nationalization in presidential elections, i.e., the extent to which changes from one election to the next have been similar across states and the extent to which that similarity has increased or decreased through time. More specifically, we will address two different but related issues. First, we will look at the electoral geography of political trends in American presidential elections. Electoral geographers have, by now, drafted different maps of distributional nationalization in the United States distinguishing different regions characterized by the electoral preponderance of a particular party or, instead, by open competition between parties (Archer and Taylor 1981; Archer and Shelley 1986; Shelley et al. 1996; Heppen 2003). However, no equivalent map exists for dynamic nationalization. Are there groups of states that tend to display similar swings from one election to the next? Is their movement through time significantly different from that observed in other groups of states or in the national results? Are the "geographical sections" that might emerge out of an analysis of voting dynamics similar to those have emerged from an analysis of the distribution of the votes? The second issue we will address in this paper concerns the increase in the dynamic nationalization of presidential elections in the United States. Is that increase real? What can we say about its timing and the relevant historical turning point in this respect? What can a new approach and the use of new tools say about the states or groups of states have contributed the most to increase or decrease the "universality of political trends" in American politics? And what do the results suggest about the real causes behind it?

Half a century ago, E. E. Schaatschneider remarked on two important changes in American politics. First, he noted a "flattening of the curve showing the percentage distribution of the major party vote outside the South" in presidential elections (1960: 89). Large majorities of the vote for one party or another in any state had become increasingly rare events, bringing the United States "within striking distance of a competitive two-party system throughout the country" (1960: 90). The second development concerned what Schaatschneider called the "universality of political trends": "the Republican party gained ground in every state in 1952 and lost ground in forty-five states in 1954, gained ground throughout the country in 1956 and lost ground in nearly every state in 1958. These trends are national in scope" (1960: 93). In sum, both in terms of the distribution of the vote and of

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the uniformity of electoral trends throughout the territory, a "nationalization of politics" had taken place in the United States. Parties were being transformed into national political organizations involved in strong political competition in a system characterized by frequent alternation in power. Without such competition, he thought, governmental power and popular sovereignty would be undermined, opening the way to the control of policy by particularistic interests. Many others, analyzing either the United States or other political systems, have noted other potential consequences of a low nationalization of politics: parochialism and low party cohesion and institutionalization; executives weakened vis-à-vis fragmented legislatures; low information and lack of coordination among voters; and an emphasis on pork barrel distributive politics rather than public goods provision (Stokes 1967; Jones and Mainwaring 2003; Morgenstern and Potthoff 2005; Allemán and Kellam 2008).Thus, the nationalization of American politics was a development that Schaatschneider, profoundly concerned with the vigorousness of electoral competition between strong national political parties, saw as rather welcome.

However, in the scholarship produced since *The Semisovereign People* on the issue of the nationalization of politics in the United States, the picture that has emerged is somewhat less clear-cut. Most studies have continued to distinguish (and to further clarify the distinction) between two aspects of nationalization: *convergence* of partisan support, i.e., "the increasing similarity of geographic units"; and *uniform response*, i.e., the extent to which one finds a "similar response by all subunits of the electorate to the political forces in a given year" (Claggett, Flanigan, and Zingale 1984: 81-82). This corresponds to what Morgenstern, Swindle, and Castagnola (2009) have more recently reframed as the two distinct dimensions of nationalization: *static/distributional*, "the consistency of a party's support across a country at a particular point in time"; and *dynamic*, "the degree to which a party's vote in the various districts changes uniformly across time". Consensus on how either of them have evolved through time, however, has remained elusive. In what concerns House elections, different methods have yielded different results: increased dynamic nationalization (Stokes 1967; Brady D'Onofrio, and Fiorina, 2000); no major trends in either distributional or dynamic nationalization (Claggett, Flanigan, and Zingale, 1984); and increased district-level heterogeneity in both levels of partisan support and electoral swings since the 1950s (Kawato 1987; Morgenstern, Swindle, and Castagnola, 2009). In a sense, it is unsurprising that the picture remains so unclear. Although many trends have worked in favor of such nationalization, other factors have complicated the picture, such as the rise (and later

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decline) of the incumbency advantage and the uncertainties about the size of "presidential coattails", midterm losses, and the causes behind the emergence of quality challengers (see Gelman and King 1990; Ansolabehere, Snyder, and Stewart 2000; Brady, D'Onofrio, and Fiorina, 2000).[1]

The absence of such complications in what concerns presidential elections would lead us to imagine a much clearer picture in what concerns their distributional and dynamic nationalization. To some extent, that seems to be the case. Even when looking at county-level returns, national forces were, at least since the 1960s, understandably far stronger in presidential than in any other type of election (Vertz, Frendreis, and Gibson, 1987). And there is a clear sense that a long-term trend towards the nationalization of presidential elections has taken place throughout the past century. Party support across states and regions seems to have become more homogeneous than in the past, and political trends across states have also become more synchronized than before (Ladd 1970; Sundquist 1983; Archer and Taylor 1981; Sorauf 1984; Schantz 1992; Bartels 1998; Heppen 2003; Brown and Bruce 2008). And yet, the timing of such trend, particularly in what concerns dynamic nationalization, remains surprisingly unclear. While Schaatschneider suggested that the 1950s were the decisive turning point in what concerned the "universality of political trends", others, looking at a longer time series and using more sophisticated methods, suggested that the major drive towards a greater dynamic nationalization of elections took place in the first decades of the 20th century until the 1930s, after which it subsided or leveled off (Schantz 1992; Bartels 1998). The latter findings are, however, rather intriguing. On the one hand, they do point to the importance of the New Deal as a transformational moment in American politics, as Schaatscheider himself suggested. However, on the other hand, they also seem to suggest that little of what happened afterwards seem to have been of any consequence in this respect. This is particularly surprising, not only in light of the role that Schaatscheider assigned to World War II and the Cold War in changing the "meaning of American politics," but also in light of developments such as the nationalization of the news media fostered by the rise of television networks (Schudson 1995), the demise of the Democratic "Solid South" (Petrocik 1987), or the emergence of a "nationalization era" in electoral turnout, fed by increasing competition and expanding voting rights in the South (McDonald 2010). Are we to believe that all these developments, all taking place in the 1950s and 60s, were irrelevant to the dynamic nationalization of presidential elections?

We address these problems by using wavelet analysis, which we have already showed to be partic-

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[1] For a recent broad discussion of national forces in congressional elections, see Burden and Wichowsky, 2010.

ularly well suited to the study of cycles in electoral data (Aguiar-Conraria, Magalhães, and Soares, 2010). Like Fourier spectral analysis, wavelet analysis allows us to determine whether there are frequencies that play predominant roles in explaining the overall variance of a time series. However, unlike spectral analysis, wavelets allow the estimation of the spectral characteristics of a time series as a function of time and do not require the data generating process to be time invariant. With already broad usage in the physical and biological sciences, wavelet analysis has been increasingly recognized as a standard econometric toolkit (Crowley, 2007; Kennedy 2008; Aguiar-Conraria, Azevedo, and Soares, 2008; Aguiar-Conraria and Soares, forthcoming).

In this paper, we apply the tools of wavelet analysis in order to ascertain the degree to which the national and state election cycles have been synchronized and the degree to which that synchronization has increased or decreased. The first of those tools is the wavelet power spectrum, with which we can describe the evolution of the volatility of series of national and state level presidential election returns at different frequencies. Second, we derive a measure of the differences between the wavelet spectra that characterize the volatility of election returns nationally and in the states, allowing us to compute a dissimilarity index that reveals the extent to which electoral cycles have been synchronized, both in a national/state and a state-to-state comparison. In other words, we can determine both the states where electoral change has been more in sync with the national cycle and clusters of states defined in terms of the mutual synchronization of their own electoral cycles. Third, using the cross-wavelet and the phase difference tools, we analyze how the degree of synchronization of electoral cycles in the states has changed through time, answering questions as to when, to what extent, and where has the tendency towards a "universality of political trends" in presidential elections been more strongly felt.

In section 2 of the paper, we present the formulas for the wavelet power spectrum, which describes the evolution of the variance of a time-series at the different frequencies, with periods of large variance associated with periods of large power at the different scales, the cross-wavelet power of two time-series, which describes the local covariance between the time-series, and the wavelet coherency, which can be interpreted as a localized correlation coefficient in the time frequency space, and the phase, which can be viewed as the position in the cycle of the time-series as a function of frequency, and the phase-difference, which gives us information on the delay, or synchronization, between oscillations of the two time-series. In section three, we derive a metric for measuring election cycles synchronization, the wavelet spectral distance matrix. In section four, using the wavelet spectral distance matrix, we

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find clusters of states that, throughout American electoral history, have displayed more similar or dissimilar behaviors in terms of electoral change through time. In section five, we approach the issue of the increasing dynamic nationalization of presidential elections with the help of cross-wavelet and phase-difference tools. Section six concludes.

2 Wavelets

Wavelet analysis performs the estimation of the spectral characteristics of a time-series as a function of time, revealing how the different periodic components of a particular time-series evolve over time. While the Fourier transform breaks down a time-series into constituent sinusoids of different frequencies and infinite duration in time, the wavelet transform expands the time-series into shifted and scaled versions of a function that has limited spectral band and limited duration in time. In spite of its theoretical soundness, to our knowledge, with the exception of Aguiar-Conraria, Magalhães, and Soares (2010)[2], wavelet analysis has never been used in the Political Science literature.

Apart from some technical details, for a function, ψ, to qualify for being a good mother wavelet, it must have finite energy, i.e. $\|\psi\|^2 = \int_{-\infty}^{\infty} |\psi(t)|^2 \, dt < \infty$, be well-localized in time (e.g. have compact support or, at least, fast decay when $|t| \to \infty$) and also have zero mean, i.e. $\int_{-\infty}^{\infty} \psi(t) \, dt = 0$. The last condition means that the function ψ has to wiggle up and down the t-axis, hence behaving like a wave; this, together with the dacaying property, justifies the choice of the term wavelet to designate ψ.

Starting with a mother wavelet ψ, a family $\psi_{\tau,s}$ of "wavelet daughters" can be obtained by simply scaling and translating ψ:

$$\psi_{\tau,s}(t) := \frac{1}{\sqrt{s}} \psi\left(\frac{t-\tau}{s}\right), \quad s, \tau \in \mathbb{R}, s > 0, \tag{1}$$

where s is a scaling or dilation factor that controls the width of the wavelet and τ is a translation parameter controlling the location of the wavelet. Given a time series $x(t)$, its continuous wavelet transform (CWT) with respect to the wavelet ψ is a function of two variables, $W_x(\tau, s)$:

$$W_x(\tau, s) = \int_{-\infty}^{\infty} x(t) \frac{1}{\sqrt{s}} \overline{\psi}\left(\frac{t-\tau}{s}\right) dt, \tag{2}$$

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[2]Which we refer the reader to for a detailed explanation and technical minutiae.

where the bar denotes complex conjugation.[3]

There are several types of wavelet functions available with different characteristics. Since the wavelet coefficients $W_x(s, \tau)$ contain information on both $x(t)$ and $\psi(t)$, the choice of the wavelet is important. This choice depends on the particular application one has in mind. In this paper, we will use the so called Morlet wavelet (with parameter $\omega_0 = 6$),

$$\psi(t) = \pi^{-\frac{1}{4}} e^{i\omega_0 t} e^{-\frac{t^2}{2}} \ , \quad \omega_0 = 6. \tag{3}$$

The Morlet wavelet is a complex analytic wavelet,[4] which is ideal ideal for the analysis of oscillatory signals, allowing us to estimate the instantaneous amplitude and instantaneous phase of the signal in the vicinity of each time/scale location (τ, s). The Morlet wavelet has another important property: it has optimal joint time-frequency concentration.[5] With this wavelet choice, there is an inverse relation between wavelet scales and frequencies, $f \approx \frac{1}{s}$, greatly simplifying the interpretation of the empirical results.

In analogy with the terminology used in the Fourier case, the (local) **wavelet power spectrum** (sometimes called scalogram or wavelet periodogram) is defined as

$$(WPS)_x(\tau, s) = |W_x(\tau, s)|^2 . \tag{4}$$

This gives us a measure of the variance distribution of the time-series in the time-scale/frequency plane.

The concepts of cross wavelet power, wavelet coherency and phase-difference are natural generalizations of the basic wavelet analysis tools, which enable us to deal with the time-frequency dependencies between two time-series. The cross-wavelet transform of two time-series, $x(t)$ and $y(t)$, is defined as $W_{xy}(\tau, s) = W_x(\tau, s) \overline{W_y}(\tau, s)$, where W_x and W_y are the wavelet transforms of x and y, respectively. We define the cross wavelet power, as $|W_{xy}(\tau, s)|$. The cross-wavelet power of two time-series depicts

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[3]In practice, when one is dealing with a discrete time-series, the integral defining the continuous wavelet transform is discretized. See Aguiar-Conraria, Magalhães and Soares (2010) for details.

[4]A wavelet is called analytic if its Fourier transform is zero for negative frequencies. Strictly speaking, the function (3) is not a true wavelet, since it violates the zero mean condition; however, the value of the mean, $\int_{-\infty}^{\infty} \psi(t) \, dt \approx 10^{-8}$, is small enough for $\psi(t)$ to be used as a wavelet, in numerical applications.

[5]It is possible to show that the area of the Heisenberg box, which describes the trade-off relationship between time and frequency, is minimized with the choice of the Morlet wavelet.

the local covariance between two time-series at each time and frequency. When compared with the cross wavelet power, the **wavelet coherency** has the advantage of being normalized by the power spectrum of the two time-series. In analogy with the concept of coherency used in Fourier analysis, given two time-series $x(t)$ and $y(t)$ one defines their wavelet coherency:

$$R_{xy}\left(\tau,s\right) = \frac{\left|S\left(W_{xy}\left(\tau,s\right)\right)\right|\,\left|}{\sqrt{S\left(\left|W_{xx}\left(\tau,s\right)\right|\right)S\left(\left|W_{yy}\left(\tau,s\right)\right|\right)}},$$

where S denotes a smoothing operator in both time and scale.

As we have discussed, one of the major advantages of using a complex-valued wavelet is that we can compute the phase of the wavelet transform of each series and thus obtain information about the possible delays of the oscillations of the two series as a function of time and scale/frequency, by computing the phases and the phase difference. The **phase** is given by $\tan^{-1}\left(\frac{\Im(W_x(\tau,s))}{\Re(W_x(\tau,s))}\right)$ and the **phase difference** by $\tan^{-1}\left(\frac{\Im(W_{xy}(s,\tau))}{\Re(W_{xy}(s,\tau))}\right)$, where, for a given complex number z, $\Re\left(z\right)$ and $\Im\left(z\right)$ denote, respectively, its real part and imaginary part. A phase-difference of zero indicates that the time series move together at the specified frequency; if $\phi_{xy} \in (0, \frac{\pi}{2})$, then the series move in phase, but the time-series y leads x; if $\phi_{xy} \in (-\frac{\pi}{2}, 0)$, then it is x that is leading; a phase-difference of π (or $-\pi$) indicates an anti-phase relation; if $\phi_{xy} \in (\frac{\pi}{2}, \pi)$, then x is leading; time-series y is leading if $\phi_{xy} \in (-\pi, -\frac{\pi}{2})$.

3   Wavelet Spectral Distance Matrix

We now introduce a way to measure the dissimilarities between wavelet spectra of two time-series, say $x(t)$ and $y(t)$. We use the Singular Value Decomposition (SVD) of a matrix to focus on the common high power time-frequency regions. This method extracts the components that maximize covariances, therefore, the first extracted components correspond to the most important common patterns between the wavelet spectra. With that information, we just need to define a metric to measure the pair-wise distance between the several extracted components. A value very close to zero means that $x(t)$ and $y(t)$ have a very similar wavelet transform. This, in turn, implies that the two variables share the same high power regions and that their phases are aligned. This means that (1) the contribution of cycles at each frequency to the total variance is similar, (2) this contribution happens at the same

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time and, finally, (3) the ups and downs of each cycle occur simultaneously. In this sense, we say that a value close to zero between two variables means that their cycles are highly synchronized.

3.1   Leading Vectors and Leading Patterns

Given two $F \times T$ wavelet spectral matrices W_x and W_y, let $C_{xy} := W_x W_y^H$, where W_y^H is the conjugate transpose of W_y, be their covariance matrix. Performing a SVD of this matrix yields

$$C_{xy} = U \Sigma V^H, \tag{5}$$

where the matrices U and V are unitary matrices (i.e. $U^H U = V^H V = I$), and $\Sigma = \mathrm{diag}(\sigma_i)$ is a diagonal matrix with non-negative diagonal elements ordered from highest to lowest, $\sigma_1 \geq \sigma_2 \geq \ldots \geq \sigma_F \geq 0$.

The columns, $\mathbf{u}_k$, of the matrix U and the columns, $\mathbf{v}_k$, of V are known, respectively, as the singular vectors for W_x and W_y, and the σ_i are the singular values. The number of nonzero singular values is equal to the rank of the matrix C_{xy}.

The singular vectors $\mathbf{u}_k$ and $\mathbf{v}_k$ satisfy an important variational property. For each k, they are such that

$$\mathbf{u}_k^H C_{xy} \mathbf{v}_k = \max_{\mathbf{p}_k, \mathbf{q}_k \in S} \left\{ \mathbf{p}_k^H C_{xy} \mathbf{q}_k \right\} \tag{6}$$

where S is the set of all vectors satisfying the following orthogonality conditions:

$$\mathbf{p}_k^H \mathbf{p}_j = \mathbf{q}_k^H \mathbf{q}_j = \delta_{k,j}, \quad \text{for} \quad j = 1, \ldots, k, \tag{7}$$

with $\delta_{k,j}$ denoting the Kronecker delta symbol.

Let $\mathbf{l}_x^k$ and $\mathbf{l}_y^k$ be the leading patterns, i.e. the $1 \times T$ vectors obtained by projecting each spectrum W_x and W_y onto the respective k^{th} singular vector (axis):

$$\mathbf{l}_x^k := \mathbf{u}_k^H W_x \quad \text{and} \quad \mathbf{l}_y^k := \mathbf{v}_k^H W_y. \tag{8}$$

Then, since

$$\mathbf{u}_k^H C_{xy} \mathbf{v}_k = \mathbf{u}_k^H W_x W_y^H \mathbf{v}_k = \mathbf{u}_k^H W_x (\mathbf{v}_k^H W_y)^H = \mathbf{l}_x^k (\mathbf{l}_y^k)^H,$$

we can conclude that the leading patterns are the linear combinations of the rows of W_x and W_y, respectively, that maximize their mutual covariance (subject to the referred orthogonality constraints).

Also, one can easily show, by using Eq. (5), that the (squared) covariance of the kth leading patterns is given by

$$\left|\mathbf{l}_x^k \left(\mathbf{l}_y^k\right)^H\right|^2 = \left|\mathbf{u}_k^{\text{H}} C_{xy} \mathbf{v}_k\right|^2 = \sigma_k^2. \tag{9}$$

On the other hand, the (squared) covariance of W_x and W_y is given by $\|C_{xy}\|_{Fro}^2$, where $\|.\|_{Fro}$ is the Frobenius matrix norm, defined by $\|A\|_{Fro} := \sqrt{\sum_{ij} |a_{ij}|^2}$. Since this norm is invariant under a unitary transformation, we have

$$\|C_{xy}\|_{Fro}^2 = \|U^H C_{xy} V\|_{Fro}^2 = \|\Sigma\|_{Fro}^2 = \sum_{i=1}^{F} \sigma_i^2.$$

The (squared) singular values, σ_k^2, are the weights to be attributed to each leading pattern and are equal to the (squared) covariance explained by each pair of singular vectors.

If we denote by L_x and L_y the matrices whose rows are the leading patterns $\mathbf{l}_x^k$ and $\mathbf{l}_y^k$, equation(8) shows that $L_x = U^H W_x$ and $L_y = V^H W_y$, from where we immediately obtain

$$W_x = U L_x = \sum_{k=1}^{F} \mathbf{u}_k \mathbf{l}_x^k, \qquad W_y = V L_y = \sum_{k=1}^{F} \mathbf{v}_k \mathbf{l}_y^k.$$

In practice, we select a certain number $K < F$ (K usually much smaller than F) of leading patterns, guaranteeing, for example, that the fraction of covariance $\left(\sum_{k=1}^{K} \sigma_k^2\right) / \left(\sum_{k=1}^{F} \sigma_k^2\right)$ is above a certain threshold,[6] and use

$$W_x \approx \sum_{k=1}^{K} \mathbf{u}_k \mathbf{l}_x^k, \quad W_y \approx \sum_{k=1}^{K} \mathbf{v}_k \mathbf{l}_y^k.$$

3.2 Distance Between Two Spectra

We have reduced the information contained in the two wavelet spectra to a few components: the K most relevant leading patterns and leading vectors. Now, the idea is to define a distance between the two spectra, by appropriately measuring the distances from these components. To do so, we compute the distance between two vectors (leading patterns or leading vectors) by measuring the angle between

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[6]We use $K = 3$. Three leading patterns are enough to guarantee a fraction above 90%. Using larger values for K yields indistinguishable results.

each pair of corresponding segments, defined by the consecutive points of the two vectors, and take the mean of these values. We use a complex wavelet, therefore we need to define an angle in a complex vector space. Unfortunately, there is no consensus in the mathematical literature on angles in complex vector spaces. Scharnhorst (2001) summarizes several possible definitions. In this paper we use the following approach.

In the space $\mathbb{C}^n$, we consider the usual (Hermitian) inner product $\langle \mathbf{a}, \mathbf{b} \rangle_{\mathbb{C}} = \mathbf{a}^H \mathbf{b}$ and corresponding norm $\|\mathbf{a}\| = \sqrt{\langle \mathbf{a}, \mathbf{a} \rangle_{\mathbb{C}}}$. We then define the so-called Hermitian angle between the complex vectors $\mathbf{a}$ and $\mathbf{b}$, $\Theta_H(\mathbf{a}, \mathbf{b})$, by the formula

$$\cos(\Theta_H) = \frac{|\langle \mathbf{a}, \mathbf{b} \rangle_{\mathbb{C}}|}{\|\mathbf{a}\|\|\mathbf{b}\|}, \quad \Theta_H \in [0, \frac{\pi}{2}].^7 \tag{10}$$

The distance between two vectors $\mathbf{p} = (p_1, \ldots, p_M)$ and $\mathbf{q} = (q_1, \ldots, q_M)$ with M components in $\mathbb{C}$ (applicable to the leading patterns and leading vectors) is simply defined by

$$d(\mathbf{p}, \mathbf{q}) = \frac{1}{M-1} \sum_{i=1}^{M-1} \Theta_H \left(\mathbf{s}_i^{\mathbf{p}}, \mathbf{s}_i^{\mathbf{q}} \right) \tag{11}$$

where the ith segment $\mathbf{s}_i^{\mathbf{p}}$ is the two-vector $\mathbf{s}_i^{\mathbf{p}} := (i+1, p_{i+1}) - (i, p_i) = (1, p_{i+1} - p_i)$.

To compare the wavelet spectra of country x and country y, we then compute the following distance:

$$\text{dist}(W_x, W_y) = \frac{\sum_{k=1}^K \sigma_k^2 \left[d\left(\mathbf{l}_x^k, \mathbf{l}_y^k\right) + d\left(\mathbf{u}_k, \mathbf{v}_k\right) \right]}{\sum_{k=1}^K \sigma_k^2}, \tag{12}$$

where σ_k^2 are the weights equal to the squared covariance explained by each axis.

The above distance is computed for each pair of countries and, with this information, we can then fill a matrix of distances.

4 The Geography of Electoral Cycles

It is by now a relatively well-established fact that national presidential election returns in the United States exhibit cyclical features. In other words, those returns have displayed, at least since the late 19th

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[7]Another possibility would be to consider the natural isomorphism $\phi: \mathbb{C}^n \longrightarrow \mathbb{R}^{2n}$ given by $\phi(\mathbf{a}) = \phi((a_1, \ldots, a_n)) = (\Re(a_1), \Im(a_1), \cdots, \Re(a_n), \Im(a_n))$ and simply define the Euclidean angle between the complex vectors $\mathbf{a}$ and $\mathbf{b}$ as the angle between the real vectors $\phi(\mathbf{a})$ and $\phi(\mathbf{b})$. Using the Euclidian angle approach has shown not to change the results in a sensible way.

century, a fundamental pendularity, in which the share of the vote for the major parties ebbs and flows in a fairly regular manner. Although there is controversy concerning the actual periodicity of those cycles and their prevalence throughout the entire American electoral history, empirical support for some sort of cyclicality is robust to the use of a variety of techniques (Norpoth 1995; Lin and Guillén 1998; Merrill, Grofman, and Brunell 2008). The contribution of wavelet analysis for this question, presented in Aguiar-Conraria, Magalhães, and Soares (2010), was to show that the predominant cycles in presidential election returns that had been identified in previous studies were in fact transient, failing to characterize the entire period under examination. Figure 1 displays the wavelet power spectrum for the Democratic share of the two-party vote from 1856 to 2008.[8] It reveals the existence of the 26/27-year cycle identified by Lin and Guillén (1998) and Brunell, Grofman, and Merrill (2008), but also that such cycle is temporally localized, starting in the turn of the 20th century but dissipating by the end of the 1960s. Furthermore, it shows a transitional 14-year cycle between the late 1950s and 1980, as well as (weak) evidence of the coexistence of these cycles with a long cycle of 60 years, significant at the 15% level.[9]
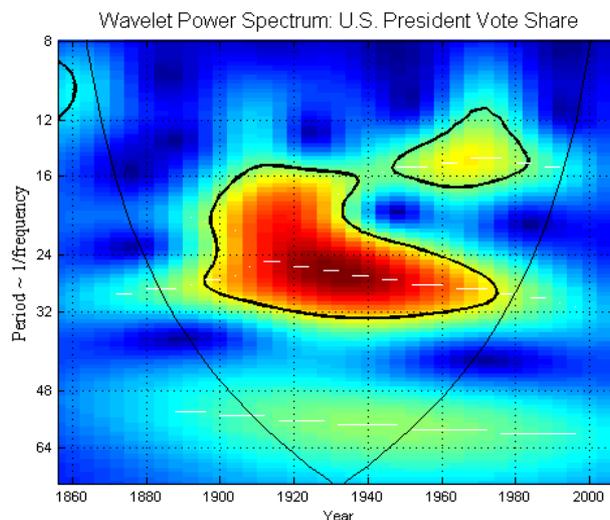
Figure 1: The black contour designates the 5% significance level. The cone of influence, which indicates the region affected by edge effects, is shown with a thin black line. The color code for power ranges from blue (low power) to red (high power). The white lines show the maxima of the undulations of the wavelet power spectrum

[8]All data used in this paper was provided by the The American Presidency Project at UC Santa Barbara (http://www.presidency.ucsb.edu).

[9]To assess statistical significance, we always rely on Monte Carlo methods with 10000 simulations. See Aguiar-Conraria, Magalhães and Soares (2010) for details.

Scholars concerned with the perennial problem of sectionalism in American politics (Turner 1914 and 1926) have been understandably more concerned with the "geography of party preponderance" than with what one might call "the geography of electoral cycles," i.e., with distributional rather than dynamic nationalization. From this point of view, we know that, in spite of the existence, today, of a higher level of homogeneity in partisan support than in the past, analysis of voting patterns in presidential elections continue to yield the existence of significant "geographic sections" of continued preponderance of a particular party. Based on S-mode factor analysis, scholars have identified three main regions: the South (old Confederacy plus Kentucky and Missouri), the Northeast (including New England, the Mid-Atlantic, the Upper Midwest and the – not geographically contiguous – Pacific Coast), and the West (the Great Plains, the Rocky Mountains, and the southwestern states of New Mexico and Arizona – Archer and Taylor 1981; Archer and Shelley 1986; Shelley et al. 1996). Others, like Heppen (2003), have proposed two alternative sectionalizations. The first, using three clusters, identifies a division between the Deep South (South Carolina, Georgia, Alabama, Mississippi, and Louisiana), a near and border South (plus New Mexico, Arizona, and Utah), and the rest of the country. The second, using four clusters, allows for a division between the Deep South (except Georgia), a Rim South, the Northeast and Pacific Coast, and the West (Great Plains and Rocky Mountains). However, none of these works have focused on the dynamic dimensions of sectionalism or nationalization: what clusters of states emerge when we look for the synchronization of their electoral cycles, both with the national cycle identified in Figure 1 and among each other?

We use data for 45 states from 1896 until 2008,[10] and compute the Democratic share of the two-party vote for all 29 elections.[11] Figure A1 (in the Appendix) shows the continuous wavelet power spectra of the Democratic share of the vote for the national aggregate (as in Figure 1) and in all 45 states considered. We assess the statistical significance against the null hypothesis of an AR(1).

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[10] Alabama (AL), Arkansas (AR), California (CA), Colorado (CO), Connecticut (CT), Delaware (DE), Florida (FL), Georgia (GA), Idaho (ID), Illinois (IL), Indiana (IN), Iowa (IA), Kansas (KS), Kentucky (KY), Louisiana (LA), Maine (ME), Maryland (MD), Massachusetts (MA), Michigan (MI), Minnesota (MN), Mississippi (MS), Missouri (MO), Montana (MT), Nebraska (NE), Nevada (NV), New Hampshire (NH), New Jersey (NJ), New York (NY), North Carolina (NC), North Dakota (ND), Ohio (OH), Oregon (OR), Pennsylvania (PA), Rhode Island (RI), South Carolina (SC), South Dakota (SD), Tennessee (TN), Texas (TX), Utah (UT), Vermont (VT), Virginia (VA), Washington (WA), West Virginia (WV), Wisconsin (WI) and Wyoming (WY).

[11] The only exception is for the 1912 presidential run. In that election, Theodore Roosevelt failed to receive the Republican nomination. Roosevelt created the Progressive party and ran for president, dividing the Republican electorate. For this individual election, we compare the votes of the Democratic candidate (Woodrow Wilson) with the total of the votes of the other two major contenders (William Taft and Roosevelt).

Looking at the time-frequency decomposition, some interesting facts are revealed. The persistent 26-year cycle (until the 1960s) and the transient 15-year cycle between early the 1950s and 1980 that we found for the United States as a whole is replicated in some states, like Maine, Ohio, Maryland, New Hampshire, New York, Pennsylvania, and others. But not all states are alike. For example, in Washington and Wisconsin, most of the action occurred until 1950, at several frequencies. In Utah, the 16-year cycle is not apparent. In Tennessee, a 10-14 year cycle is very strong between 1960 and 1990, while in Texas one can find a cycle at these same frequencies before 1950, and so on. However, visual comparisons become of little use with so much information, and we need to find summary measures of the similarity of cycles between states and the national aggregate. Furthermore, comparisons of wavelet power spectra are deceptive, since they reveal no information about the phase.[12] Therefore, even if two entities share a similar high power region – such as, for example, the United States and, say, Virginia – one cannot infer that their electoral cycles are alike. It is possible that, although cycles have a similar periodicity, while in one entity the Democratic share is increasing in a particular period, it is decreasing in the other at the same time.

Thus, based on formula (12) (multiplied by 100) we compute a pairwise dissimilarity index between the wavelet spectra that characterize the volatility of election returns nationally and in the states.[13] In Table 1, we show the dissimilarity between each state's electoral cycle and the national cycle. In Table 2, we show the pairwise dissimilarity between states. As explained in the previous section, this index takes into account both the real and the imaginary part of the wavelet transform. A value very close to zero means that two states have a very similar wavelet transform. This, in turn, implies that the two entities being compared (either state with national aggregate or state with state) share the same high power regions and also, crucially, that their phases are aligned. This means that (1) the contribution of cycles at each frequency to the total variance is similar between both states, (2) this contribution happens at the same time in both states and, finally, (3) the ups and downs of each cycle occur simultaneously in both states. In this sense, we say that a value close to zero between entities means that their electoral cycles are highly synchronized.

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[12]This is so because the phase information is obtained from the imaginary part of a complex number. However, the wavelet power spectrum is the square of an absolute value and the absolute value transforms a complex number into a real number.

[13]By national, we mean the aggregate of the states included in our sample. When we measure the distance between each state and the national aggregate defined in this way, we exclude that state from the aggregate.

	United States		United States		United States
Ohio	5.4	Nebraska	13.7	Washington	18.3
Maine	7.8	Rhode Island	14.0	Vermont	18.7
New Hampshire	9.9	Pennsylvania	14.1	Utah	20.8
Connecticut	10.2	Massachusetts	14.2	Kentucky	27.1
Iowa	10.9	Maryland	14.2	Arkansas	28.0
Wyoming	11.0	Wisconsin	14.5	Texas	28.2
New Jersey	11.0	South Dakota	14.8	Virginia	30.4
Indiana	11.0	Minnesota	15.7	Tennessee	30.8
California	11.9	Missouri	16.2	Florida	34.6
North Dakota	11.9	Colorado	17.1	Louisiana	35.5
Michigan	12.1	Idaho	17.2	North Carolina	36.1
Kansas	12.2	Montana	17.6	Georgia	45.9
Illinois	12.2	Nevada	17.7	Alabama	48.6
New York	13.5	West Virginia	17.8	Mississippi	54.0
Delaware	13.5	Oregon	18.0	South Carolina	58.2

Color code	
p<0.01	
p<0.05	
p<0.10	
p>0.10	

Table 1: Dissimilarity index between the National and the State electoral cycle

Table 1 shows that there are 24 states where we can reject, with $p<0.05$, the null hypothesis that the national cycle and the cycles in these states are not synchronized, a number that extends to 33 if we relax the significance level to $p<0.10$.[14] There have been twelve states, however, clearly out of sync with the national cycle. It does not take long to realize what unit they form: they are all the eleven states of the old Confederate South, plus Kentucky. In contrast, the ten states whose electoral cycles are more aligned with the national cycle are Ohio, Maine, New Hampshire, New Jersey, California, Wyoming, Iowa, Connecticut, Indiana, and New York. Note that the fact that these states have their electoral cycles synchronized with the national cycle does not mean that the candidate that wins in these states is the candidate that wins the country, or that the distribution of the partisan vote has been similar to that of the national aggregate. It just means that the swings around the mean in these cases have been synchronized with what occurs at the national level. Similarly, this analysis tells

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[14] The critical values were obtained by Monte Carlo simulations.

nothing about the distribution of the vote in the South and in the rest of the country. However, it does say that, contrary to what occurs in the remaining states, there is no evidence that the national ebb and flow of election returns we showed in Figure 1 has been generally reflected, in the broad 1896-2008 period, in the old Confederacy states. As historical and social legacies go, this seems to be a very profound one.

	AL	AR	CA	CO	CT	DE	FL	GA	ID	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS	MO	MT	NE	NV	NH	NJ	NY	NC	ND	OH	OR	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI
AL																																												
AR	33																																											
CA	49	37																																										
CO	47	30	17																																									
CT	48	38	12	23																																								
DE	42	34	15	26	8																																							
FL	36	28	37	36	34	32																																						
GA	31	29	37	39	40	33	31																																					
ID	54	24	20	17	21	26	32	34																																				
IL	57	29	13	18	12	15	34	38	22																																			
IN	50	22	19	19	17	19	33	37	19	16																																		
IA	51	34	15	12	17	21	34	49	19	17	15																																	
KS	49	26	18	12	19	23	31	36	15	19	12	14																																
KY	41	23	30	32	23	25	28	32	32	33	21	27	23																															
LA	39	32	36	41	33	32	23	32	34	35	33	36	38	33																														
ME	47	34	11	21	5	9	33	39	19	13	15	15	16	22	31																													
MD	50	30	15	25	9	11	35	37	25	12	19	21	23	23	35	11																												
MA	51	37	14	25	6	10	34	42	26	12	21	19	23	25	31	9	12																											
MI	49	32	9	14	13	16	38	40	21	9	17	15	18	30	38	12	14	15																										
MN	52	34	16	17	21	25	37	44	23	18	22	15	21	34	35	19	22	23	13																									
MS	21	27	56	53	57	51	46	19	47	55	58	57	51	37	28	58	51	52	52	49																								
MO	42	20	23	18	17	20	29	33	23	15	10	20	12	16	34	17	20	17	19	28	53																							
MT	52	32	18	15	21	25	31	41	11	22	17	17	16	30	32	18	25	27	18	22	46	21																						
NE	47	26	16	13	18	22	31	35	15	18	17	11	14	33	35	16	23	21	16	18	50	18	14																					
NV	52	27	14	15	20	21	32	31	16	21	20	18	16	33	40	17	21	22	14	21	42	20	11	14																				
NH	47	34	13	22	5	10	33	41	20	14	16	17	17	22	31	5	10	9	15	22	57	16	19	17	19																			
NJ	47	37	13	26	5	8	34	39	24	12	18	19	20	25	33	8	9	8	15	23	53	17	25	20	21	7																		
NY	48	44	14	26	5	10	34	37	26	11	19	19	22	25	33	9	10	7	15	23	51	17	27	21	19	9	4																	
NC	27	24	44	36	40	25	28	27	39	43	32	44	28	22	35	36	26	48	43	47	19	32	42	34	45	32	39	45																
ND	50	30	14	17	17	20	32	40	16	19	15	12	14	29	38	14	21	20	16	17	44	19	12	9	13	16	18	20	43															
OH	46	27	10	15	12	15	35	37	16	15	12	12	10	26	35	8	15	15	13	13	56	18	16	14	15	11	13	14	33	11														
OR	52	30	15	10	23	24	37	32	15	22	15	13	11	28	44	20	23	24	17	20	38	20	12	11	13	21	25	25	37	13	14													
PA	47	35	11	18	15	18	36	40	23	15	19	13	19	29	33	13	16	18	10	15	66	24	23	19	18	16	17	17	37	19	12	16												
RI	48	41	14	25	8	13	35	41	27	13	21	20	22	30	30	9	12	7	14	22	44	20	26	20	22	10	12	11	41	20	15	24	16											
SC	29	34	58	54	54	55	48	19	48	54	60	58	58	41	33	56	57	51	51	52	13	57	49	54	42	54	56	54	26	45	61	50	61	49										
SD	48	29	18	18	17	20	33	31	20	21	18	17	17	32	38	15	21	19	20	23	43	21	17	16	14	15	17	19	39	9	16	17	23	20	46									
TN	29	17	37	36	28	23	24	27	35	34	28	38	31	19	28	26	26	36	35	42	24	29	35	32	37	27	29	33	15	34	30	40	34	31	31	32								
TX	51	36	31	27	27	25	27	35	30	23	26	24	24	24	25	29	28	32	29	32	30	26	24	38	24	28	29	29	28	27	27	26	26	39	28	33								
UT	52	33	24	16	24	31	35	32	13	24	23	20	20	35	33	20	29	28	22	23	44	27	12	18	18	21	28	31	39	18	20	14	21	25	44	24	39	24						
VT	56	43	17	25	12	15	37	40	27	15	22	24	25	26	32	13	11	13	14	23	49	23	29	23	24	13	16	14	37	25	20	26	16	9	46	24	32	29	27					
VA	40	37	34	29	32	25	21	32	30	32	27	27	30	25	29	31	29	32	33	29	54	30	35	32	36	30	33	34	15	33	31	29	28	29	57	36	18	21	35	29				
WA	53	38	11	11	20	24	39	47	19	19	21	12	17	34	42	18	22	22	12	15	50	25	16	15	14	20	23	22	47	16	15	10	13	21	53	21	41	31	18	23	31			
WV	47	23	21	24	19	18	28	39	23	24	15	19	18	18	35	17	19	21	21	25	53	15	22	23	23	18	22	22	32	21	19	20	20	21	59	22	31	22	22	22	21	25		
WI	51	43	12	17	17	21	35	44	22	16	19	11	17	31	40	17	18	19	13	10	50	26	21	15	16	19	19	19	50	15	13	17	11	19	54	19	43	33	21	20	28	13	24	
WY	49	24	16	13	14	19	31	32	11	18	14	12	10	23	37	12	21	18	15	18	44	17	9	10	14	13	16	17	31	10	11	11	18	17	55	15	28	23	14	22	32	15	15	17

Color code   p<0.01   p<0.05   p<0.10

Table 2: Dissimilarity Index Matrix

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Table 2 shows the pairwise dissimilarity between the electoral cycles in the 45 states considered. However, because Table 2 has too much information to be easily readable - more than 900 entries - we try to visualize this matrix by performing some clustering analysis. First we produce a hierarchical tree clustering. The idea is to group the states according to their similarities. We follow a bottom up approach. We start with the 45 states and group, in cluster, the two most similar states, say C1 and C2 (New Jersey and New York, to be more precise). In the second round, states C1 and C2 are replaced by a combination of the two, say C46. Now one has to build a new matrix, not only with the distance between the 44 remaining states, but also with the distance between each state and C46 (which we consider to be the average of the individual distances). The procedure continues until there is only one cluster with all the states.
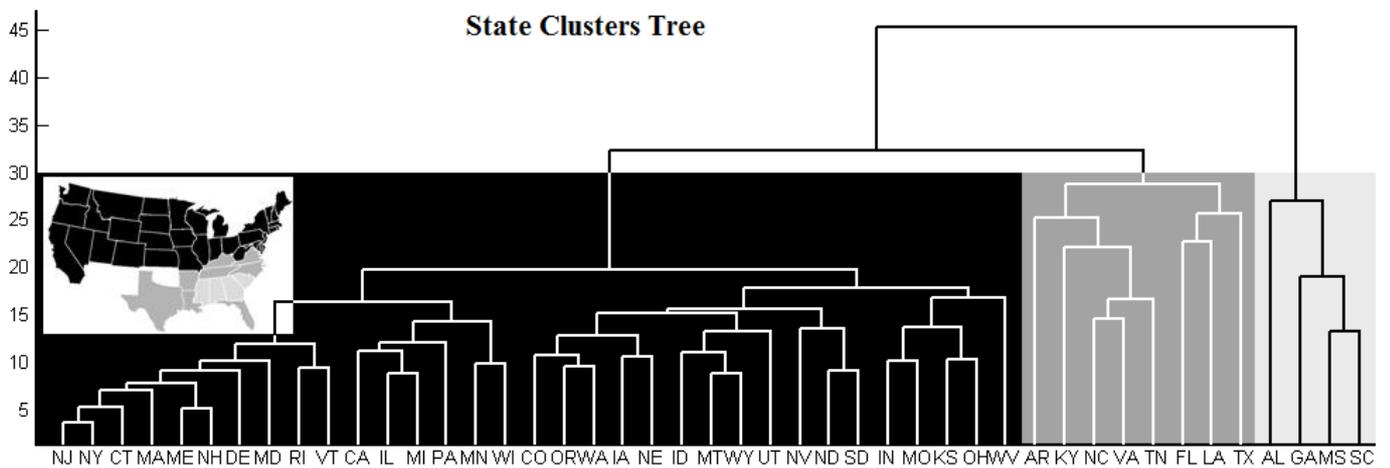
Figure 2: Hierarchical Tree Clusters

In Figure 2, we can see the result of this hierarchical clustering. Depending on how demanding one is in the definition of a cluster, one can identify several clusters. We use Matlab's default which results in partitioning the tree in three clusters. A big cluster of several states, whose electoral cycles are similar, emerges. Note that this cluster of states coincides exactly with those that, in Table 1, we showed to have an electoral cycle significantly (at least at 10% level) synchronized with the national cycle. Then, among those states that were not synchronized with the national cycle, two additional clusters emerge when we make pairwise comparisons. One comprises the states of Arkansas, Tennessee, Kentucky, North Carolina, Virginia, Florida, Louisiana and Texas. The third and last cluster, with

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the most asynchronous electoral cycles, includes Alabama, Georgia, Mississippi and South Carolina, i.e, four of the five states that comprise the traditionally defined "Deep South".
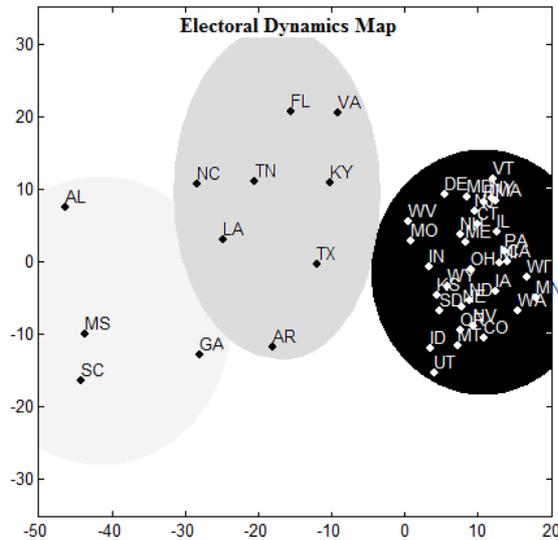
Figure 3: Multidimensional Scaling Map

Although very suggestive, the clustering tree has some limitations that could conceivably distort the analysis. Since each state is solely linked to one other state (or cluster of states), one may loose sight of the whole picture. An alternative approach is to use the dissimilarity matrix as a distance matrix and map the states in a two-axis system. The idea is to reduce the dissimilarity matrix to a two-column matrix. This new matrix, the configuration matrix, contains the position of each state in two orthogonal axes. Therefore, we can position each state on a two dimensional map. This cannot be performed with perfect accuracy because the dissimilarity matrix does not represent Euclidean distances. Its interpretation should be ordinal. Therefore, the goal is not to reproduce the "distances" given by Table 2 on a map, but rather to produce to map with pairwise distances that reproduce, as much as possible, the ordering of Table 2. We use Kruskal (1964a and 1964b)'s stress algorithm and minimize the square differences between the distances in the map and the "true distances" given in Table 2. Figure 3 displays this map. Again, although the precise frontiers are, naturally, somewhat arbitrary,[15] it remains possible to identify three clusters of states that coincide with the information we had extracted from the clustering tree.

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[15]With the exception of the largest cluster, which, as we have seen, includes all the states that have an electoral cycle significantly synchronized with the national cycle.

In sum, then, we find two clusters of states that exhibit greater dissimilarity both from the "national" cycle and from the "core" states. These two clusters include all the old Confederacy states plus Kentucky, and are internally differentiated in such a way as to separate the Deep South (with the exception of Louisiana) from the remaining Southern states. Kentucky is a "bordeline" case from another perspective: had we used the Euclidean angle, rather than the Hermitian, to compute the distance, Kentucky would have appeared in the first cluster. All remaining main results would stand.

5   The Dynamics of Electoral Cycles

As we have seen early on, there is, ever since Schaatschneider, a clear sense that, both from the distributional and the dynamic points of view, American presidential elections have become increasingly nationalized. There remains considerable uncertainty, however, about the specific timing of this change, particularly in what concerns the greater homogeneity of electoral swings. For Schaatschneider, the New Deal was just the first step in a change in the agenda of American politics. This change in public policy — "the greatest in American history" — "was in its turn swamped a decade later by an even greater revolution in foreign policy arising from World War II and the Cold War." Cumulatively, they produced a "new government" and a change in the "meaning of American politics," which modified the nature of party alternatives and created a national political alignment that replaced the previous sectional alignment (Schaatscheider 1960: 89). Thus, for Schaatschneider, the change in the direction of a greater "universality of political trends" was to be shown by comparing the directionality of electoral swings in the states before and after the 1950s.

However, not all later studies agree with the timing of this change. Schantz (1992) calculated the average of the absolute deviations between regional and national swings from 1892 to 1988, and found a decreasing heterogeneity in the way the Republican vote had changed from one election to the next among eight different regions. He found that such decline was particularly steep until the New Deal, after which it leveled off (1992: 367-370). Bartels (1998), in a celebrated and influential article, regressed the Republican vote margins in all states and presidential elections from 1868 to 1996 on the vote margins of the three preceding elections, weighting by the total number of votes, and interpreted the intercept as the overall vote shift attributable to national electoral forces in each given election. Like Schantz, he saw "the magnitude of national forces increasing markedly over the

first three decades of the 20th century, reaching a peak at the beginning of the New Deal era, before subsiding to a fairly consistent average (...) for the remainder of the century" (Bartels 1998: 284). Analyzing the relative magnitude of national and sub-national forces, while seeing a broad long-term trend towards nationalization – especially until the New Deal and in the most recent elections - Bartels also detects the balance tipping "toward sub-national forces during the racial sorting-out of the 1950s and '60s." (1998: 285). In sum, then, although there is general agreement on the existence of a long-term trend towards the dynamic nationalization of presidential elections, the particular timing of that change remains contested.

We approach this issue through the use of additional tools of wavelet analysis, i.e, cross wavelets and phase-difference. With cross wavelets, we can estimate the coherency between cycles in different entities. Regions of high coherency between two entities are synonym of strong local (both in time and frequency) correlation. Then, the phase-difference gives us information on the delay, or synchronization, between oscillations of the two time-series for a given frequency. By estimating it, we can observe whether there are tendencies towards convergence in electoral cycles between the states and the national aggregate, localize those tendencies in time, and distinguish between states where convergence is observable from those where it is not. This is one of the major advantages of wavelet analysis when compared with other tradicional methods. If we were using the tradicional spectral analysis, we would loose the time information, making it impossible to analyse dynamic convergence. On the other hand, if we were using traditional time-domain methods (such as correlations or Grander causality analysis), we would miss the information on frequencies.

Figure 4 shows, for each state, the coherency between the national cycle in the Democratic share of the two-party vote and the cycle for the same share of the vote in the states.[16] We also estimate the phase of the oscillations at the national and state level, as well as their phase-difference. Given that, in Figure 1, we identified two main cycles, one at the 14-year frequency and the other at the 27-year frequency, we focus our phase difference analysis on these cycles. So, for each state, we calculate the average phase and phase-difference for the 12-16 and for the 22-32 frequency bands. The green line represents the national phase, and the blue line the state's phase, while the red line provides, for ease of interpretation, the instantaneous phase-difference between the two series.

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[16] To perform the cross-wavelet analysis we focus on the wavelet coherency, instead of the wavelet cross spectrum, because there is some redundancy between both measures and the wavelet coherency has the advantage of being normalized by the power spectrum of the two time-series.
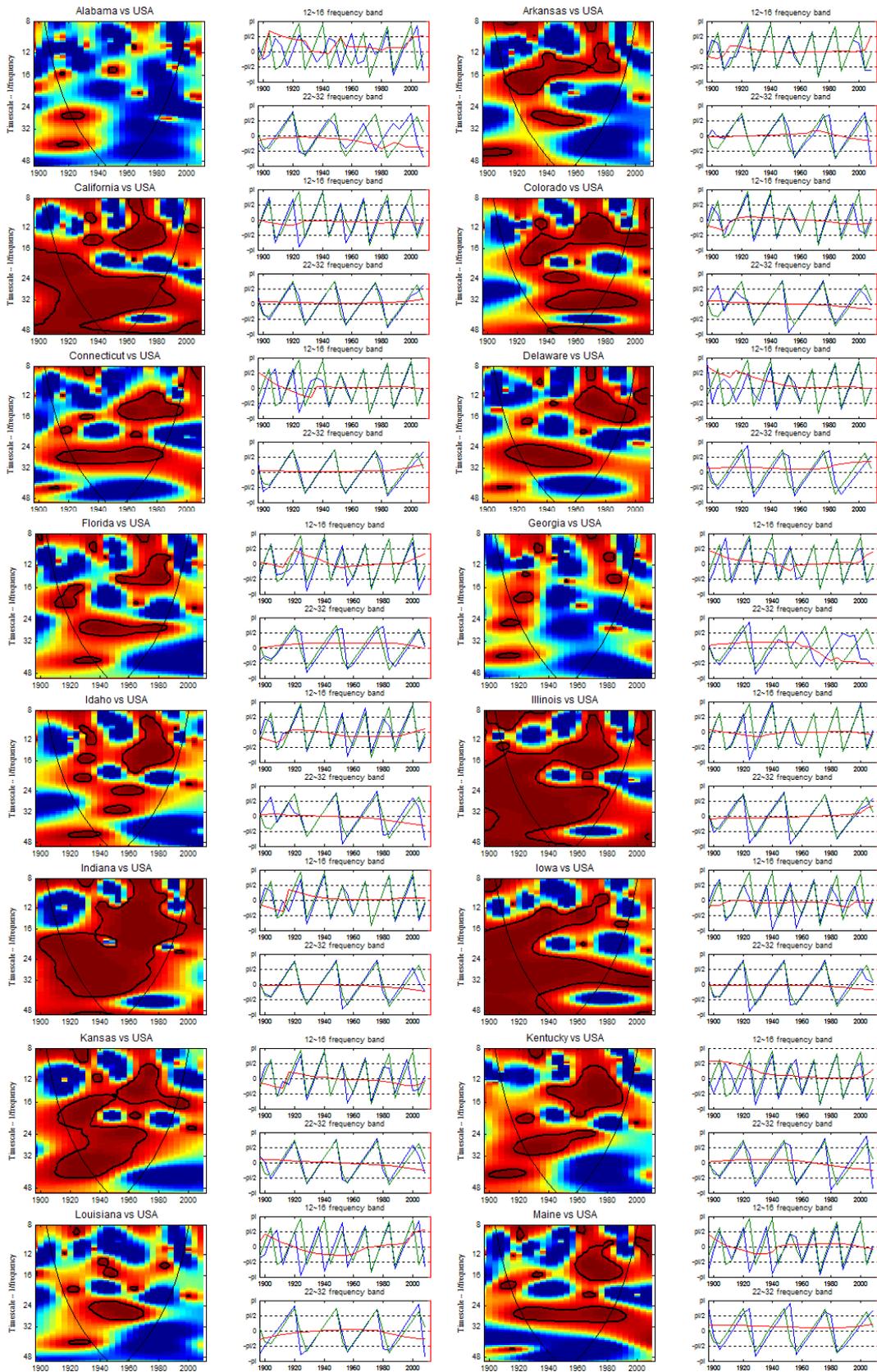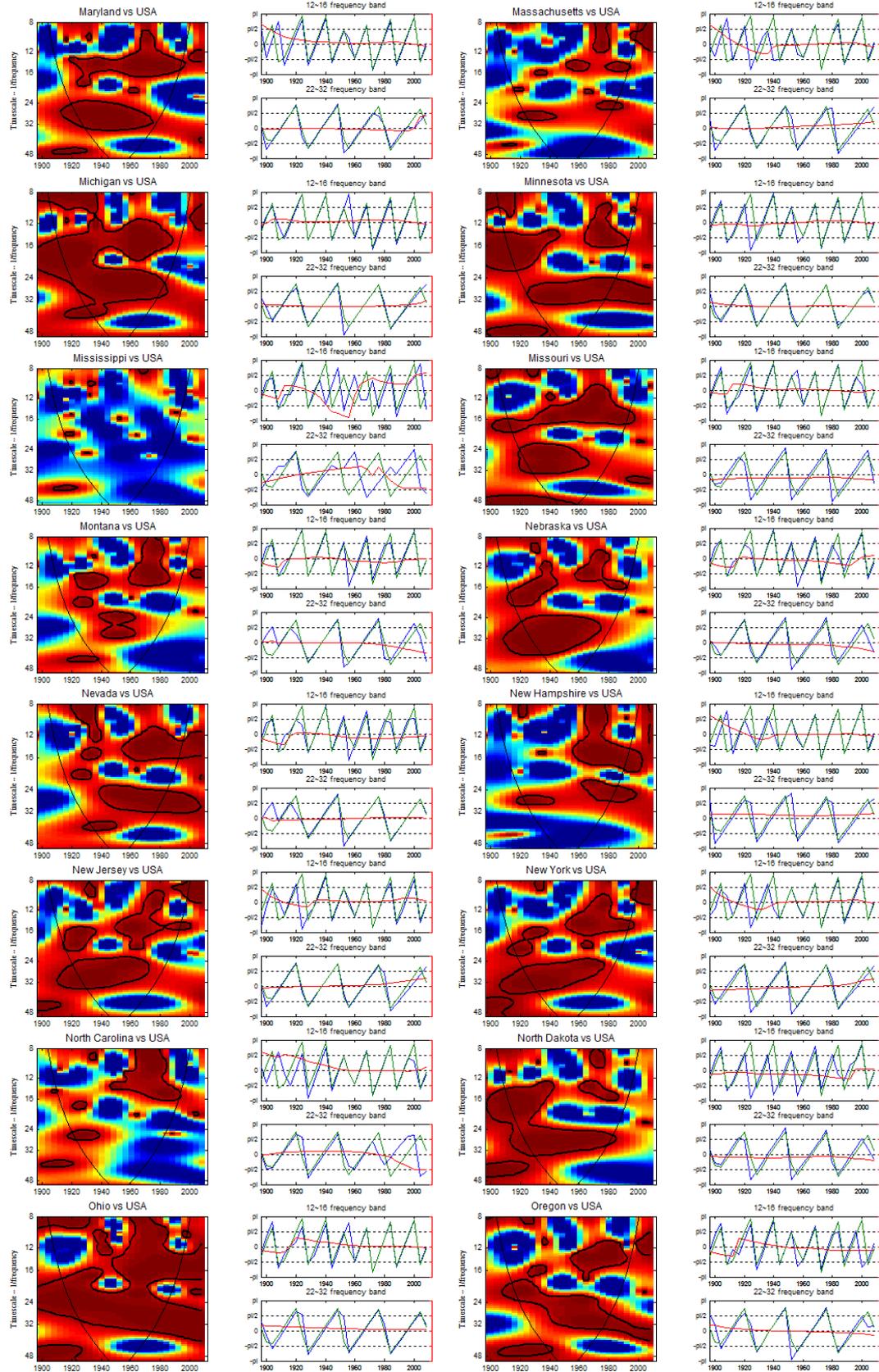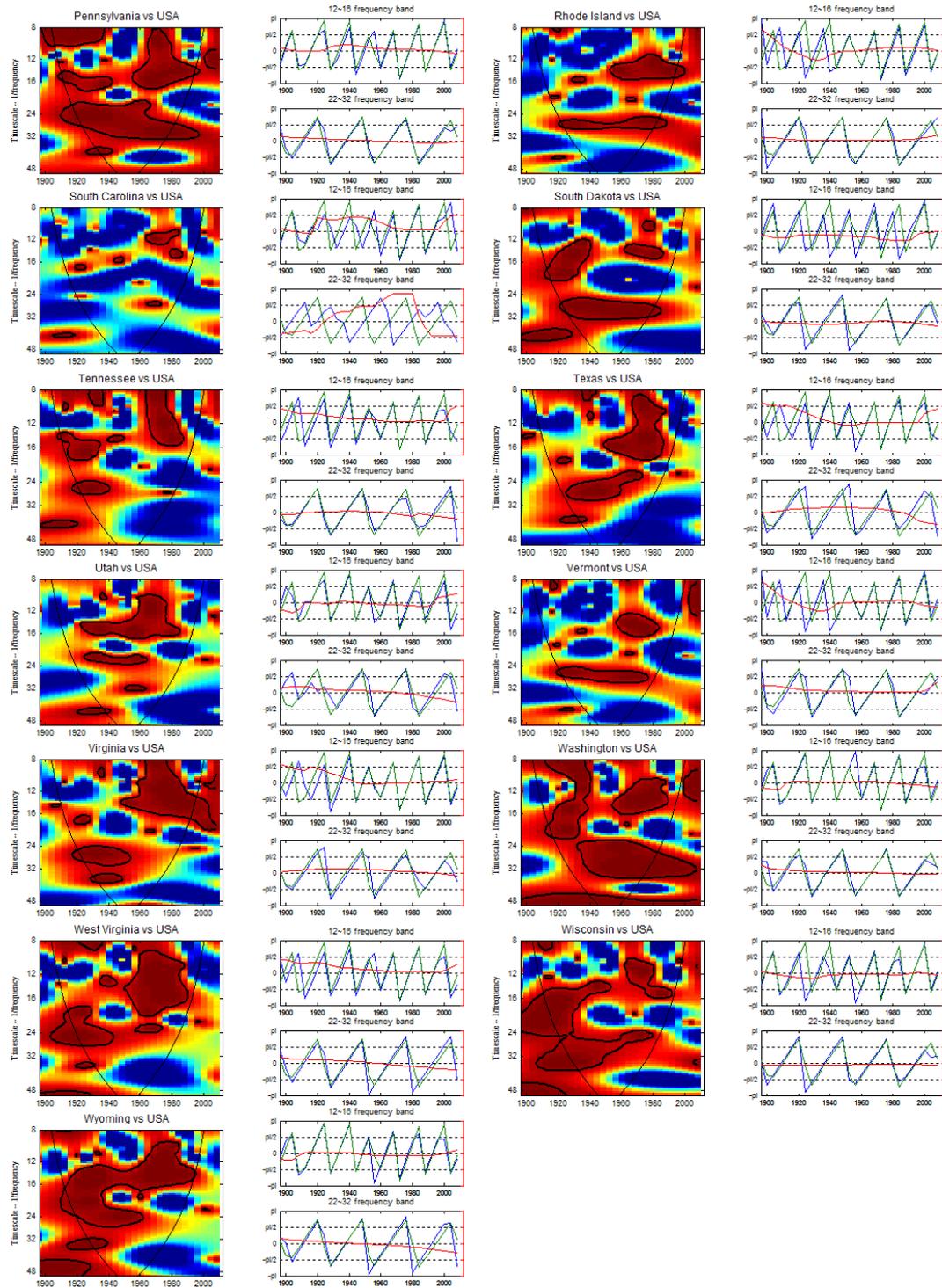
Figure 4: On the Left: Cross-Wavelet Coherency. On the right: Phase and Phase-Difference
Legend: Wavelet Coherency: The black contour designates the 5% significance level. The color code
for coherency ranges from blue (low coherency – close to zero) to red (high coherency – close to one).
Phase and Phase-Difference: The green line represents the National phase, and the blue line
represents the state's phase. The red line gives us the instantaneous phase-difference between the
two series.

We can immediately appreciate some interesting dynamics. For example, the states we identified early on as belonging to the most peripheral cluster - South Carolina, Alabama, Georgia and Mississippi - do not show, as could be expected, many regions of high coherence with the national cycle. Furthermore, the phase difference shows that their cycles are not only not aligned with the rest of the country, but also show no tendency to converge. If anything, as time goes by, their electoral cycle is diverging more and more, in some cases in both relevant frequency bands. If there has been a tendency towards the "universality of political trends" in presidential elections in the United States, the evidence suggests that these four states have been mostly impervious to it.

In contrast, if we focus on the second cluster of states – the remaining old Confederacy states plus Kentucky - we do tend to observe a tendency towards convergence with the national electoral cycle. In most cases, we find that it is at about 1950 that these states' phases reach convergence with the national phases, especially in the 12-16 year frequency band. Interestingly, there is one exception: Louisiana is the only one of the states on the second cluster where convergence in cycles with the national aggregate is reached at a later point in time, at about 1970. This seems to have been enough, however, to have brought Louisiana out of the "Deep South" cluster where it, one might argue, originally belonged.

Finally, Figure 4 reveals that there is another group of states – those in the first "core" group identified in the cluster analysis - like Michigan, Pennsylvania, Washington, New Jersey, Minnesota, and many others - that show many areas of strong coherency and oscillations that are very much aligned with the national ones. Ohio, which according to Table 1 is the most aligned state, shows many regions of high coherency, but its phases reveal that Ohio's electoral cycles have been slightly lagging the national cycle, although it is also clear that even on that regard there has been a strong convergence since mid-century. In the case of New York, we observe the opposite dynamics: New York seems to have led the national cycle (on both frequencies) until mid-century, after which it converged to the national cycle. Massachusetts also illustrates another type of change in long-run behavior: in the first half of the sample, in the 22-32 frequency band, the phases are very much aligned, but after 1950 this long cycle is lagging the national cycle. We can also identify some states that are very much synchronized for some periods and some frequencies, but not for others. North Carolina is one such example. In the first half of last century, there is a region of high coherency at the 27 years frequency,

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while in the second half the high coherency shifts to the 12-18 year frequency. In this latter case, one can also see that the phases are perfectly aligned with the national phase. If one had to choose the "leader state", that choice would fall on North Dakota (and also Illinois, but not as strongly), whose cycles have persistently been leading the national cycles, on both frequency bands.
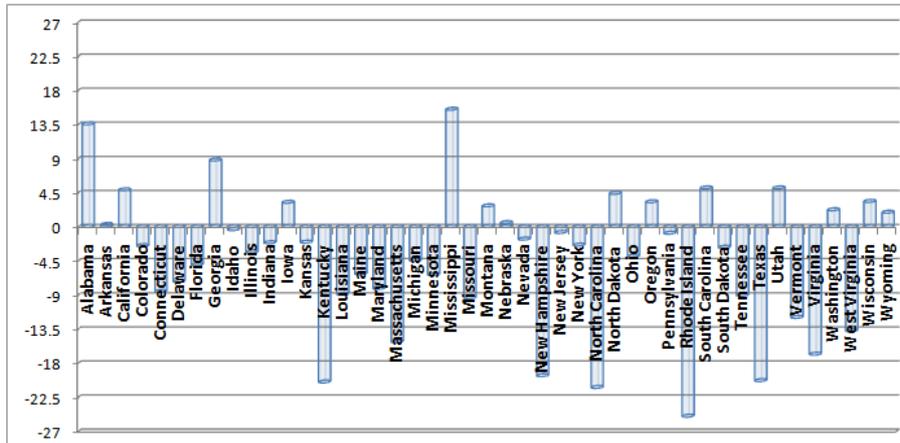

Figure 5: Distance difference

Inevitably losing some detail, we can summarize the findings in Figure 4 in two ways: aggregating periods in time or aggregating states. First, we divided our observations in two sub-samples, the first running from 1896 until 1952 and the second from 1952 to 2008, i.e., using the generic turning point suggested by Schaatschneider's original analysis. We then computed our dissimilarity index for each sub-sample, in order to determine which states converged to the core and which states did not. Figure 5 displays the variation observed from the first to the second sub-samples in terms of the dissimilarity index vis-à-vis the national cycles: positive values represent an increase in dissimilarity while negative values represent an increase in similarity. Clearly, most states have become more synchronized with the national cycle since the 1950s than they were in the preceding period.[17] The exceptions are Alabama and Mississippi, which have become significantly more peripheral in the second half of the sample.

To formally test the nationalization hypothesis, one can compute the mean and the variance of the distances in each sub-sample and perform a simple t-test against the null hypothesis that the mean is the same in both sub-samples. This can be performed either by computing the mean of the distances

[17]In Figure 5, we are comparing each state with the national aggregate. However, if we had used the average dissimilarity between each state and all other states, the results would be almost identical.

between every pair of states or computing the mean between the distance between each state and the aggregate. In both cases, the results are statistically clear: the null of equal means is rejected against the alternative that the mean distance decreased, at 1% significance level. Dynamic nationalization has indeed increased from the first to the second half of the 20th century.
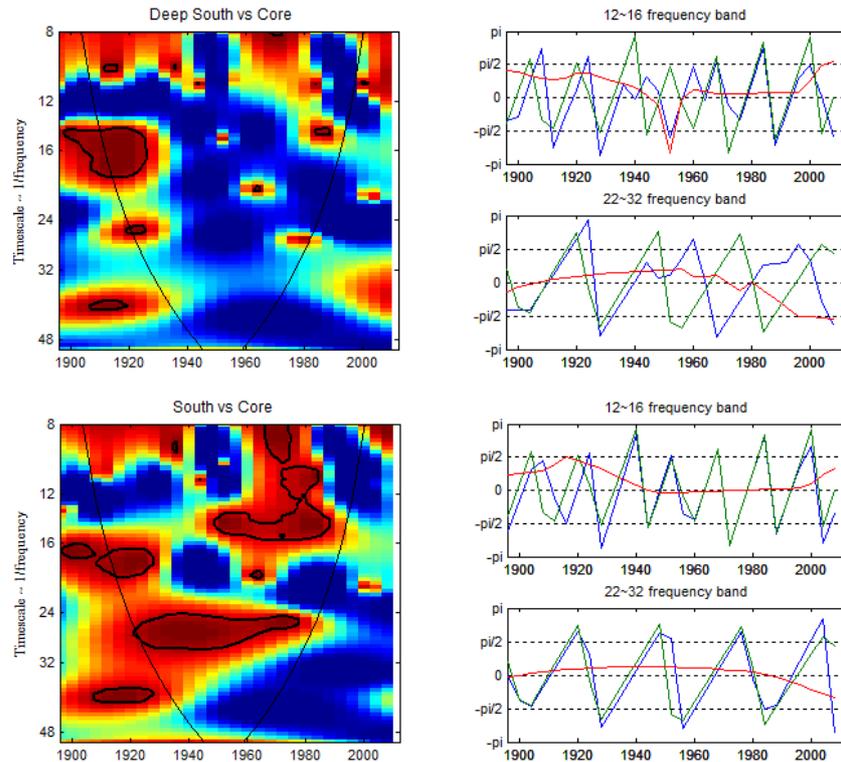

Figure 6: Wavelet coherency Core/Deep South and Core/South

A second way of summarizing the results is to calculate the aggregate Democratic share of the two-party vote for three groups of states and estimate the cross wavelets and phase-differences pertaining to their cycles. The three groups are the ones we identified early on: the four states of the "Deep South" cluster; the remaining Southern states (plus Kentucky); and the "core" states. In Figure 6, it is clear that the Deep South states have not approached the core. Coherency, if anything, decreases with time, and the phase-differences are messy, showing no sign of alignment with the core. On the other hand, one can see that the rest of the South has indeed converged to the core. This is particularly evident when one looks at the phases in the 12-16 year frequency band, where coherency increases sharply since 1950.

In sum, the evidence obtained by means of wavelet analysis paints a different picture from that presented in Schantz (1992) and Bartels (1998) concerning the dynamic nationalization of presidential elections. As Schaatschneider suggested, it is the 1950s, not the 1930s, that seem to constitute the decisive turning point in terms of the synchronism in electoral cycles both among the states and between the states and the national cycle. Furthermore, we can see exactly where developments occur driving this convergence in electoral cycles: it is only in the 1950s that the phase-difference between the "core" states and those in the South (with the exception of four "Deep South" states), particularly in the 12-16 frequency band, approaches zero, suggesting a convergence with the national electoral cyclicality that already characterized the core states.

6 Conclusion

In this paper, we analyzed the dynamic nationalization of presidential elections in the United States. Taking states — the natural battlegrounds of elections for an Electoral College — as our basic unit of analysis, we focused on the divergence or convergence of electoral movements across the American polity. Complementing extant research on the geography of electoral support in the United States, we searched for patterns distinguishing groups of states characterized by high and low synchronism in electoral cycles, both among each other and with the national aggregate. Then, we analyzed trends in the extent to which such cycles have become more or less synchronized from 1896 until today. For these purposes, we resorted to the tools of wavelets analysis, an innovative and highly promising approach to the study of time series data.

We found, first, that a rather meaningful division between states emerges when we look for similarities and differences in the cyclicality of electoral returns, separating a large number of "core" states from the old Confederacy states. Within the South, an additional division emerges, allowing us to identify the "Deep South" states as those that have been characterized by electoral cycles that have remained asynchronous with the rest of the United States and, furthermore, show no signs of convergence in electoral trends. These are states that have remained totally impervious to the ebb and flow of electoral returns that previous research has shown to characterize the national aggregate (Lin and Guillen 1998; Merrill, Grofman, and Brunell 2008; Aguiar-Conraria, Magalhães, and Soares 2010).

We also provided additional evidence concerning an increase of the dynamic nationalization of politics in American elections. Schaatscheider's original argument was that the New Deal, albeit a crucial step in the nationalization of American politics, was not a sufficient condition, and had to be complemented by the accumulation of additional developments that contributed to an increased relevance of the federal government. Others, however, have dated the most dramatic change in this respect to the period immediately preceding the New Deal and saw a more modest increase in dynamic nationalization afterwards. Our evidence, using wavelet analysis, suggests that dynamic nationalization in the United States presidential elections is, in fact, mostly a post-war phenomenon. Furthermore, the fact that most of that increased nationalization resulted from the convergence in electoral cycles of the South (with the exception of the "Deep South") with the national core since the 1950s suggests that the erosion of Democratic dominance and the expansion of voting rights in the South clearly line up as perhaps the crucial factors behind the "universality of political trends" in presidential elections.

7 Appendix
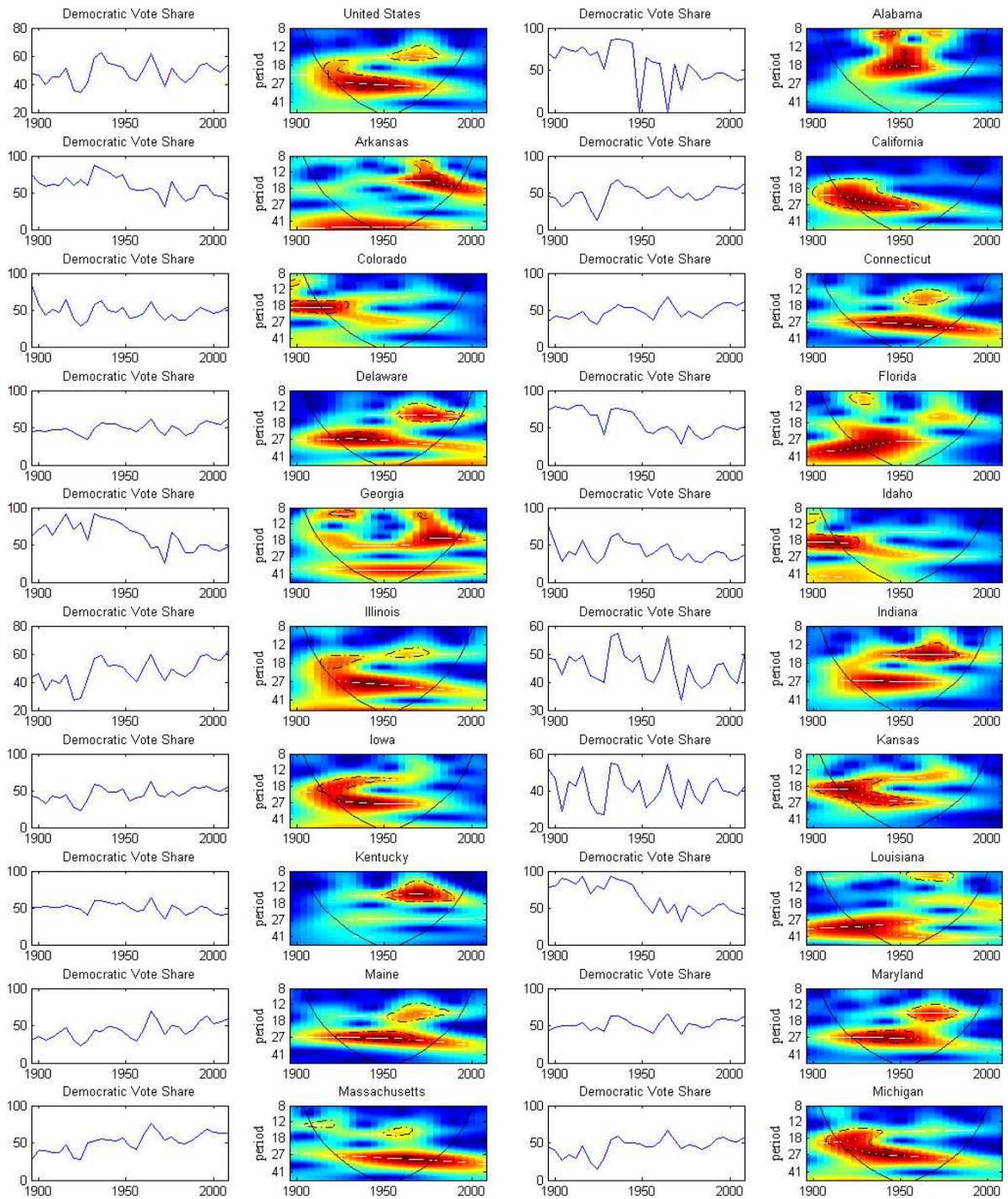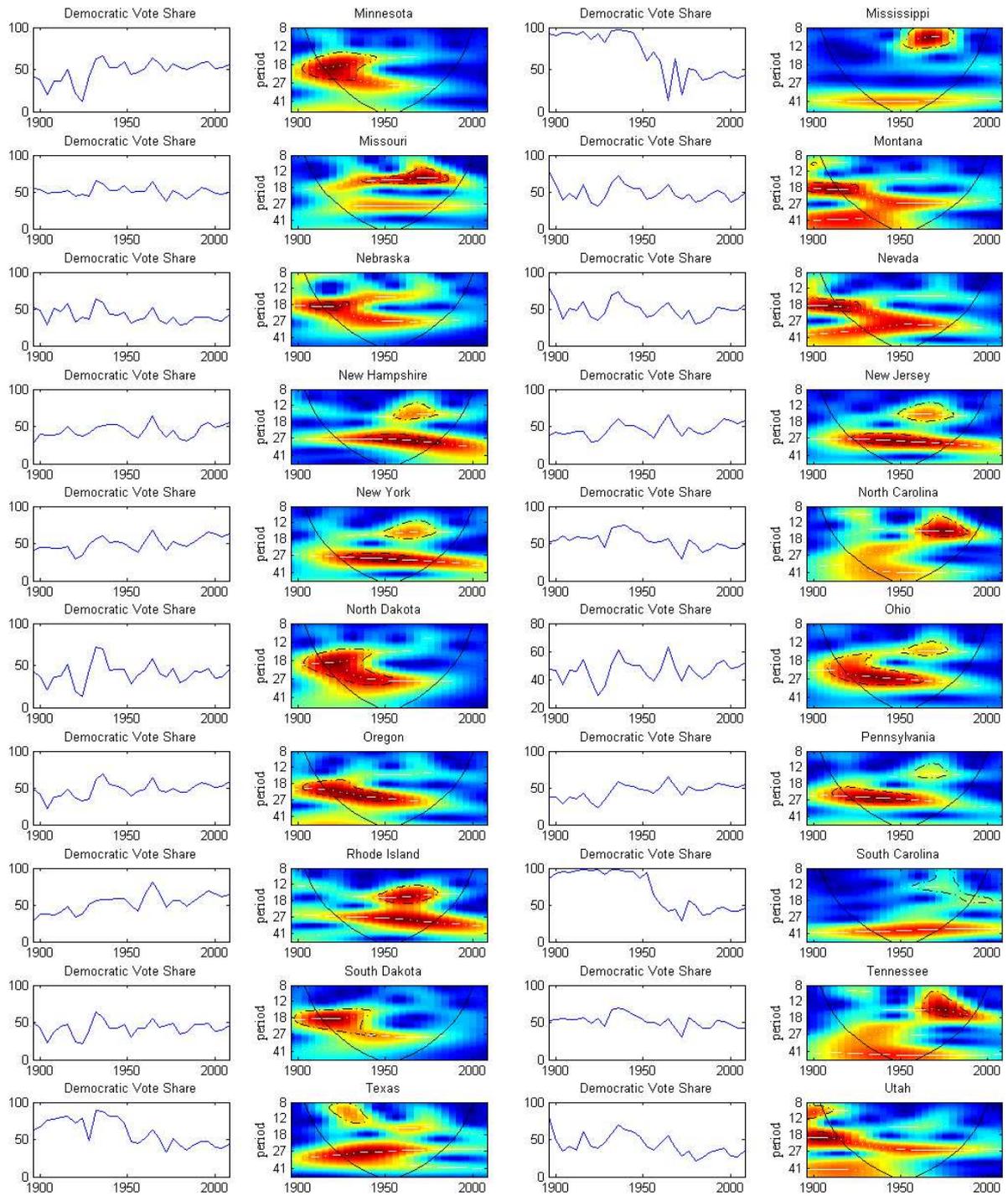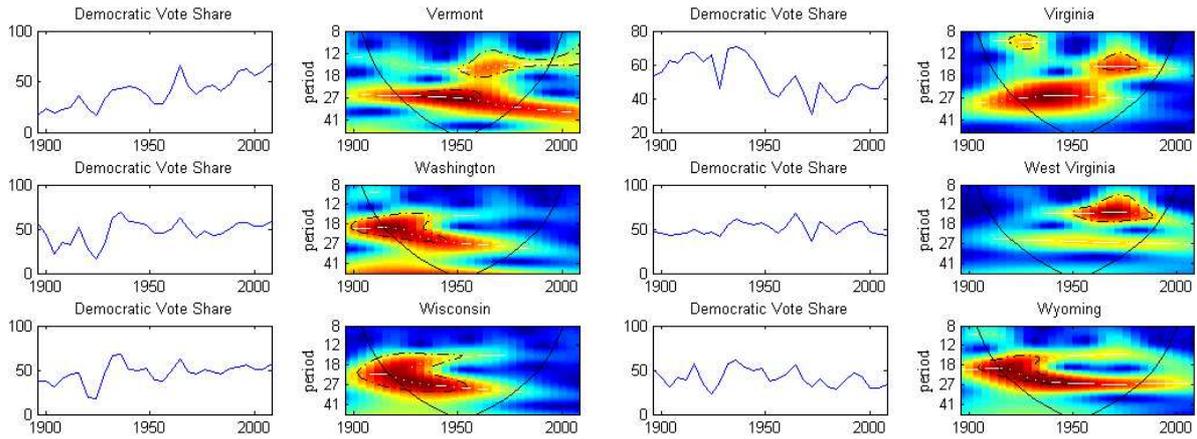
Figure A1: On the left, the Democratic Share by State in each Presidential election since 1896. On the right, the Wavelet Power Spectrum.

Legend: The black contour designates the 5% significance level. The cone of influence, which indicates the region affected by edge effects, is shown with a thin black line. The color code for power ranges from blue (low power) to red (high power). The white lines show the maxima of the undulations of the wavelet power spectrum.

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