Who's in Charge, Who Do I Work With, and Who Are My Friends: A Latent Space Approach to Understanding Elite Coappearance in China*

Abstract

How the ruling elite arrange and maintain their power-sharing is key to our understanding of authoritarian politics. We propose a latent space framework to systematically analyze the dynamics of elite power-sharing in authoritarian regimes. We also introduce a new type of data — elite appearance at political events. Our new framework and data allow us to disentangle three key aspects of elite power-sharing in authoritarian regimes: (1) who's in charge, (2) who do I work with, and (3) who are my friends. We empirically assess the three questions by computing elites' total appearances, dyadic coappearances, and their latent network distance using a latent factor network model and a dataset that tracks about 10000 appearance records of over 200 top CCP elites from 2013 to 2017. We test how well these three indicators fare in predicting elites' appointments in the leading small groups (LSGs) of the CCP Central Committee and the Central Government.

*The replication datasets and codes will be available online.

Only one in ten autocrats are toppled down by popular uprisings. Most authoritarian rulers are instead ousted by regime insiders (Svolik, 2012). How the ruling elite arrange and maintain their power-sharing is thus key to our understanding of authoritarian politics (Bueno de Mesquita et al., 2003; Acemoglu, Egorov and Sonin, 2008; Svolik, 2012). A burgeoning literature turns to authoritarian institutions (e.g., national legislatures) and explores how institutionalization of power-sharing contributes to authoritarian resilience (e.g, Brownlee, 2007; Gandhi, 2008; Magaloni, 2008; Magaloni and Kricheli, 2010; Boix and Svolik, 2013), as well as economic growth (e.g., Bizzarro et al., 2018), social welfare provision (e.g, Miller, 2015*b*), and accountable foreign polices (e.g., Weeks, 2012). However, as stressed by Pepinsky (2014), a fundamental dilemma confronting this "institutional turn" is that these institutions are inherently endogenous to strategic interactions of the ruling elite (also see Brancati, 2014). That is, de facto cooperation and contention of the authoritarian elite still hide behind the facade of formal institutions.

Another group of scholars have adopted an alternative and elite-oriented approach to uncovering the inner workings of authoritarian regimes. Relying on a wide range of data like anecdotes, interviews, media coverage, and biographical archives, these studies try to identify key elites and analyze their social backgrounds, career patterns, and patronage ties (e.g., Li and Bachman, 1989; Levitsky, 2001; Albrecht and Schlumberger, 2004; Perthes, 2004; Shih, Shan and Liu, 2010; Opper, Nee and Brehm, 2015; Buehler and Ayari, 2018). However, partly due to data incompatibility, we find few attempts to synthesize these aspects of elite dynamics, leaving us only a fragmented view about power-sharing in authoritarian regimes. Unfortunately, it is this lack of a systematic approach that fundamentally constrains our understanding of authoritarian politics.

In this article, we propose a latent space framework to systematically map and analyze the dynamics of elite power-sharing in authoritarian regimes.[1] We also introduce a new type of data

[1]To clarify, here we use the term of latent space in a generic sense, i.e., some area where elites with similar preference are in proximity to each other. In our later analysis, we treat the space as a latent factor space and use the the Latent Factor Model (Hoff, 2008; Minhas, Hoff and Ward,

that has yet to come to attention of scholars of authoritarian politics, that is, elite appearance and coappearance at political events. Our new framework and data allow us to disentangle and synthesize three key aspects of elite power-sharing in authoritarian regimes: (1) who's in charge, (2) who do I work with, and (3) who are my friends. The question of "who's in charge" focuses on the power and influence of *individual* elites. The answer to this question is of critical importance in authoritarian regimes where formal political institutions are vulnerable to elites' manipulation. Moving beyond individual and monadic elites, the question of "who do I work with" points to the *dyadic* relationship between a given pair of elites (e.g., collegial ties and patronage connections), which serves as the very basis of coalitions and factions. However, a simple dyadic "who do I work with" approach will, we argue, overlook the indirect and latent relationships between elites and forgo important information about latent coalitions. For instance, without a direct collegial or patronage connection, two elites could still form a latent coalition because of their ties to a common friend. The question of "who are my friends" then captures such indirect *latent* interdependences between elites. Together, by jointly considering the monadic, dyadic, and latent attributes, the three "who" questions reveal systematic dynamics of elite power-sharing in authoritarian regimes.

Our empirical analyses and tests are focused on the Chinese Communist Party (CCP) regime. While the CCP regime has been commonly accepted as one of the most institutionalized and "machine-like" authoritarian regimes, many China scholars emphasize that institutional rules are epiphenomenal to elite politics (Nathan, 1973; Tsou, 1976; Shih, Shan and Liu, 2010). After Xi Jinping became the general secretary of CCP in 2012, the interest in elite power-sharing has been rekindled and become even more heated. Xi's first term was marked with major elite reshuffles, swift institutional changes, and wide-ranging policy alterations (Miller, 2014*a*; Naughton, 2014; Lampton, 2015; Shirk, 2018). These dramatic changes not only urge us to reassess CCP's intra-elite relations, but also make it an ideal laboratory to explore the three "who" questions.

2016), which is different from the Latent Space Model proposed by Hoff, Raftery and Handcock (2002).

Specifically, we utilize a latent factor network model (Minhas, Hoff and Ward, 2016; Hoff, Raftery and Handcock, 2002) and analyze a unique database that tracks about 10000 appearance records of over 200 top CCP elites from 2013 to 2017. We attempt to answer the three "who" questions by computing elites' total appearances (i.e., "who's in charge"), dyadic coappearances (i.e., "who do I work with"), and, finally, their latent network distance (i.e., "who are my friends"). Together, our latent factor network analysis of the appearance data presents a possible avenue to disentangle and synthesize key aspects of elite power-sharing in authoritarian regimes.

To probe the validity of this approach, we test how well these three indicators fare in predicting elites' appointments in the leading small groups (LSGs) of the CCP Central Committee and the Central Government (Batke and Stepan, 2017; Huhe and Stepan, 2018). LSGs are an informal institutional arrangement of CCP that has not been incorporated into charts of party or government organs. However, they play a pivotal role in formulating, coordinating, and implementing of important decisions across different segments and levels of the CCP regime (Hamrin, 1992; Lieberthal, 1992). LSGs not only ameliorate the regime's prolonged problem of political fragmentation, they can also be an effective vehicle for overpassing formal institutions and asserting personal influences as shown by the infamous Central Cultural Revolution Group (1966-69). Recently, it has been found that Xi relied heavily on LSGs to push forward institutional reforms and policy changes (Miller, 2014*b*; Naughton, 2014; Johnson, Kennedy and Qiu, 2017; Lee, 2017; Shirk, 2018). Our tests then show that while elites' total appearances are strongly associated with their appointments in LSGs memberships, their dyadic coappearances bear a much weaker association. Most excitingly, the best predictor of LSG membership is our measure of latent network proximity.

Our study contributes to the extant studies of authoritarian politics in many ways. First, our latent space framework (i.e., the three "who" questions) provides a possible approach to bridge and synthesize the fragmented studies of the ruling elite in authoritarian regimes. This in turn allows us to develop a systematic view of their power-sharing patterns and dynamics. Second, our approach explicitly highlights and models the latent relationships between elites, which so far has

received only scant scholarly attention. As revealed in our analysis of LSG appointments, the incorporation of such latent distances could significantly improve our assessment about elite power-sharing. Finally, our study introduces a new source of data, i.e., public appearances of the elite. The appearance data not only complements our existing data like news coverage and biographical archives, but, more importantly, allows a systematic exploration of the dynamic and relational changes in elite power-sharing.

I Literature Review: The Elite and Their Relationships

How to understand the elite and their relationships behind the facade of formal institutions has been one enduring question in social science. For instance, the "power elite" thesis emerged in 1950s stimulated a heated debate on whether power in America was concentrated on a small cohesive group of quasi-hereditary and well-positioned elites (Hunter, 1953; Mills, 1956; Dahl, 1961). The debate in turn has significantly advanced our understanding about the nature of democracy (e.g., Dahl, 1971). In studies of authoritarian politics, scholars have been increasingly confronted by the same problem, particularly after the recent development of studies on authoritarian institutions. Although recent theoretical works like Svolik (2012) provide us valuable insights to link authoritarian institutions with elite contention and cooperation, we still lack a systematic framework to conceptualize and analyze the actual power-sharing dynamics in authoritarian regimes.

Our lack of a systematic framework has a lot to do with the highly secretive nature of authoritarian politics. It prohibits researchers to employ the methods like Hunter's (1953) sociometric interviews emerged in the "power elite" debate. Many studies of authoritarian elites, therefore, have "been based on anecdotal and impressionistic 'readings of the tea leaves'" (Ishiyama, 2014, p. 137). Only recently has a new group of scholars introduced novel empirical approaches to exploring different aspects of elite politics. Such studies are particularly developed in the studies of the CCP elite, and they largely fall into two separate lines of inquiries: (1)

identifying key actors (i.e., the positional approach) and (2) exploring their relations (i.e., the relational approach).

First, the positional approach focuses on *individual* elites and aims to assess their de facto positions within the CCP regimes. Jaros and Pan (2017) exemplifies this approach as they explore Xi's actual power and influence by examining CCP's official newspaper coverage. It is argued that the ruling elite usually rely on official media to signal their political presence and influence to the lower-level officials and the general public (Huang, 2015). Their coverage in official newspapers, therefore, can be used to infer their ability to dominate the party-state. Based on their collection and analysis of province-level party newspapers between 2011 and 2014, Jaros and Pan (2017) find that Xi has received disproportionately more coverage over time, indicating a consolidating grip on power. Such large-scale quantitative analysis of texts, therefore, allow us to reveal ups and downs of key elites in a dynamic way.[2] However, due to its focus on individual elites, this approach falls short in uncovering the relations between them.

The relational approach, on the other hand, examines *dyadic* affinity and ties between elites. This empirical approach is rested on the thesis of factional politics. It postulates that the political struggle between competing factions is the key to our understanding of CCP elite politics, and a faction usually grows out of patron-client relationships that are cultivated by a patron through the career path (Pye, 1981; Nathan and Tsai, 1995; Huang, 2000; Shih, Shan and Liu, 2010; Shih, Adolph and Liu, 2012). Empirically, scholars rely on biographical archives to uncover such patron-client relationship. Based an extensive review, Meyer, Shih and Lee (2016) identify four different empirical indicators of factional ties, i.e., broad ties, complete work ties, early work ties, and restrictive work ties (for details see Table 1, p. 47). They further examine how CCP elites' varying ties with the party secretary general predict their promotion into the Central Committee. Their analysis shows that while work ties with the secretary general consistently matter, non-work ties (e.g., a common educational background) sometimes could also help. In light of this, by steering our attention to factional ties associated with key patrons, this approach helps us to move

[2]For similar studies, see the review of Ban et al. (forthcoming).

beyond the power core and probe the rest of the ruling elite.

While these two approaches provide us important insights about elite dynamics of the CCP regime, we find some critical problems remain unresolved. First and foremost, we still lack a conceptual framework to synthesize different insights from the existing studies (e.g., dynamic changes of personal powers on the one hand and abiding factional ties between patrons and clients on the other). This in turn hinders our systematic understanding of elite power-sharing in China. Second and more specifically, our emphasis on key patrons and their direct clients tend to leave much valuable information neglected. This is mainly due to the importance and prevalence of *indirect* and *non-dyadic* relationship. A client of a factional leader, for instance, could also serve as the patron for other elites, forming a three-party relationship at least. The existence of such indirect relationship not only significantly increases the scope of factions, but, more importantly, generates a complex interdependent network of elites. Without a systemic study of such indirect relationship, we are unable answer a series of similar questions like hierarchies within factions or nuanced distinctions between apathetic and antagonistic relationship. We are limited to only looking at direct relationships rather than being able to understand the complete system of affinity, patronage, and antipathy. To understand elite dynamics, and thus authoritarian politics writ large, requires both new conceptual exploration and empirical strategies.

II Elite Power-Sharing as a Latent Space

In this study, we conceptualize the elite power-sharing in authoritarian regimes as a latent space. This latent space not only encompasses a collection of individual elites, it subsumes all the relationships between them, direct or indirect. In light of this, a latent space understanding could allow us to synthesize both *positional* and *relational* attributes of the ruling elite and thus develop a systematic view about power-sharing in authoritarian regime. Yet, despite its apparent conceptual advantages, a latent space understanding requires us to answer two critical questions: (1) how to capture it and (2) how to analyze it.

A Political Events and Power *Foci*

How to capture the power elite and their relationship has been a key front of the power elite debate (Domhoff, 2005). In *Who Governs? Democracy and Power in an American City* (1961), Dahl argues that the problem has risen from the obscure distinction between the legal theories of power and the realities of power: "the American creed of democracy and equality prescribes many forms and procedures from which the actual practices of leaders diverge. Consequently, to gain legitimacy for their actions leaders frequently surround their covert behavior with democratic rituals" (p. 89). Recognizing this, Dahl proposes to focus on political events and meetings where the actual processes of influence are at work. For instance, after observing local political nominations, Dahl finds that "the number of persons who have participated in these decisive negotiations and influenced the outcome seems never to have been more than a half dozen in recent years" (p. 105).

In this study, we follow Dahl's approach and turn to what we call power *foci*, i.e., important political events and meetings as well as elites' appearances at them. The concept of foci is originally introduced by Feld (1981) to explore people's complex and embedded social circles in a community. A focus is usually defined as a social entity or event around which joint activities are organized (e.g., voluntary organizations, hangouts, and families). Since it is around these foci that individuals organize their social relations, we could learn essential features of their latent social space by studying the observable foci. Similarly, we argue that political events like ceremonies, policy meetings, and state visits can be treated as power foci, around which the ruling elite signal and manage their power relationships. For instance, an elite's presence in a policy meeting would suggest her or his involvement in the decision-making activities and thus convey valuable information about the actual processes of influence. As the ruling elite coordinate with each other via numerous such events, we could approximate their latent space of power-sharing by examining how these foci are interconnected.

The interlocking network of power foci reveals both positional and relational attributes about the ruling elite. It is positional in its ability to uncover individual elites' relative activeness and

prominence in events where the actual processes of influence are at work. Moreover, the particular patterning of an elite's appearance defines her or his points of reference in the nebulous ruling group. This then is consistent with Dahl's (1961) emphasis on observation of decision-making activities. The interlocking foci network is also relational. Beyond specific events or individual elites, it shows how elites are connected via a variety of political events. Political elites intersect with each other within different political events, which are created based on shared policy problems or personal affinities. These links are not only able to channel important resources like information, but also can support mechanisms through which elites monitor and sanction each other.

B Three Who Questions in a Latent Space

So how can we approximate the latent space of power-sharing from the interlocking foci network? In this study, we treat the foci network as a product of both stochastic and strategic factors. Moreover, we disaggregate the strategic factors into three questions — i.e., who's in charge, who do I work with, and who are my friends, which correspond to the individual level characteristics, dyadic links, and latent affinities. Generally speaking, our approach can be summarized as follows: after controlling for random noises, powerful elites (i.e., who's in charge) are more likely to make appearances; elites who are in the same and related policy domains (i.e., who do I work with) are more likely to appear together; and finally elites who share latent affinities (i.e., who are my friends) are more likely to show up together. Together, the three who questions could help us to approximate the latent space of elite power-sharing.

The first two who questions are quite consistent with the existing studies of elite politics. Similar to such positional studies as Jaros and Pan (2017), the question of who's in charge is focused on network dynamics that are stemmed from characteristics of individual elites. For instance, certain type of actors tend to be more active in initiating connections. In our case of elite politics, this suggests that powerful elites are more likely to preside and participate in important ceremonies and meetings. From the network analysis perspective, this greater tendency of certain

actors to undertake certain behaviors is usually referred as the first-order dependency (Hoff, 2005; Kenny, Kashy and Cook, 2006). In light of this, we expect, for example, Xi Jinping is simply going to make more appearances in aggregate than would a junior CCP elite. That is, if we compare two possible elites, a third person is *ceteris paribus* more likely to make a coappearance with Xi than with the junior CCP elite. On the other hand, the second who question examines if two elites attend the same event. Given its focus on the observable direct and dyadic links, this question follows the similar approach like Shih, Shan and Liu (2010). The question of "who do I work with" then highlights whether there is a direct coordination and collaboration between a pair of elites.

However, what we emphasize in this study is that we cannot equate "who do I work with" with "who are my friends." Simply using direct and dyadic links as a proxy of the latent affinity could lead to two types of errors, the incorrect rejection of a true friend and the false acceptance of a real enemy. A simply example of the first error is an indirect patronage relationship which involves a patron, a client, and a sub-client. If we rely solely on dyadic coappearance, we may end up in wrongly rejecting the relationship between the patron and sub-client. The second error could also occur in a three-party relationship when an elite share links with two rival patrons. In this case, we could run into either a false conclusion or no conclusion at all. Provided with these possible errors, some scholars have questioned the validity of factional studies based on dyadic analyses. For example, Miller (2015*a*), a long-time observer of CCP elite politics, points to two problematic cases (i.e., Liu Yunshan and Li Yuanzhao), both of whom share strong ties with competing Jiang and Hu factions. Without a consistent criterion, she argues that "in the Xi era, faction-based analyses frequently rest on assertions of factional association that are tenuous, arbitrary, and at times peculiarly fungible" (p. 7).

In this study, we argue that the above problems stem from the prevalence of indirect ties in elite politics, and one remedy is to examine the more complex and non-dyadic relationships like the aforementioned three-party transitivity problems. We thus turn to the question of "who are my

friends," which is commonly accepted as the third order dependency in network analysis.[3] Unlike first-order dependencies that are associated with attributes of individual actors, such high-dimensional dependencies usually arise from mechanisms like latent homophily and stochastic equivalence. Homophily is the tendency for actors who share unobserved characteristics, for example their patron-client linkages, are more likely to be linked and make coappearances than actors that do not share those characteristics. Stochastic equivalence is the idea that actors might have similar roles in the network, and thus be more or less likely to make appearances with common third parties. If two elites in China are both proteges of Xi Jinping, then they are both more likely to make co-appearances with Xi and his other proteges, and less likely to make co-appearances with Xi's rivals and his rivals' proteges. Therefore, a systematic study of such third order dependencies helps us understand the complex interdependencies between elites and thus provides a more accurate answer to the question of "who are my friends."

To sum up, in this study we propose to conceptualize the elite power-sharing as a latent space, which allows us to synthesize both of its positional attributes and relational dynamics. We further argue that we can approximate this latent space by examining how power foci (i.e., political events and elites' appearance at them) are interconnected. Finally, we highlight the three who questions we need to answer in this approximation. In the following parts, we introduce our empirical strategies and discuss how the approach could help shed light on the development such informal institutions like LSGs in the CCP regime.

III Data

In this study, we rely on a unique database from the China Vitae project, which tracks the public appearances of the CCP elites. We focus on the time period between January 1 2013 and January

[3]The second-order dependency usually refers to reciprocity, which does not apply to our case here.

1 2017, and there are about 10000 appearance records of over 200 elites. This allows us to systematically examine the elite power-sharing in Xi's first tenure. Table 1 presents a small sample of our dataset and reports the date, the event, and elites in attendance.[4] From Table 1, we can find our dataset captures how top CCP elites structured their power relationships via a variety of political activities, ranging from the civil-military unity meeting to the China-US summit. As argued above, these power foci constitute an interlocking network of events and elites, and Figure 1.a shows how the six sample events in Table 1 could form such an interlocking network. Since our main focus is elite relationships, we then extract the elite coappearance network as shown in Figure 1.b, and this coappearance network serves as the starting point of our later analyses.

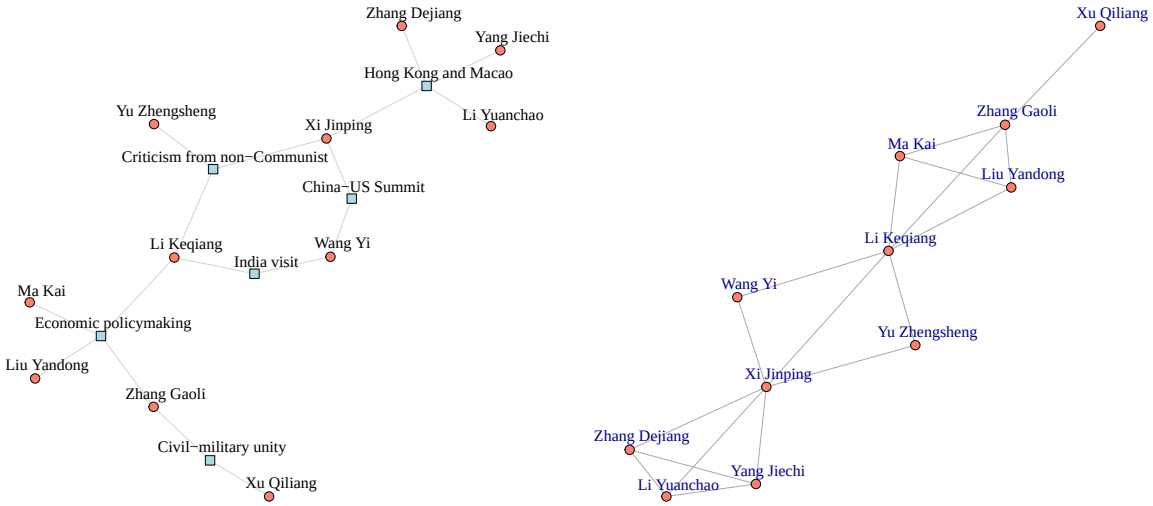
[Table 1 is about here.]

[4]Further information about the event locations, topics raised, and sources are also available.

Table 1: A selected sample of political events

Date	Event	Attendee
2013-01-25	Vice-Chairman of the Central Military Commission calls for efforts to promote unity among army, government and the people	Zhang Gaoli, Xu Qiliang
2013-02-07	Xi Jinping urges #CPC to accept criticism and be receptive to the views of non-communists	Xi Jinping, Li Keqing, Yu Zhengsheng
2013-03-18	Xi Jinping endorses work of Hong Kong #HK, #Macao governments #China	Xi Jinping, Zhang Dejiang, Li Yuanchao, Yang Jiechi
2013-04-14	Premier stresses foresight in economic policymaking #China	Li Keqiang, Zhang Gaoli, Ma Kai, Liu Yandong
2013-05-20	Chinese Premier visits memorial of Mahatma Gandhi in New Delhi #India #China	Li Keqiang, Wang Yi
2013-06-07	Xi, Obama meet for 1st summit #China #USA	Xi Jinping, Wang Yi
...	...	...

[Figure 1 is about here.]



(a) (b)

Figure 1: The interlocking networks of power foci

[Figure 2 is about here.]

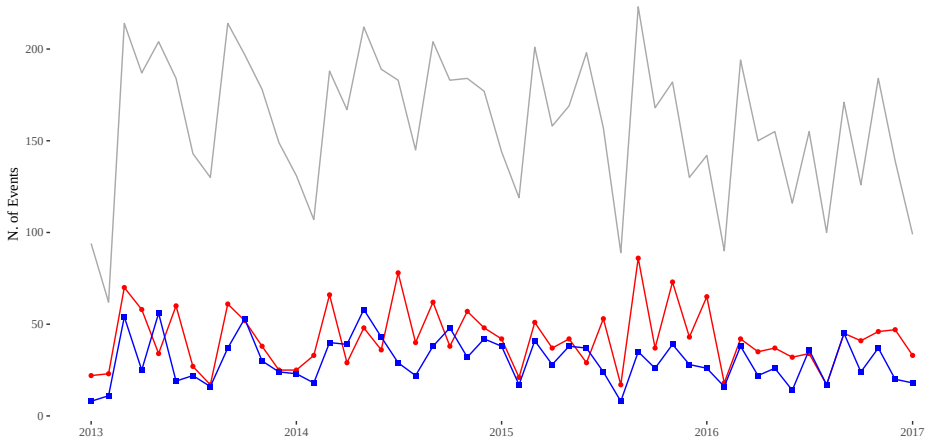
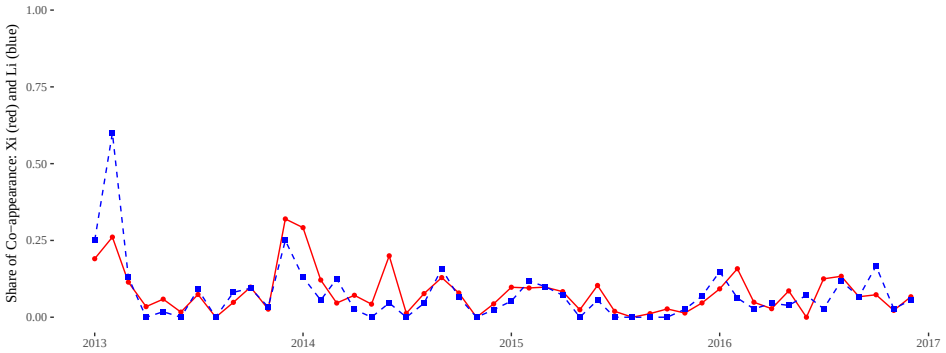


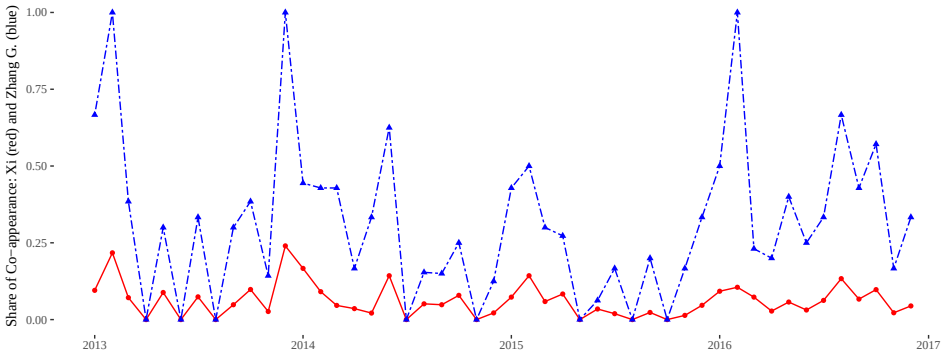
Figure 2: Total appearances (gray), Xi (red), and Li (blue)

After constructing the complete coappearance network, we can answer the questions of "who's in change" and "who do I work with" by calculating elites' total appearances and

coappearances. Figure 2 plots the total number of elite appearances (gray), as well as those associated with Xi Jinping (red) and Li Keqiang (blue) respectively. A quick examination shows a consistent annual pattern across the four years under examination. There are much fewer elite appearances in February and August, and their activities peak in March and September. While the low points in springs are mainly due to the Chinese new year, those in August have a lot to do with the CCP's tradition of Beidaihe retreat (Miller, 2014*b*). A comparison of Xi and Li's appearances points to some interesting changes. In 2013 and 2014, we can find that their total appearances crisscrossed a lot. Yet starting from 2015 Xi has made markedly more appearances. This corroborates with Jaros and Pan (2017) that Xi has significantly consolidated his power in his first term.



(a) Xi and Li



(b) Xi and Zhang

Figure 3: Coappearance

[Figure 3 is about here.]

In Figure 3, we plot and contrast two pairs of coappearances, Xi-Li and Xi-Zhang coappearances.[5] In Figure 3a, while the red line indicates the share of Xi-Li coappearance to Xi's total appearance, and the dashed blue line denotes the share of their coappearance to Li's. From Figure 3.a, we can find that the two lines crisscrossed each other throughout the four years, and their shares of coappearances have declined steadily over time. In other words, for both Xi and Li, their coappearances account for similar weights in their total activities, though they were gradually departing away from each other. However, Xi-Zhang coappearances in Figure 2b show a different trend. Xi-Zhang coappearances were highly asymmetrical. The share of their coappearance is markedly more salient for Zhang.

[Discussion of triadic dependence]

Together, we can find that the CCP elites tracked in the dataset demonstrate important variations in their total appearances and coappearances. In the following section, we introduce our latent network model to systematically their latent distance.

IV Latent Factor Analysis

To answer the question of "who are my friends," we introduce the latent factor model (LFM).It allows us to disentangle elite's latent affinities from their coappearance network (Hoff, 2005; Minhas, Hoff and Ward, 2016). Generally speaking, LFM positions actors in a k dimensional latent vector space. In this space, actors whose vectors point in similar dimensions are more likely to share similar preferences and be members of the same factions. The angles between these actors vectors then provide a measure of the extent to which the preferences and factional links are similar. Given its ability to capture latent affinities between interconnected actors, LFM has been used to infer state foreign policy preferences (Gallop and Minhas, 2018) and political party

[5]Zhang Gaoli was one of the seven members of the Politburo Standing Committee. He also served as the first-ranked Vice Premier.

preferences (Weschle, forthcoming).

More formally, we conduct LFM analysis as follows. We treat our coappearance network as an $n \times n$ matrix, where n denotes the number of elites, and the matrix cell y_{ij} represents the number of coappearances between elite i and elite j.[6] To obtain the latent affinities between elites (i.e., a lower-dimension relational measure), we then have an LFM as follows,

$$Y = f(\theta) \tag{1}$$

$$\theta = \beta^{\top} X + Z \tag{2}$$

$$Z = M + E \tag{3}$$

$$M = A + U \Lambda U^{\top} \tag{4}$$

where $u_i \in \mathbb{R}^k$ and Λ is $k \times k$ diagonal matrix. $f(.)$ is a general link function corresponding to the distribution of Y (in our case the coappearance count), and $\beta^{\top}\mathbf{X}$ is the standard regression term for dyadic and nodal fixed effects.[7]

This LFM accounts for network interdependencies is by decomposing the error term Z. \citet{hoff:2009} notes that we can write $Z = M + E$ such that the matrix E represents noise, and M is systematic effects representing first and third order dependencies. A represents nodal random effects, which are included to account for first-order dependencies – who matters and their overall level of activity. By matrix theory, we can factorize the multiplicative effects into the product of two simpler matrices: $U \Lambda U^{\top}$, where $u_i \in \mathbb{R}^k$ is a latent vector associated to node i and Λ is a $k \times k$ diagonal matrix. Thus under this framework a vector of latent characteristics are estimated for each actor, $u_i = \{u_{i,1}, \ldots, u_{i,k}\}$. Similarity in the latent factors between two actors, $u_i \approx u_j$, corresponds to how stochastically equivalent they are and the diagonal entries in Λ, $\lambda_k > 0$ or $\lambda_k < 0$, determine the level of homophily (or anti-homophily) in the network (Minhas,

[6] It should be noted that the coappearance data is symmetric and so $y_{ij} = y_{ji}$ for all i, j, T. The approach we describe below has already been generalized to the case where $y_{ij} \neq y_{ji}$.

[7] For the purpose of parsimony we abstain from using fixed effects in this study.

Hoff and Ward, 2016).[8]

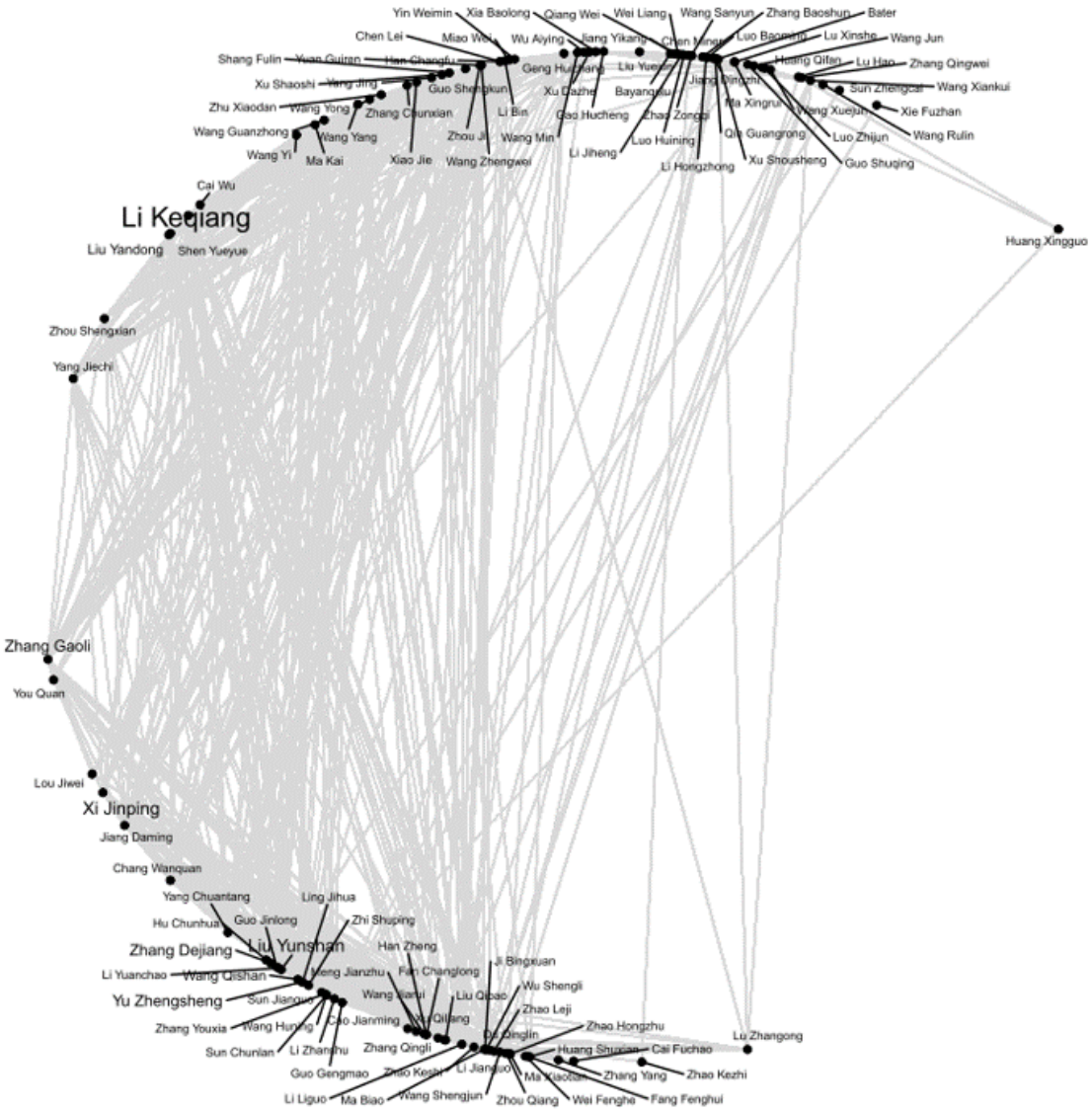


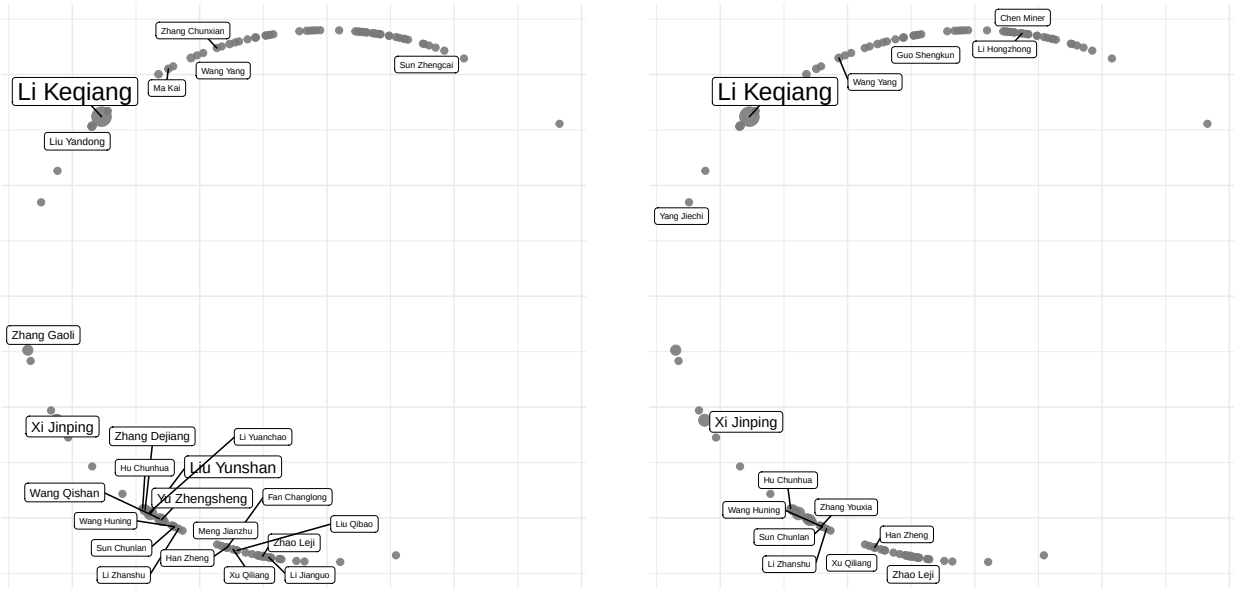
Figure 4: Latent space network

[Figure 3 is about here.]

For our purposes, the key output is $U\Lambda U^\top$. This matrix provides us the effect of stochastic equivalence and homophily on official appearances. We can look at the matrix U, an $n \times k$ matrix which represents each actors vector in the k-dimensional latent network. But key to interpreting

[8] A Bayesian procedure to estimate the LFM is available in the amen R package.

this space is that it is non-Euclidean, as actor's latent positions are actually embedded within a k-dimensional hyper sphere, and so we cannot simply look at distances in this space. Rather, the important measure here is an actors vector in this space, and the similarity between the vector of one actor and another. Comparing the similarity of preferences between two states, $\{i, j\}$, can be accomplished by comparing the direction to which their respective factor vectors point. A commonly used metric for this sort of problem in the recommender system literature from computer science is the cosine of the angle formed by the latent vectors of both actors.[9] We refer to this distance metric as latent angle distance. Thus, if the estimated latent vectors of two actors are in the same direction, they are apt to have made appearances with similar partners. We measure this by looking at the absolute distance of the angles created by each officials position and the center of the latent network in a given year.



(a) 18th (b) 19th

Figure 5: Latent space network

[Figure 3 is about here.]

[9]For a review of this literature see Amatriain and Pujol (2015).

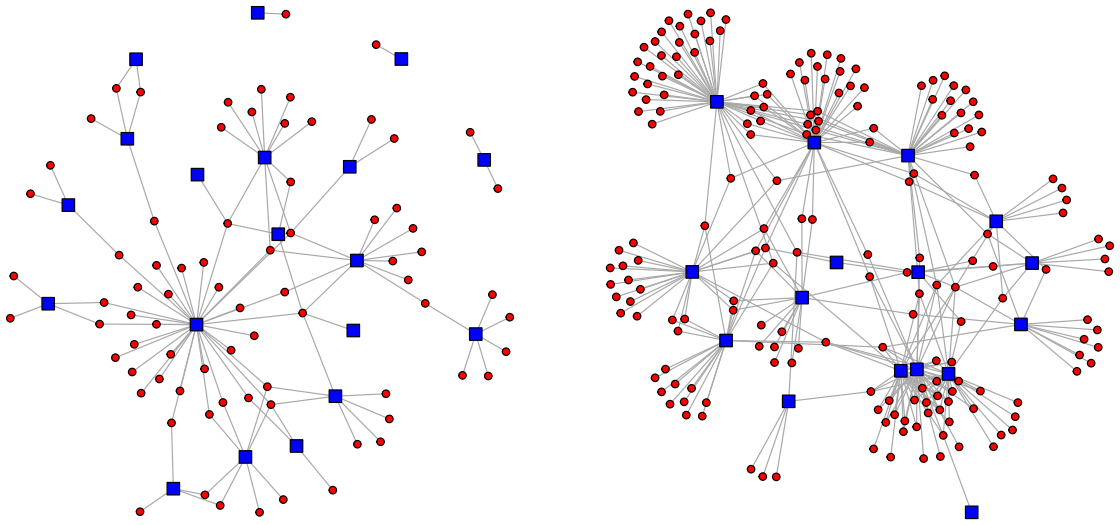
[Key elites stand out. Some interesting pattern of power-sharing has emerged. Yet, two surprising overlapping (Yu Zhengsheng and Liu Yunshan) and (Wang Qishan and Zhang Dejiang)]

[An interesting pattern, while Xi was distant from Li, the premier of Li Keqiang, all four vice premiers (i.e., Zhang Gaoli, Liu Yandong, Wang Yang, and Ma Kai). While this peculiarity cannot be explained by institutional/legal explanations, which would suggest vice premiers cooperate more the premiers, it is consistent with studies like Jaros and Pan]

V A Testing Case: Leading Small Groups

To test the validity of our measures, we attempt to estimate membership on the Leading Small Groups (LSG) using measures of latent similarity we discuss above. To contribute to the debate, we focus on a critical and unique arrangement in the Chinese party-state, the leading small groups (LSGs). LSGs, though not incorporated into charts of Party or government organs, play a pivotal role in communicating, coordinating, and implementing of important decisions across different segments and various levels of the governments. LSGs, therefore, not only can serve as an institutional remedy to the regime's prolonged problem of political fragmentation, but also, as shown by the development of the infamous Central Cultural Revolution Group (1966-69), LSGs could become an effective vehicle for expansion of personal power.

In this study we examine LSGs at the national level as well as their members, and we further differentiate between Central Committee (*zhongyang lingdao xiaozu*, Party LSGs) and State Council Leading Small Groups (*guojia*, *quanguo*, *guowuyan*, or *zhongguo lingdao xiaozu*, State LSGs). All LSGs are involved in the collecting and providing policy intelligence, and coordinate among different stakeholder interests. However, only a small share of them has coordination (*xietiaozu*) in its name. The ones that do have, often include stakeholders that are strictly speaking outside of the party-state bureaucracy, such as business associations.

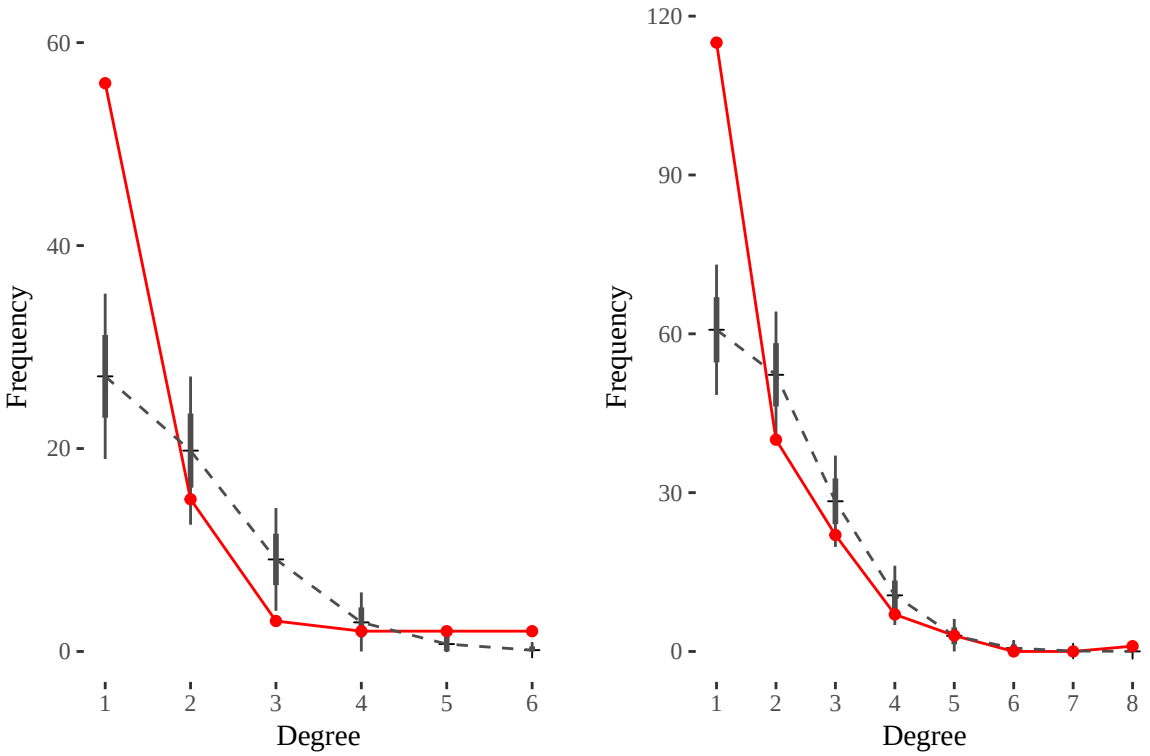


(a) Central Committee LSG (b) State Council LSG

Figure 6: Leading small group at the national level

[Figure 4 is about here.]

Fig. 4a plots our data of Party LSGs. It shows how 77 CCP elites (red circle points) are linked with 19 Party LSGs (blue rectangle points) via 110 affiliation ties. Given the duality nature of the bipartite network, we can further project the bipartite network of Party LSGs into two one-mode networks, a LSG network and a member network. We then plot our data of State LSGs in Fig. 4b. The bipartite network of State LSGs encompasses 188 individuals, 16 State LSGs, and 312 unique entries of affiliation relationship.



(a) Party LSGs (b) State LSGs

Figure 7: Degree distribution

[Figure 5 is about here.]

In revealing the general pattern of how nodes are interconnected, degree distribution perhaps is the most basic graph-level statistic. Scholars have long relied on degree distribution to identify different network typologies (e.g., Albert and Barabási, 2002; Clauset, Shalizi and Newman, 2009). Yet, a bipartite graph complicates its calculation and interpretation since two types of degree distributions are available, one for elites (i.e., "how many LSGs an elite is appointed to") and one for LSGs (i.e., "how many members a LSG is consisted of"). Here we are interested in the extent which elites are assigned to multiple LSGs, and Fig. 5 plots degree distributions respectively. An examination of Fig. 5a shows the Party LSG network differs significantly from a random network in three ways. First, there are much more nodes with low degrees in the Party LSG network. Specifically, the Party LSG network deviates from a random one in its systematic

control over membership concurrency. Most elites are assigned to a single LSG, and only a few are appointed to multiple LSGs. Second, while a random network lacks hub nodes with high degrees, the Party LSG network has a few central nodes. Finally, differing from random network, the Party LSG network has a much smaller number of nodes with middle range degrees. In contrast, the State LSG network deviates from random networks only in its larger number of low-degree nodes. Together, these findings suggest that compared to that of the State LSG network, the degree distribution of Party LSG network is more like a fat-tail one, which is usually the hallmark characteristic of the centralized scale free network.

Given that Chinese elites can be members of multiple LSGs, and that we have reason to believe that more powerful members of the party are in more of these groups, we start by using a count model of membership, in particular a negative-binomial regression. We compare three main models. Our null model looks simply at the individuals total level of appearances in the Chinese Vitae data, this provides an approximate measure of popularity at the individual level. We also look at a measure that includes both total appearances and coappearances with Xi Jinping, attempting to capture the direct dyadic relationship with the Chairman of the party. Finally, our main model includes overall appearances, and rather than looking at appearances with Xi, we look at the latent angle similarity an elite has with Xi, which gets at not only their direct interactions, but also third order effects like homophily and stochastic equivalence.

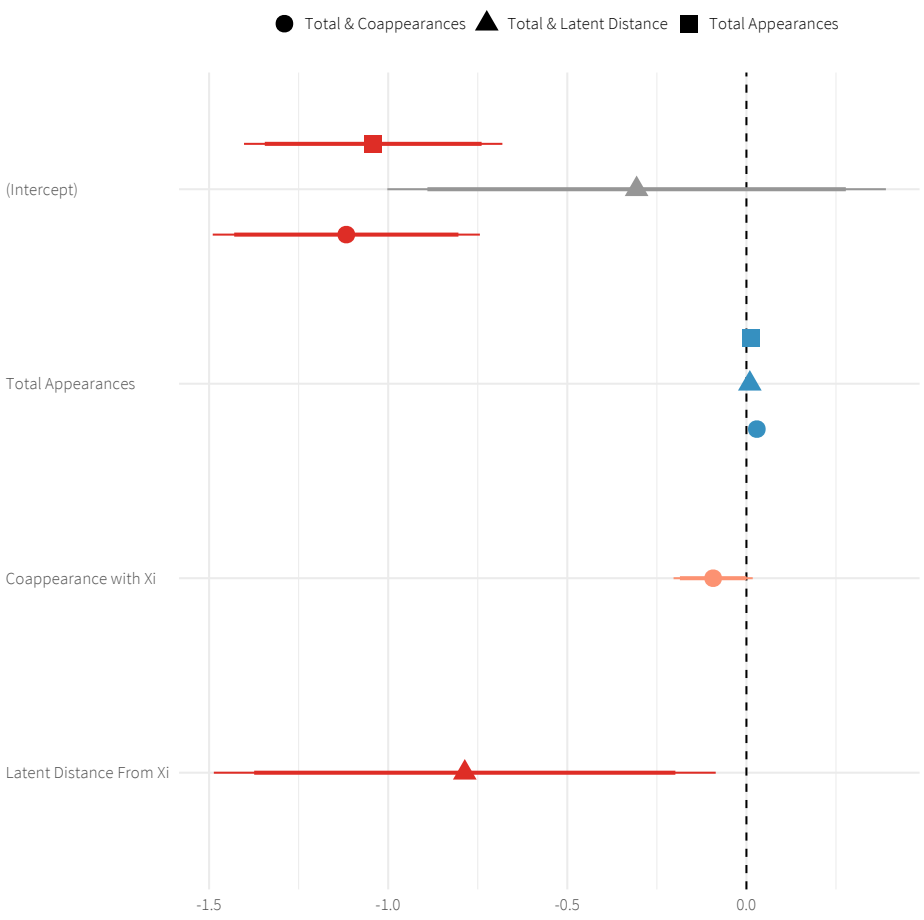


Figure 8: Estimates of Negative Binomial Analysis of Number of Total LSGs

[Figure 6 is about here.]

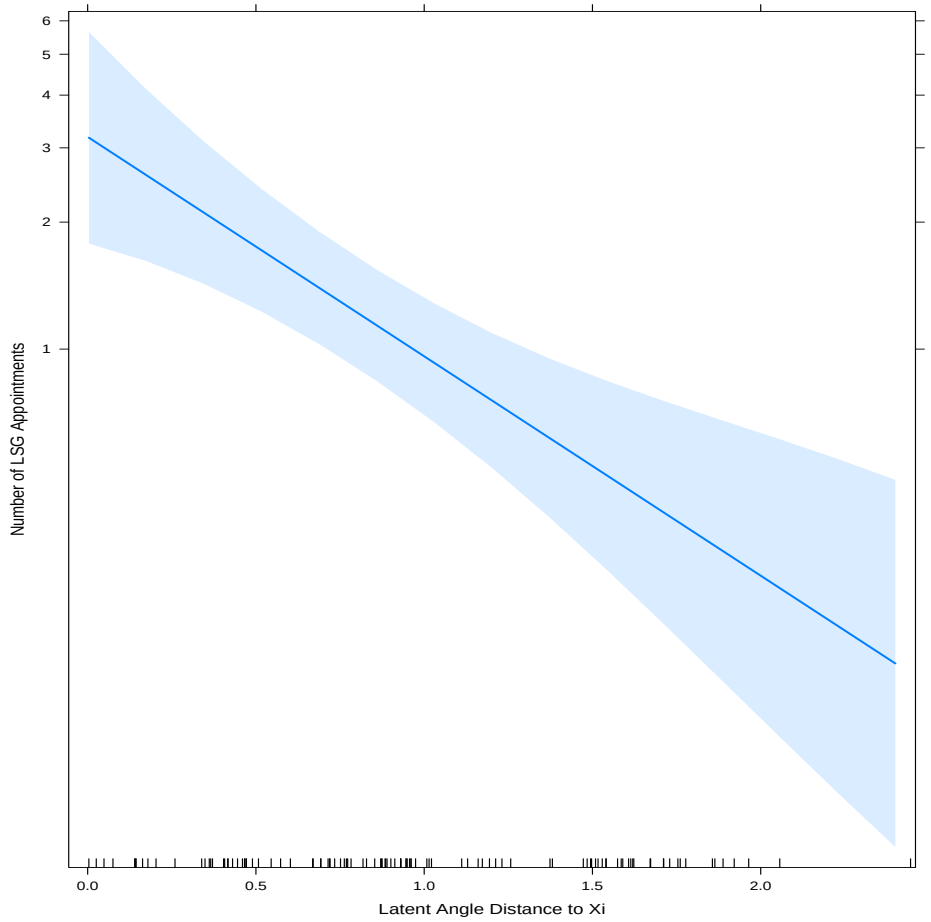


Figure 9: Estimated Effects of Latent Distance to Xi

[Figure 7 is about here.]

The results of the three models are reported in Figure 6. Interestingly, while coappearances with Xi do not have a robust relationship to placement on more LSGs, the latent distance measure is significant and in the predicted direction — elites who are further from Xi in the latent space are seated on more Leading Small Groups. In Figure 7 we show the expected number of LSGs an elite with an average number of total appearances would be appointed to based on their latent distance from Xi, for that elite, moving from the closest angle distance observed to the furthest is associated with a drop in LSG appointment of about 2.5. We also see that when we take into account latent proximity to Xi Jinping, the first order characteristics cease to matter, whereas they

have the predicted positive effects (elites that make more appearances also sit on more LSGs) in the other models.

[Table 1 is about here.]

Table 2: Out of Sample Root-Mean Squared Error for Count Models

Model	Out of sample RMSE
Total appearance model	1.90
Total appearance and coappearance model	1.84
Total appearance and latent distance model	1.72

While it is heartening that our measure of Chinese latent proximity conforms to our theoretical expectations in terms of conventional statistical significance, the more relevant test is whether it improves our ability to predict behavior out of sample. To do this, we divide Chinese elites into 20 groups at random, and in each case predict how many LSGs an elite in that group will be appointed to using a model fit on the other 19 groups. We do this for each of our three main models. As you can see in table 1, the model using latent angle similarity significantly outperforms the models that only use total and coappearances, showing that this measure of latent similarity helps us to predict promotion to the Leading Small Group.

[Table 2 is about here.]

Of course, not all LSGs are the same. There are groups at the State level and at the Central level. Based on institutional setup, while Xi has the final say on appointments to the Federal LSGs, Premiere Li Keqiang is responsible for the state level ones. Thus, to account for these differences, we run a bivariate probit analysis, which simultaneously estimates the likelihood that an elite will be appointed to any Central or State LSGs. Again in this analysis, latent distance from Xi has a consistent negative effect for both types of LSGs.

[Figure 8 is about here.]

Table 3: Bivariate probit analyses of Central and State LSGs

	Model 1		Model 2		Model 3		Model 4	
	Central	State	Central	State	Central	State	Central	State
Total appearances	0.062^{***}	0.002					0.055^{***}	-0.0004
	(0.017)	(0.003)					(0.017)	(0.003)
Coappearances with Xi			0.219^{***}	0.016				
			(0.072)	(0.016)				
Latent distance to Xi					-1.134^{***}	-0.708^{***}	-0.541^{*}	-0.727^{***}
					(0.278)	(0.255)	(0.302)	(0.274)
Intercept 1	-1.082^{***}		-0.794^{***}		0.474^{*}		-0.534	
	(0.175)		(0.145)		(0.264)		(0.354)	
Intercept 2	-0.646^{***}		-0.657^{***}		0.023		0.046	
	(0.137)		(0.134)		(0.256)		(0.294)	
Intercept 3	0.913^{**}		0.920^{**}		0.648^{*}		0.826^{**}	
	(0.398)		(0.379)		(0.365)		(0.407)	

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

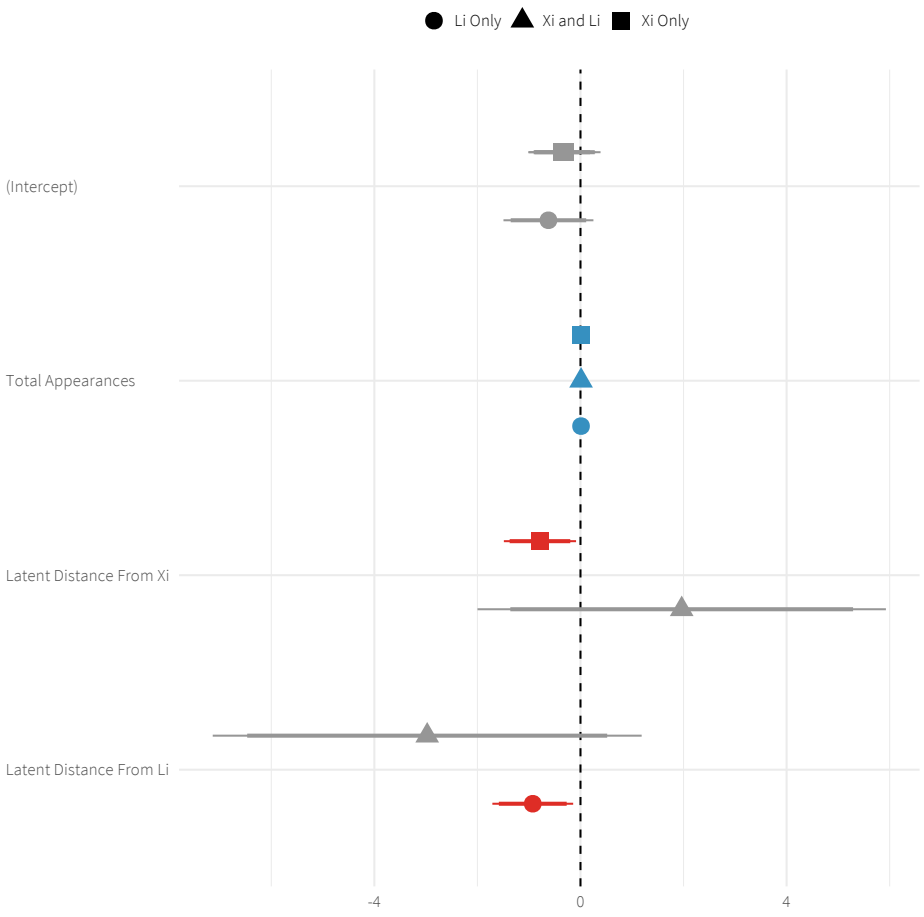


Figure 10: Estimates of Negative Binomial Analysis: Comparing distances to Xi and Li

[Table 3 is about here.]

Table 4: Out of Sample Root-Mean Squared Error for Count Models

Model	Out of sample RMSE
Total appearance with latent distance to Xi only	1.72
Total appearance with latent distance to Li only	1.89
Total appearance and latent distances to Xi and Li	1.86

Finally, we attempt to look at models based on distance, not to Xi Jinping, but to Li Keqiang,

to see how well individuals closer to Xi's rival perform in terms of appointment to these groups. We find that latent distance from Li, as depicted in Figure 8, is similarly associated with a lower probability of appointment to LSGs. However, combining the two distance measures results in a model that has ambiguous effects, and this is in part because for most members of the party, distance from Xi and Li are highly collinear. Importantly however, they differ for some individuals. However, as depicted in Table 3, inclusion of latent distance to Li Keqiang actually results in a *worse* performing model out of sample. This implies that, for elites where their distance to Xi and Li diverge (because they are between them in the latent angle space) adding information about proximity to Li actually hurts the model's performance. This might be because Xi has such a dominant hand in determining advancement in the party.

VI Conclusion and discussion

Under Xi Jinping, Chinese politics has become less institutionalized and more personalist. The institutional limit on leadership terms has been elimitated, and Xi has centered power in his hands, and the hands of his allies. Given these developments, it is crucial to understand and measure factions and affinity within Chinese elites. In this study, we propose a latent network approach to explore the dynamic interactions of the CCP elites. We conceptualize public co-appearances as "foci," around which various political activities are organized. Since elites' engagement in these foci is highly selective, their co-appearances signal important information about elites' collusion and cooptation. Based a unique dataset, we aim to answer three critical questions — 1) who's in charge, (2) who do I work with, and (3) who are my friends — by examining elites' total appearances, dyadic coappearances, and finally their latent network distance. We find that latent proximity to Xi corresponds to policy prominence for Chinese elites. Most excitingly, we find that this latent measure significantly outperforms measures that simply look at individual power (who's in charge) and dyadic relationships (who do I work with).'

While we believe that this measure has aided us in our understanding and measurement of

the Chinese political system, we can further improve our understanding in a few ways. First, this data can not only be compared to biographically and media measures of elite prominence, but in fact, the technique can incorporate these factors to gain a more nuanced understanding of elite networks and relationships. Secondly, we believe this technique can be expanded beyond China, to help us understand factional politics in other, even more opaque autocracies, such as North Korea or the Kingdom of Saudi Arabia.

References

Acemoglu, Daron, Georgy Egorov and Konstantin Sonin. 2008. "Coalition Formation in Non-Democracies." *The Review of Economic Studies* 75(4):987–1009.

Albert, Réka and Albert-László Barabási. 2002. "Statistical Mechanics of Complex Networks." *Reviews of Modern Physics* 74(1):47–97.

Albrecht, Holger and Oliver Schlumberger. 2004. "'Waiting for Godot': Regime Change Without Democratization in the Middle East." *International Political Science Review* 25(4):371–392.

Amatriain, Xavier and Josep M. Pujol. 2015. Data Mining Methods for Recommender Systems. In *Recommender Systems Handbook*, ed. Francesco Ricci, Lior Rokach and Bracha Shapira. Boston, MA: Springer US pp. 227–262.

Ban, Pamela, Alexander Fouirnaies, Andrew B. Hall and James M. Snyder. forthcoming. "How Newspapers Reveal Political Power." *Political Science Research and Methods* []([]):[].

Batke, Jesscia and Matthias Stepan. 2017. *Party, State, and Individual Leaders: The Who's Who of China's Leading Small Group*. Berlin: Mercator Institute for China Studies.

Bizzarro, Fernando, John Gerring, Carl Henrik Knutsen, Allen Hicken, Michael Bernhard, Svend-Erik Skaaning, Michael Coppedge and Staffan I. Lindberg. 2018. "Party Strength and Economic Growth." *World Politics* 70(2):275–320.

Boix, Carles and Milan W. Svolik. 2013. "The Foundations of Limited Authoritarian Government: Institutions, Commitment, and Power-Sharing in Dictatorships." *Journal of Politics* 75(2):300–316.

Brancati, Dawn. 2014. "Democratic Authoritarianism: Origins and Effects." *Annual Review of Political Science* 17:313–326.

Brownlee, Jason. 2007. *Authoritarianism in an Age of Democratization*. New York: Cambridge University Press.

Buehler, Matt and Mehdi Ayari. 2018. "The Autocrat's Advisors: Opening the Black Box of Ruling Coalitions in Tunisia's Authoritarian Regime." *Political Research Quarterly* 71(2):330–346.

Bueno de Mesquita, Bruce, Alastair Smith, Randolph M. Siverson and James D. Morrow. 2003. *The Logic of Political Survival*. Cambridge, MA: The MIT Press.

Clauset, Aaron, Cosma Rohilla Shalizi and Mark E.J. Newman. 2009. "Power-Law Distributions in Empirical Data." *SIAM Review* 51(4):661–703.

Dahl, Robert A. 1961. *Who Governs? Democracy and Power in an American City*. New Haven, CT: Yale University Press.

Dahl, Robert A. 1971. *Polyarchy: Participation and Opposition*. New Haven, CT: Yale University Press.

Domhoff, G. William. 2005. *Who Rules America? Power, Politics, and Social Change*. 5th ed. New York, NY: McGraw Hill.

Feld, Scott L. 1981. "The Focused Organization of Social Ties." *American Journal of Sociology* 86(5):1015–1035.

Gallop, Max and Shahryar Minhas. 2018. "A Latent Factor Approach to Measuring State Preferences.".

Gandhi, Jennifer. 2008. *Political Institutions under Dictatorship*. Cambridge and New York: Cambridge University Press.

Hamrin, Carol Lee. 1992. The Party Leadership System. In *Bureaucracy, Politics and Decision-making in Post-Mao China*, ed. Kenneth Lieberthal and David M. Lampton. Berkeley, LA: University of California Press pp. 95–124.

Hoff, Peter. 2008. "Modeling Homophily and Stochastic Equivalence in Symmetric Relational Data." *Manuscript* .

Hoff, Peter D. 2005. "Bilinear Mixed-Effects Models for Dyadic Data." *Journal of the American Statistical Association* 100(469):286–295.

Hoff, Peter D., Adrian E. Raftery and Mark S. Handcock. 2002. "Latent Space Approaches to Social Network Analysis." *Journal of the American Statistical Association* 97(460):1090–1098.

Huang, Haifeng. 2015. "Propaganda as Signaling." *Comparative Politics* 47(4):419–444.

Huang, Jing. 2000. *Factionalism in Chinese Communist Politics*. Cambridge and New York: Cambridge University Press.

Huhe, Narisong and Matthias Stepan. 2018. "Office or Office Holder? Understanding the Leading Small Groups in the Chinese Party-State." Presented at the Annual Meeting of the Association of Asian Studies, Washington DC.

Hunter, Floyd. 1953. *Community Power Structure: A Study of Decision Makers*. Chapel Hill, NC: University of North Carolina Press.

Ishiyama, John. 2014. "Assessing the Leadership Transition in North Korea: Using Network Analysis of Field Inspections, 1997–2012." *Communist and Post-Communist Studies* 47(2):137–146.

Jaros, Kyle and Jennifer Pan. 2017. "China's Newsmakers: Official Media Coverage and Political Shifts in the Xi Jinping Era." *China Quarterly* []([]):[].

Johnson, Christopher K., Scott Kennedy and Mingda Qiu. 2017. "Xi's Signature Governance Innovation: The Rise of Leading Small Groups." *Center for Strategic and International Studies* .
URL: *www.csis.org/analysis/xis-signature-governance-innovation-rise-leading-small-groups*

Kenny, David A., Deborah A. Kashy and William L. Cook. 2006. *Dyadic Data Analysis*. New York, NY: The Guilford Press.

Lampton, David M. 2015. "Xi Jinping and the National Security Commission: Policy Coordination and Political Power." *Journal of Contemporary China* 24(95):759–777.

Lee, Sangkuk. 2017. "An Institutional Analysis of Xi Jinping's Centralization of Power." *Journal of Contemporary China* 26(105):325–336.

Levitsky, Steven. 2001. "Inside the Black Box: Recent Studies of Latin American Party Organizations." *Studies in Comparative International Development* 36(2):92–110.

Li, Cheng and David Bachman. 1989. "Localism, Elitism, and Immobilism: Elite Formation and Social Change in Post-Mao China." *World Politics* 42(1):64–94.

Lieberthal, Kenneth. 1992. The 'Fragmented Authoritarianism' Model and Its Limitations. In *Bureaucracy, Politics, and Decision-making in Post-Mao China*, ed. Kenneth Lieberthal and David M. Lampton. Berkeley, CA: University of California Press pp. 1–30.

Magaloni, Beatriz. 2008. "Credible Power-Sharing and the Longevity of Authoritarian Rule." *Comparative Political Studies* 41(4-5):715–741.

Magaloni, Beatriz and Ruth Kricheli. 2010. "Political Order and One-Party Rule." *Annual Review of Political Science* 13:123–143.

Meyer, David, Victor C. Shih and Jonghyuk Lee. 2016. "Factions of Different Stripes: Gauging the Recuitment Logics of Factions in the Reform Period." *Journal of East Asian Studies* 16(1):43–60.

Miller, Alice L. 2014*a*. "How Strong Is Xi Jinping?" *China Leadership Monitor* (43):1–12.

Miller, Alice L. 2014*b*. "More Already on the Central Committee's Leading Small Groups." *China Leadership Monitor* 44:1–8.

Miller, Alice L. 2015*a*. "The Trouble with Factions." *China Leadership Monitor* 46:1–12.

Miller, Michael K. 2015*b*. "Electoral Authoritarianism and Human Development." *Comparative Political Studies* 48(12):1526–1562.

Mills, C. Wright. 1956. *The Power Elite*. Oxford and New York: Oxford University Press.

Minhas, Shahryar, Peter D. Hoff and Michael D. Ward. 2016. "Inferential Approaches for Network Analyses: AMEN for Latent Factor Models." *arXiv preprint* arXiv:1611.00460.

Nathan, Andrew J. 1973. "A Factionalism Model for CCP Politics." *China Quarterly* 53:34–66.

Nathan, Andrew J. and Kellee S. Tsai. 1995. "Factionalism: A New Institutionalist Restatement." *China Journal* 34:157–192.

Naughton, Barry. 2014. "'Deepening Reform': The Organization and the Emerging Strategy." *China Leadership Monitor* 44:1–14.

Opper, Sonja, Victor Nee and Stefan Brehm. 2015. "Homophily in the Career Mobility of China's Political Elite." *Social Science Research* 54:332–352.

Pepinsky, Thomas. 2014. "The Institutional Turn in Comparative Authoritarianism." *British Journal of Political Science* 44(3):631–653.

Perthes, Volker, ed. 2004. *Arab Elites: Negotiating the Politics of Change*. Boulder, CO: Lynne Rienner Publishers.

Pye, Lucian W. 1981. *The Dynamics of Chinese Politics*. Cambridge, UK: Oelgschlager, Gunn and Hain.

Shih, Victor C., Christopher Adolph and Mingxing Liu. 2012. "Getting Ahead in the Communist Party: Explaining the Advancement of Central Committee Members in China." *American Political Science Review* 106(1):166–187.

Shih, Victor, Wei Shan and Mingxing Liu. 2010. "Gauging the Elite Political Equilibrium in the CCP: A Quantitative Approach Using Biographical Data." *China Quarterly* 201:79–103.

Shirk, Susan L. 2018. "The Return to Personalistic Rule." *Journal of Democracy* 29(2):22–36.

Svolik, Milan W. 2012. *The Politics of Authoritarian Rule*. Cambridge and New York: Cambridge University Press.

Tsou, Tang. 1976. "Prolegomenon to the Study of Informal Groups in CCP Politics." *China Quarterly* 65:98–114.

Weeks, Jessica L. 2012. "Strongmen and Straw Men: Authoritarian Regimes and the Initiation of International Conflict." *American Political Science Review* 106(2):326–347.

Weschle, Simon. forthcoming. "The Impact of Economic Crises on Political Representation in Public Communication: Evidence from the Eurozone." *British Journal of Political Science* []([]):[].