# Chinese Leadership: Provincial Perspectives on Promotion and Performance

**Abstract**

This article addresses whether the promotion of China's provincial leadership can be explained through economic growth or alternative factors (experience, education or having previously held a central government post). We use promotion definitions, based on official administrative rankings and a more accurate reflection of political-governmental power relationships, and five econometric models. Analysis is also located within specific scholarship about promotion in the Chinese bureaucracy, bureaucratic cultures and transitions from socialism. Findings suggested some support for the idea that economic growth records affected promotion in terms of the second definition and additional evidence to imply impacts from non-economic factors.

## Introduction

This article considers whether promotion of provincial Chinese leaders (Governors and Communist Party of China (CPC) Provincial Committee Secretaries) can be explained through their economic growth records or whether alternative explanations offer plausible narratives. We address themes significant to understanding administrative contexts of the world’s second largest economy and aim to augment a small existing scholarly literature. Our starting point is the development of a market economy following the third plenary session of the 11th CPC Central Committee in December 1978.

In locating this analysis within transitions from socialism, we also connect to debates about bureaucratic responses to such reforms. This issue has been discussed widely, for instance Walder (2003) studied capacity of Communist-era elites to appropriate public assets through reform processes. Similarly, Brown *et al.* (2009) considered participation of Russian bureaucrats in the privatization of state assets. We also place our study within a wider literature about why people are promoted, particularly the importance of performance (Weber, 1947; Blau and DeVaro, 2007) and the emergence of public sector performance and improvement agendas (McLaughlin *et* *al.,* 2002), thus connecting this study with substantive international scholarly and practitioner perspectives.

Our analysis is shaped through a distinctive contemporary delegation in China of much of ‘the governance of national economy……..to sub-national governments’ (Xu, 2011: 1078), which facilitated territorial competition, for example, through rivalry for inward investment (Yeung, 2000). Competition occurred, however, within centrally-imposed agendas, a process that has accelerated since 2012 under Xi Jinping (Lee, 2017), and which has been delivered, partly, through central control over sub-national, or at least provincial, appointments. These arrangements have been characterized as a *‘regionally decentralized authoritarian (RDA) regime’* (Xu, 2011: 1078)*.*

The *authoritarian* element also reflected imposition of performance agendas, which could be interpreted as Chinese adaptations of western public sector improvement programmes (Afonso *et al.*, 2005) or Maoist planning legacies (Fan, 2006). These

developments have been chronicled by scholars such as Tsui and Wang (2004: 89), who observed ‘emergence of a target-based vertical control system’ that could be used to affect sub-national expenditure.

This top-down performance agenda has long emphasized economic growth, both the tenth (2001-05) and eleventh (2006-10) five-year plans incorporated objectives to double the level of gross domestic product (GDP) recorded in the year 2000 by 2010. Similarly, the twelfth five year plan (2011-15) included a 7% annual GDP growth target. Sub-national competition operated within a framework of quantifiable economic targets and territories competed ‘to generate the highest growth rates’ (Chien and Gordon, 2008: 38). This context shifted behavior of sub-national bureaucrats, as Nee (1992: 14) observed, such ‘cadre-entrepreneurs’ sought success in the market-place ‘to advance their careers, to gain higher bonuses, and to expand their organizational power and influence’.

Our core research question concerns whether promotion of provincial leaders to national level was affected by their economic growth records or a range of alternative explanations - experience; education; or central connection, the latter defined through previous employment at the national tier. We also ask what implications our findings have for shifting organizational cultures amongst the Chinese government and changes to the ethos and values of the Chinese bureaucracy. We make, therefore, clear connections between our empirical analysis, wider debates about bureaucratic leadership in China and transitions from socialism, whilst also connecting to the extensive international literature about promotion and performance.

In the remainder of this article, we consider relevant scholarly literature before discussing our data sources and outlining the methodology. Subsequently, we specify and apply two definitions of promotion and five econometric models and evaluate the results. Finally, conclusions are highlighted and future research directions sketched.

## Promotion and Performance

There is a substantive relevant academic literature about why individuals are promoted within public sector bureaucracies. Scholars such as Weber (1947) recognized the importance of seniority and performance, but ‘stopped short of stating explicitly the conditions that might result in emphasizing one criterion at the expense of another’ (Halaby, 1978, 466). Limitations that were evident in wider scholarship about promotion decisions (Gouldner, 1957; Blau and Scott, 1962).

More recent decades have witnessed the emergence of a rigorous empirical literature investigating why promotions occurred. Halaby (1978) studied US financial bureaus and drew conclusions about how organizational characteristics affected promotion criteria, for example agencies with a relatively high proportion of employees with advanced accounting degrees gave less importance to seniority. Similarly, Baron *et al.* (1986) considered variations in the internal promotion regimes of 100 organizations, while Kalleberg and Van Buren (1996) discussed effects derived from organizational scale.

Alternatively, writers such as Groot and Van Den Brink (1996); Booth *et al*. (2003); and Blau and DeVaro (2007) considered impacts arising from gender, while scholars such as Ruderman *et al.* (1995); and Pudney and Shields (2000) assessed promotion within wider diversity contexts. Others such as Spilerman and Lunde (1991) studied the importance of educational backgrounds. Promotion prospects have also been connected to wider social themes, for example Kim (2002) associated promotion with individuals’ social capital, while Lemons and Jones (2001) and Garcia-Izquierdo *et al.* (2012) discussed promotion decisions through procedural justice.

A substantial theme of this literature has been explicit expression of the idea of promotion as a merit-derived process reflective of performance (Alonso and Lewis, 2001; Fairburn and Malcomson, 2001; DeVaro, 2006). An issue that has also been contexualised through the emergence of the New Public Management (McLaughlin *et al*., 2002) and an invigorated and enhanced emphasis on public sector performance (Horn 1995; Bale and Dale, 1998; Brown, 2004). Overall, scholarship indicates that promotion can reflect achievement of specific-job related goals and or other forms of personal attainment such as educational qualifications. It also highlights the importance of personal attributes unrelated to performance, for example seniority, gender or ethnicity, and notes impacts from broader organizational characteristics.

**Promotion, Performance, the Chinese Bureaucracy and Economic Growth**

The positions of authority in the government or the Communist Party mentioned here comprise part of a *cadre* system, with its origins in the revolutionary struggle. During the Maoist period (1949-76), *cadres* were chosen from the peasantry and at the start of the period typically had revolutionary credentials forged in the civil war and or the Japanese conflict. Maoism regarded intellectuals as bourgeois and, in contrast to European communist regimes, excluded them from leadership roles. *Cadre* recruitment was ‘based on class background and social relations rather than on talent and specialization’ (Wang, 1981: 4). Attempts by more pragmatic leaders, such as Liu Shaoqi, to co-opt intellectuals as *cadres*, so that their skills could be used for economic development, were resisted (Lee, 1991: 77). Furthermore, recruitment of peasants meant that levels of educational attainment amongst the *cadres* were typically low. Absence of a retirement system made breaking into the communist elite difficult. Established hierarchies were disrupted during the Cultural Revolution, when many in senior positions were purged, although almost everyone was eventually reinstated, provided they survived.

During the 1980s, the *cadre* system was overhauled and recruitment and promotion criteria shifted from revolutionary zeal towards technical competency. Changes that can be dated to a speech made by Deng Xiaoping to the Politburo on 15th August 1980, which acknowledged a new policy to improve the education and competence of the *cadre* corps, and lower its age profile. An agenda that, in part at least, was motivated through aims to promote economic growth.

In order to remove *cadres* without the technical skills required for economic growth, retirement rules had to be addressed. In February 1982, the CPC Central Committee issued a document (*CPC Central Committee Decision on the Establishment of a Veteran Retirement System)* which commenced the process of abolishing life-tenures for senior officials.[[1]](#footnote-1) Certain veteran *cadres* were eligible for a special form of retirement (*lixiu),* which effectively translates as *‘*leaving a job to recuperate’(Lee, 1991: 235). Retirement was combined with “unchanged political treatment’ and ‘slightly better economic treatment” (Lee, 1991: 236).

From the mid-1980s onwards, there was also evidence of the development of a more rigorous *cadre* management system (Manion, 1985). This evolved into the *Cadre Responsibility System* (Edin, 2003), which involved accountability for the delivery of ‘goals on a scale of importance: soft targets, hard targets and priority targets’ (Collins and Cottey, 2012: 86). Failure to implement those priorities negating other achievements. Accountability being (of course) through party-state structures at the next level in the hierarchy, political cultures that also facilitate swift implementation of new agendas. This effect can be illustrated through reference to how the decision by the national government to make climate change ‘a high priority of provincial and prefectural governments’ (Collins and Cottey, 2012: 86) quickly affected *cadre* performance targets and actions (Qi *et al*., 2008). The *cadre* system also incorporated procedures to constrain the decentralization reforms through limiting the extent to which *cadres* identified with their locality, for example through rotation of individuals between different areas (Zheng, 2009).

Importance of Chinese national policy agendas, evidenced particularly through the five-year plans and capacity of national government to quickly impose its policies, might suggest that leadership of territories experiencing strong economic performance facilitates promotion. This interpretation, nevertheless, assumes similar reorientations in bureaucratic cultures (O’Reilly *et al.*, 1991) to reward performance with promotion and so the emergence of organizational cultures and processes reflective of the reform agenda. It is, therefore, assumed that these changes have effectively challenged the traditional ‘mode of conduct’ (Rokeach, 1973: 5), dating from the Maoist period.

Such changes can be illuminated through relevant typological distinctions. Adopting Cameron and Freeman’s (1991) classification, constructed through internal-external and organic-mechanistic axes, we can postulate that cultural shifts reflecting performance agendas are consistent with movements from hierarchy-based to market-based cultures. The former coalescing around prioritizing internalmaintenance, for example through integration and smoothing actions, the latter stressing external competition and differentiation. Both orientations are, however, focused on the mechanistic axis, reflective of values such as control and order.

Literature about China’s transition from socialism has also addressed shifting organizational cultures. Writers such as Tsui *et al.* (2006) considered variations amongst state-ownership, private domestically-owned enterprises and foreign-owned firms. Others, such as Lau *et al.* (2002), connected Chinese organizational cultures to change agendas and employee attitudes towards their firm and job. Similarly, our study has implications for understanding organizational cultures of the Chinese bureaucracy. Regarding the hierarchy and market distinctions specified by Cameron and Freeman (1991), evidence that promotion reflected economic growth performance could be interpreted as indicating market cultures. Central control imposed to encourage provincial leaders to respond to external stimuli. Alternatively, dominance of other factors, particularly experience and central connection, might be appreciated as indicating hierarchy-based and inward-focused cultures.

Although, there is an absence of scholarship connecting organizational cultures to bureaucratic promotions, the career trajectories of territorial Chinese leaders have been addressed through several studies. Chen *et al.* (2005) argued that promotion prospects of provincial leaders depended on relative economic performance compared to their immediate predecessors. Li and Zhou (2005) asserted that promotion and dismissal of provincial leaders reflected their economic records, while Blanchard and Shleifer (2001: 175) claimed that the Chinese Communist Party supported ‘governors whose regions have performed well economically’ and disciplined ‘governors who have followed anti-growth policies’. Similarly, Wei (2002: 1733) commented that ‘local government officials who have succeeded in achieving local economic development can be promoted’. Guo (2007) associated promotion with revenue growth; while Landry (2003) observed positive but limited impacts from economic performance on mayoral careers.

Alternatively, Su *et al.* (2012) concluded that economic growth records didn’t alter the career paths of provincial bureaucrats. This finding echoed those of Bo (1996), who expressed some scepticism about the idea that good economic records facilitated the promotion of provincial leaders. Similarly, Shih *et al.* (2012: 166) concluded that there was ‘no evidence that strong growth performance was rewarded with higher party ranks’ and Zhang (2014: 263) observed that good ‘economic performance’ did not increase probability of a Politburo or Secretariat appointment.

Regarding alternative explanations, studies addressed the impact of age. Bo (1996: 149) commented that amongst provincial leaderships, younger bureaucrats were ‘less likely to be demoted’; while Li and Zhou (2005) noted age-related impacts on promotion and termination. Scholars also considered educational attainment, Bo (1996: 147) concluded that provincial leaders with no college education were more likely to be promoted than those with college education. Similarly, the idea that promotion reflected previous employment at national level was addressed. Bo (1996: 145) argued that ‘Provincial leaders of central origins are more likely to be promoted because they have stronger connections with the center’, while Li and Zhou (2005: 1755) commented that ‘previous or current work experience in the central government increases…the probability of promotion’.

This scholarship has, however, been characterized by significant methodological weaknesses, implying requirements for further analysis. First, some studies were limited in scope, for example Su *et al.* (2012) was restricted to re-coding data used by Li and Zhou (2005) and Chen *et al.* (2005); while Landry’s (2003) study was confined to mayors, ignoring other echelons of the Chinese bureaucracy. Furthermore, this focus on mayors meant that the study was beset with intensive difficulties in obtaining accurate and comprehensive data.

Second, there were timeframe deficiencies in several studies. Specifically, both Landry (2003) and Guo (2007) used data from relatively short eleven and eight-year periods respectively. Bo (1996) covered a substantive 1949-1994 period but failure to differentiate between sub-periods meant that impacts derived from post-1978/1980 reform processes were obscured.

Third, the literature has, to some extent, been characterized by definitional weaknesses. Studies, such as those undertaken by Chen *et al.* (2005) and Li and Zhou (2005), have been diminished through failure to recognize and model valid alternative definitions of promotion. Similarly, deficiencies in the treatment of economic growth were widespread (see Bo, 1996; Landry, 2003; Chen *et al.*, 2005; Li and Zhou, 2005; Guo, 2007; Su *et al*., 2012; Zhang, 2014). For example, Guo (2007) omitted to situate economic growth records within contemporary economic performance of the relevant regions. This issue matters given uneven spatial development (Li and Wei, 2010) and substantive economic cycle variations (Zhang and Wan, 2005).

Fourth, potential connections with wider themes such as changes to bureaucratic leadership in China (Lin, 2008), or more generally transitions from socialism (Ferrero, 2001), have not been properly addressed through this existing literature. Our study avoids these methodological weaknesses, it covers a substantive timeframe relevant to modernization; uses an extensive quantitative dataset; deploys precise and robust definitions of promotion, economic growth and the other explanatory variables; and makes connections to the wider themes.

## Methodology and data

Our data comprises biographic details about Governors and CPC Provincial Committee Secretaries and economic growth statistics. Information about the leaders was collated from a diversity of authoritative sources, including governmental and party websites and media outlets, such as *xinhuanet.com* and *people.com.cn*. Our decision to study provincial governmental and party leaderships reflected common scholarly approaches (Bo, 1996; Chen *et al.,* 2005; Li and Zhou, 2005) and the importance of this tier. Particularly through economic decentralization, which rendered ‘each provincial leader’s performance individually distinguishable and comparable and thereby allows for a sensible link between performance and turnover’ (Chen et al., 2005: 422).

We included individuals from 31 territories - the 22 provinces, four municipalities (Beijing, Tianjin, Shanghai and Chongqing) and five autonomous regions (Inner Mongolia, Guangxi Zhuang, Tibet, Ningxia Hui and Xinjiang Uyghur). We excluded the two special administrative regions (Hong Kong and Macau), which operate under the one country, two systems regime and were, partly, insulated from national governmental authority. We incorporated leaders, whose tenure ended after the Third Plenary Session of the 11th Central Committee of the Communist Party of China (December 1978). This timeframe reflects commencement of economic reforms and shifting bureaucratic perspectives from revolutionary agitators to technocrats (Lee, 1991). Data was obtained about 487 postings undertaken by 350 individuals, 345 (98.6%) of which were male and 309 (88.3%) Han Chinese. We treated each posting as a separate case because key characteristics, such as age, central connection and education, of each official, and their economic growth records, differed amongst postings.

### Promotion

We used two definitions. First, an official version constructed through the Chinese administrative rankings; that codifies equivalence of Ministers, Provincial Governors and CPC Provincial Committee Secretaries (see Table 1). This classification has been recognized by scholars, specifically Li and Zhou (2005: 1745) commented that a ‘province ranks at the same level as a ministry in the central government’. Second, criteria that is more reflective of political and governmental power-relationships. This aligns us with Li and Zhou (2005), in terms of classifying shifting from Provincial Governor to CPC Provincial Committee Secretary as promotion; assumptions reflexive of the central role of the CPC in delivering national agendas. Similarly, and in contrast to the definition adopted by Li and Zhou (2005), we interpreted moving from provincial leadership to a ministerial appointment as promotion; participation in national decision-making being the key factor.

**Insert table 1 here.**

### Economic Growth

Economic performance of a given provincial leader is measured by the time weighted geometric growth rate during their tenure. Denote as the economic growth rate of province at year. Suppose the Governor of province began their tenure in March 2003 and departed in July 2005. We ignore the month when the tenure started, a decision reflexive of inadequate data about the precise appointment date; similarly we ignore the end month. Here, tenure would be recorded as 27 months. The average economic growth rate is calculated as follows:

.

The geometric average is used because the arithmetic average tends to overstate actual average growth. Our analysis incorporates 20 cases without a valid growth measure. This occurs when the tenure started and ended in the same year, or when there were no valid provincial economic statistics. However, partial information was available for these leaders; hence these cases are included in the tabulation but omitted from the model-building.

The economic growth measure of the province alone cannot capture effectively performance of the provincial leadership, because we need to address the issue of national government benchmarking the performance of individuals against their peers. Furthermore, economic growth rates include many shocks, both domestic, such as regional economic policy; and international, for instance the severe economic recession in 2008-09. To address these issues, we developed and improved the approach used by Chen *et al.* (2005), who included provincial GDP growth of the immediate predecessor and GDP growth of the neighboring provinces as benchmarks.

First, we used a five-year geometric average provincial growth rate for the period before the start of a given tenure to measure predecessor(s)’ performance. This approach reflects the length of a normal tenure and concern to prevent wide variations in the tenure length of immediate predecessor(s) undermining our comparison benchmarks. Calculation is relatively straightforward, it is identical to the growth measure of a hypothetical predecessor who has had a 60 months tenure.

Second, we grouped provinces into regions using the standard geographical classification of Chinese regions. The regional groupings are as follows: - North (Beijing, Tianjin, Hebei, Shanxi and Inner Mongolia), North-East (Liaoning, Jilin and Heilongjiang), East (Shanghai, Jiangsu, Zhejiang, Anhui, Fujian and Shandong), Central (Jiangxi, Henan, Hubei and Hunan), South (Guangdong, Guangxi Zhuang and Hainan), South-West (Chongqing, Sichuan, Guizhou, Yunnan and Tibet) and North-West (Shaanxi, Gansu, Qinghai, Ningxia Hui and Xinjiang Uyghur). This approach is adopted because growth rates reflect regional policy variations. Chinese economic policy has long had a regional focus, for example from 1979 onwards central government implemented preferential economic policies to stimulate the economic growth of the coastal regions. More recently, several specific regional economic policies have been introduced; an example being the North East Area Revitalization Plan (China State Council, 2007). Furthermore, to isolate the impact of the province on the regional economic growth rate, we excluded the province while calculating the average regional economic growth. This is particularly important for smaller regions, or regions with uneven economic growth among provinces. Suppose there are provinces in the region, we index them as . We need to calculate the rate of returns for all the other provinces during the tenure, as follows:

The regional economic growth benchmark is then generated as

Third, to consider possible shocks from the global economy, we selected five countries; specifically, the **United States, Japan, South Korea, Germany** and **Australia**; and calculated the average economic growth rates during the tenure of the provincial leader. These are the top countries in terms of trading volume with China (based on 2014 figures), and are G20 members. The economic growth shocks of these countries were likely to have had spill-over effects on the Chinese economy.

Fourth, pre-existing prosperity is also important for evaluating impacts of individual leaders. Particularly this reflects the economic convergence literature (see Quah, 1996)*,* which indicates that territories with higher income levels typically grow at slower rates, and vice versa. Suppose two provinces have the same economic growth; *ceteris paribus*, the leader from the more affluent province would effectively be outperforming his colleague from the poorer province, because it would be more difficult for the economy of the more affluent province to grow. There is also an interpretation through those with the most political leverage securing appointments in the more affluent provinces, rather than the poorer and less developed parts of the country. Thus, similar to Liand Zhou*.* (2005), we included the lagged provincial per capita GDP (per capita GDP of the year before the start of the tenure) to control for pre-existing prosperity.

### Central Connection

Central connection enters the regression as a dichotomous variable (Li and Zhou, 2005). Leaders having previous experience in national government, or holding contemporaneous joint-appointments in both central government and as provincial leaders, equating to 1, and 0 otherwise.

Information on central connection, was, however collected in an ordinal scale, detailing the exact tier in the bureaucratic system (see Table 2). This facilitates exclusion of cases that would otherwise generate over-counting of promotion and bias estimation results. Specifically, there are officials who possessed central connection at tier two, this cohort had effectively already been promoted to the national leadership, and would need to be removed from the first set of regressions. Furthermore, officials with central connections at tier three level (*e.g.* ministerial posts) before appointment to the provincial leadership, would also need to be excluded. Such cases included Sun Zhengcai, who served as Minister of Agriculture before becoming the CPC Committee Secretary of Jilin province; and Jiang Zemin, later the General Secretary of the CPC Central Committee and then President of China, who served as Minister for the Electronics Industry before becoming the Mayor and then the CPC Committee Secretary of Shanghai. This cohort would need to be removed from the second set of regression analysis. Such job changes might be reflexive of personal desires to relocate back to Beijing or the natural culmination of temporary postings aimed at broadening administrative experience rather than a genuine promotion. Including those cases might, therefore, produce a false significant relationship between central connection and promotion. Similarly, we do not count posts below tier four, given their low ranking. Furthermore, our decision to investigate specific positions rather than individuals was confirmed because some officials had no central connection in an initial tenure but acquired one before a subsequent tenure. Most of them eventually acquiring central connection (see table 3).

**Insert table 2 here.**

**Insert table 3 here.**

### Experience and Education

Experience was addressed through age and length of service. Our age statistics reflect age at the end of each tenure (see table 4). Age is (of course) important in determining bureaucratic career trajectories. Since our purpose is to identify contributing factors to promotion, retirement rules must be addressed, specifically the introduction of mandatory retirement. These rules specified retirement of provincial leaders at aged 65; and were implemented in 1983 (Li and Zhou, 2005: 1759). Although there are dispensations to retain office until completion of current terms, tenures are seldom renewed for those aged above 63, and 68 is, with some very rare exceptions (see table 7), usually the ceiling for joining the national leadership. Thus, to reflect impacts from implementation of mandatory retirement, we generated a dummy variable indicating whether the tenure commenced from 1st January 1983 and onwards[[2]](#endnote-1) (post-82) and an age indicator (age>65). We then included age, the post-82 indicator and the multiplication of age with the post-82 indicator, to capture the effects of age, the mandatory retirement rule and their interaction on promotion.

**Insert table 4 here.**

Length of service is considered through two aspects. First, the number of months an individual has served in the relevant post, cases where an official held their position for more than five years (one-tenure) have been flagged out and effects captured as a dummy variable through regression analysis. Second, we recorded the number of provinces an individual has served in, as either Governor or CPC Provincial Committee Secretary. This, similar to central connection, captures the extent of their personal connections and administrative experience. We thus identified a variable overlooked by others such as Li and Zhou (2005) and Chen *et al*. (2005).

Educational attainment is assessed through a fourfold classification. *Cadres* were categorised in terms of whether their highest educational qualification was a PhD, master’s degree, a first degree or a high school graduation certificate or below. Levels were recorded for when each individual attained their first tier three position and each subsequent tenure. Similar to central connection, educational attainment enters the regression as a binary variable (undergraduate and above=1, lower=0). Data on the educational attainment of 51 leaders was missing. However, it is unlikely that a provincial leader with higher education would omit those details from their resume. Alternatively, it is probable that those leaders had minimal formal education. Analysis strengthened this hypothesis. The oldest of these people is Liu Tianfu, born October 1908, and the youngest Song Xiangrui, born October 1939. All were born and obtained maturity during the civil war or very shortly afterwards, when receiving higher education was unusual. We, therefore, classified them as high school graduates and below. We then compared the educational attainment of leaders whose tenure started before 1st January 1983 with those commencing on/after 1st January 1983 (see table 5). This analysis suggested that educational attainment of the officials in the second sample exceeded substantially the first cohort. These findings might also be interpreted as reflexive of transitions from revolutionary *cadres* to party technocrats (Lee, 1991), given the rough proximity of our cut-off date to the start of reform processes.

**Insert table 5 here.**

## Analysis

We explore connections between our explanatory factors and both promotion definitions. Our dependent variable is the turnover of provincial leaders, which is categorical or, more specifically, ordinal. Our dataset is panel data in nature, although we wouldn’t be able to specify a categorical panel model; the dataset is heavily unbalanced, because data about characteristics of specific leaders were collected for different years. Neither should a time-series framework be used, as individuals seldom spend more than a few years in senior provincial positions. Geographical categorization of our data implies relevance for a spatial model; however severe limitations concerning spatial categorical modeling, and the related econometric theory, mean that we eschew this approach. Nevertheless, spatial effects can be incorporated through specification of regional GDP growth rates as an explanatory variable. With regard to the overall analysis, there were another two crucial technical issues.

First, each category of explanatory variables included multiple measures, some of which are highly correlated, for example growth and lagged growth. This matters, because such multicollinearity causes estimation problems and the consequential failure of the estimation algorithm. Thus, we first ran a separate linear regression of the independent variables on the dependent variable, examined the VIF (Variance Inflation Factor) and only considered possible combinations of explanatory variables with a VIF less than 10.

Second, choice of the most appropriate categorical data model. Scholars such as Li and Zhou (2005) and Chen *et al.* (2005) applied ordinal regressions, however ordinal models are based on the parallel lines assumption. We were, therefore, obliged to undertake a full-likelihood ratio test on our dataset to compare the fitted ordinal model to a model with varying slope parameters, and found that the parallel lines assumption failed to hold. To resolve this problem, we could split the ordinal dependent variable into dichotomies and run binomial logistic regressions on each of these cumulative dichotomies, but that specification would not be parsimonious and the results would present interpretation difficulties. We decided, therefore, to specify a more parsimonious binary logistic model, with 1 representing promotion and 0 otherwise.

The binary logistic model predicts the probability of success given the set of explanatory variables. The model takes the following format:

where is the predicted odds ratio, is the predicted probability of the event of promotion, which is coded as ; is the matrix of explanatory variables with the first column being , and the vectors of coefficients.

### Promotion: Official administrative rankings

Promotion is specified exclusively as elevation to tiers one and two.[[3]](#footnote-2) After removing those with no economic growth measure and those having tier two central connection, 450 cases remained. Using this definition, 63 (14%) were promoted, 250 (55.6%) re­mained at tier three and 137 (30.4%) were retired or demoted.

Our regression analysis used five models to explain promotion from the provincial leadership. Each model is adequate, in the sense that the Hosmer-Lemeshow tests don’t reject. Because an important objective is to establish whether there is a causal relationship between economic performance and promotion, in the first three models the explanatory variables are restricted to economic growth indicators. The first model is confined to the provincial GDP growth measure. The second model extends the first model by including the current leader’s regional growth measure, both the provincial and regional growth measures of the predecessor(s) and lagged provincial per capita GDP. The third model incorporates possible international shocks by including the top five international trading partners’ corresponding per capita GDP growth rates.[[4]](#footnote-3)



**Insert table 6 here.**

The results indicate that, except for lagged per capita GDP, which is used to capture existing levels of each province’s economic development (pre-existing prosperity), all economic growth related variables are insignificant. Note that, apart from the provincial, regional, international economic growth rates during the tenure of the provincial leader, we examined the lagged three, six and twelve month economic growth rates. However, we dropped them from the tabulation as we found their coefficients were statistically insignificant. The calculation of these growth rates was the same as for those of a hypothetical provincial leader whose tenure was shifted backward by three, six and twelve months respectively.

We also examined non-linear interactions among different economic growth rates, for example ratios of the provincial economic growth rate plus 1 over the national economic growth rate plus 1. It is impossible to exhaust all non-linear interactions of growth rates, however we found that the economic growth rates and the non-linear interactions we attempted to include were all associated with statistically insignificant coefficients, and that there were no statistically significant reductions of the ‘-2 Log Likelihood’ by including them. These results were, therefore, omitted from the tabulation. The details are available from the authors upon request.

Next, we tried to include most of the explanatory variables in one regression, provided that the VIF would permit, and reported this configuration in the fourth model. We found that South Korea’s per capita GDP growth rate appeared to have a significant impact on the odds of promoting to the national leadership at the 5% level. However, this raises a question - why South Korea? South Korea has not been China’s largest trading partner. Moreover, such benchmarking would only make sense if the provincial economic growth rate matters first; on the contrary, the provincial economic growth rate itself is insignificant. Our results imply, therefore, that this significant relationship is spurious. Indeed, we found such significance disappeared after we removed some of the insignificant variables. We also reported the Cox & Snell and Nagelkerke .[[5]](#footnote-4)

Model five contains the explanatory variables which are statistically significant at the 5% level. Clearly, the fourth model can be interpreted as extending the fifth model by adding ten explanatory variables. It has reduced the ‘-2 Log Likelihood’ by 11.265. However, such a reduction would be statistically insignificant, considering that ten variables were added to the equation.

We, therefore, established the fifth model as being the parsimonious model, adequate for determining the key contributing factors to the odds of promotion. In summary, it is suggested that age, whether tenures ended after 1982, the interaction of the

age dummy and post-1982 indicator, central connection, serving more than one tenure in a specific provincial role and the number of provinces served in as a leader all significantly affect the odds of promotion to the national leadership.

Overall, our findings imply that promotion to tiers one and two from the provincial leadership is not much affected by performance as measured through the economic growth of the province. However, having leadership positions in the more affluent provinces appears to be an important positive factor in promotion to the national leadership, signaled by a significant and positively estimated coefficient for lagged provincial per capital GDP – the measure for initial income level. Had the economic growth rate been positive and statistically significant, a positive and statistically significant lagged per capita GDP would imply a promotion rule based on economic growth, given that it would be more difficult for a more developed economy to grow, as indicated by the economic convergence literature (*e.g.* Quah, 1996). However, given the insignificant impact of the provincial growth rate on the odds of promotion, the significant and positive impact from initial income level may suggest that certain individuals possess the initial political leverage to secure postings in the more affluent areas rather than the poorer and less developed areas. Part of this political leverage can be measured by the depth and width of their political connections, specifically the central connection indicator and the total number of provinces served in as a leader by the end of the tenure. The first variable measures the connection with the top (depth), the second variable measures the broadness of the connection at the provincial level (width), both of which have statistically significant impacts on promotion; although such political leverage would also be related to qualities (*e.g.* family background) that would be very difficult to quantify.

Interpretation of the post-1982 indicator might not be straightforward. Superficially, it seems that cases in the post-1982 sub-sample are less likely to be promoted. This outcome might, however, reflect the fact that some officials have not yet realized their career potential as a consequence of relative youth (see table 7). Most officials are promoted when aged between 56 and 65, while many cases in the post-1982 sample were under 55 years old. Nevertheless, we included a post-82 indicator as an explanatory variable since it is reflexive of an important change in the age composition of the provincial leadership. We found that education has no significant impact on promotion, which is consistent with the findings in Li and Zhou (2005). Furthermore, an independent T test was conducted to test the difference in the average levels of education between the cohort who were promoted to the national leadership and the cohort who weren’t; we found that there were no significant differences in levels of education.

**Insert table 7 here.**

### Promotion: Political-governmental power relationships

Here, we also interpret moving from Governor to CPC Provincial Committee Secretary and from the provincial leadership to ministerial positions as promotion. We, therefore, specified promotion criteria more reflective of contemporary power-relationships. Apart from removing cases with no valid end of tenure GDP, and those with central connections at tier two and above, we eliminated cases with central connection at tier three (see above), leaving 396 cases in total. Otherwise, we retained the same explanatory variables and our estimation results are reported in table eight.

**Insert table 8 here**

For the same reason as in the previous case, concerning the official administrative ranking, we base our interpretation primarily on the fifth model. Comparison with findings from the previous case (see tables 6 and 8), implies some shifts in promotion explanations. Specifically, coefficients for the provincial economic growth rate as well as for its initial income level (measured through lagged per capita GDP) are positive and statistically significant (Model 5). Our findings imply, therefore, that strong performance through good economic growth records facilitates promotion. Similarly, these findings suggest that, assuming similar growth records, possession of leadership roles in the more affluent provinces facilitates promotion (Model 5).

These results for provincial and lagged per capita GDP growth imply, therefore, a possible interpretation that aligns our findings with the economic convergence literature (*e.g.* Quah, 1996). As indicated above, this scholarship acknowledges that achieving economic growth is more difficult in a relatively affluent province and so equaling growth rates from the poorer areas means that leaders in those more prosperous provinces can be said to have outperformed their colleagues. In contrast with the first case, interaction between the age and post-1982 indicators, central connection, whether the leader served for more than one tenure in a specific provincial job and the number of provinces served in are insignificant (Model 4). In particular, findings about central connection are reflective of the fact that we have removed central connection at tier three and above, leaving only those with central connection at tier four. As for the insignificance concerning the Post 82 indicatorAge65 indicator, it can be seen (see table 9) that the age composition of the post-1982 cases is not very different from the overall sample.

**Insert table 9 here.**

## Conclusions

We have evaluated whether promotion of provincial Chinese leaders can be explained through their economic growth records or several alternative factors. This emphasis means that our study contributes to wider debates about relationships between promotion and performance (see Alonso and Lewis, 2001; DeVaro, 2006) and deliberations about the extent to which Chinese governance is reflective of the emergence of the pronounced performance agenda (McLaughlin *et al*., 2003) observed across the public sector in a wide range of countries. Here, we utilized two sets of promotion criteria, official administrative rankings and an alternative definition more closely equated to actual politico-governmental power relationships.

Concerning our first definition, promotion was facilitated through factors such as serving as a provincial leader beyond one five-year tenure in a specific leadership role and or in leadership roles in multiple provinces; and age. Alternatively, promotion wasn’t facilitated through good economic growth records; although political leverage, as measured by the lagged per capita GDP of the province and central connection appeared to have an impact.

We identified, however, a positive and significant relationship between economic growth and promotion through the alternative promotion definition (see table 8). This is interesting given the strategic authority exercised both directly from national government and indirectly through Communist Party structures, and supplies evidence to reinforce market and performance-driven interpretations of Chinese governance. There is, therefore, support for the interpretation that central government exercised its substantive control to reward bureaucrats with good economic records. Particularly, these findings are important in terms of understanding organizational cultures amongst the Chinese bureaucracy. It suggests that whilst promotion from Governors to CPC Provincial Committee Secretaries, and from the provincial leadership to ministerial positions, might be interpreted through market cultures reflective of adherence to values appreciative of a competitive ethos; promotion to higher levels appears to reflect a hierarchical and internally-orientated organizational culture. Factors such as central connection, age, whether the leader has served more than one tenure in a specific provincial job and the number of provincial leadership tenures being important. Promotion can, therefore, be equated more with characteristics reflexive of status, and or seniority, rather than achievement.

Our analysis might, therefore, be interpreted to signify emergence of dual organizational cultures as expressed through bureaucratic promotions. With advancement to the less important levels reflective of market cultures, but promotion to more senior roles indicative of hierarchical and traditional values. We suggest, therefore, that after approximately 40 years of economic reforms, the senior bureaucracy seems reluctant to allow performance at provincial leadership level to affect directly composition of tiers one and two; insulating leadership selection for the upper echelons of the government and the CPC from market cultures, performance considerations and, specifically, the successful implementation of economic reform agendas.

Our findings about this dual organization culture concerning promotion raise questions about whether such cultural distinctions are sustainable or whether a convergence will occur at some stage. Of potential significance are contrasting organizational arrangements for promotion at different levels in the hierarchy. For example, the upper echelons are selected through three conferences, particularly the National People’s Congress (NPC), which has the supreme authority. The candidates for most senior positions being proposed by the presidium of the NPC, a temporary organization functioning during the duration of the NPC. Alternatively, ministerial positions are nominated by the Premier of the State Council, and approved by the NPC. When the NPC is closed, the NPC Standing Committee has the authority to appoint and dismiss ministers. CPC Provincial Committee Secretaries are usually selected by the Organization Department of the CPC Central Committee, or sometimes recommended by the Chinese national leadership, screened by the Central Political Bureau and its standing committee, and appointed by the central government.

Such institutional variations for selections at contrasting stages in the structure might, however, imply that erosion of this dual culture might have to await institutional reform and establishment of more uniform procedures. Alternatively, eventual promotion of individuals from CPC Provincial Committee Secretaries and ministerial positions with strong economic growth records, and perhaps acute concerns with such performance, might erode this dual culture.

Central is the issue of whether, despite its focus on economic growth, the system is reluctant to allow such performance criteria to determine elevation to the most senior levels, where the real power resides. This might also be considered within the emergence of a more nationalistic and authoritarian atmosphere (Lagerkvist, 2014) under Xi Jingpin since 2012. The core questions are whether this new authoritarianism might marginalize technocratic expertise, or if aspirations towards a more substantive global role might eventually facilitate promotion to the upper echelons of those with the stronger economic growth records. Economic strength being (of course) a key determinant of international influence and authority.

This discussion implies future research agendas through investigating changes to this dual preferment culture. Options might include interview-based projects to capture shifting attitudes and quantitative studies of promotion across a narrower range of posts using subsequent, and perhaps more detailed, data-sets. The focus might also be on whether it was possible to detect movement in organizational culture through a more fine-tuned and micro-analysis of selections of a smaller cohort of *cadres* occupying a more distinctive position in the hierarchy.

Alternatively, our analysis might be extended through application to a wider group of lower-level *cadres* and orpromotions of leaders of state-owned enterprises (SOEs), particularly with regard to the fact that the career trajectories of these individuals often incorporate similar roles in party and or governmental structures. This reality suggests some significant research questions, for example – does the economic performance of the SOE under their tenure affect their promotion prospects? Are the successful achievement of other goals, such as providing employment, more important for promotion?

Our approach might also be extended through use of much more complex datasets to consider promotion of certain political cliques, such as *princelings*, namely national leaders with family connections to previous members of that same elite. Prominent contemporary examples of Chinese *princelings* include current General Secretary, President and Chair of the Central Military Commission Xi Jingpin, who is the son of Xi Zhongxun, whose senior positions included Vice-Chair of the NPC Standing Committee; and Wang Qishan (the current Vice-President of China), who is the son-in-law of Tao Yilin (a former Vice-Premier). There are research questions concerning explanations for their promotion to the national leadership and how such explanations vary with those identified for the wider cohort of provincial leaders. Scholars could consider whether, or to what extent, those *princelings,* once established in provincial leadership roles, have an enhanced chance of promotion to the national leadership.

There is also potential to apply our models to other countries, either through promotion of governmental officials or, more specifically, to political systems with similar relationships between a dominant political party and governmental structures, and where electoral choice is heavily constrained.

## References

Afonso, A., Schuknecht, L. and Tanzi, V. (2005) Public sector efficiency: an international comparison. *Public Choice* 123(3-4)**:** 321-347.

Alonso, P. and Lewis, G. (2001) Public Service Motivation and Job Performance: *Evidence from the Federal Sector.* *The American Review of Public Administration* 31(4): 363-380.

Bale, M. and Dale, T. (1998) Public Sector Reform in New Zealand and its Relevance to Developing Countries. *The World Bank Research Observer* 13(1): 103-121.

Baron, J., Davis-Blake, A. and Bielby, W. (1986) The Structure of Opportunity: How Promotion Ladders Vary Within and Among Organizations. *Administrative Science Quarterly* 31(2): 248-273.

Blanchard, O. and Shleifer, A. (2001) Federalism With and Without Political Centralization: China Versus Russia. *IMF Staff Papers* 48(S1):171-179.

Blau, F. and DeVaro, J. (2007) New Evidence on Gender Differences in Promotion Rates: An Empirical Analysis of a Sample of New Hires, *Industrial Relations.* 46(3): 511-550.

Blau, P. and Scott, R. (1962) *Formal Organizations: A Comparative Approach.* San Francisco: Chandler.

Bo, Z. (1996) Economic performance and political mobility: Chinese provincial leaders, *Journal of Contemporary China.*5(12):135-154.

Booth, A., Francesconi, M. and Frank, J. (2003) A Sticky Floors Model of Promotion, Pay and Gender, *European Economic Review.* 47(2): 295-322.

Brown, D., Earle, J. and Gehlbach, S. (2009) Helping Hand or Grabbing Hand? State Bureaucracy and Privatization Effectiveness, *American Political Science Review* 103(2): 264-283.

Brown, K. (2004) Human Resource Management in the Public Sector. *Public Management Review* 6(3): 303-309.

Cameron, K. and Freeman, S. (1991) Culture, Congruence, Strength and Type: Relationships to Effectiveness, *Research in Organizational Change and Development* 5: 23-58.

Chen, Y., Li, H. and Zhou, L-A. (2005) Relative performance evaluation and the turnover of provincial leaders in China. *Economic Letters* 88(3): 421-425.

Chien, S. and Gordon, I. (2008) Territorial Competition in China and the West. *Regional Studies* 42(1)**:** 31-49.

China State Council (2007), *Northeast Revitalization Plan*. Beijing: China State Council.

Collins, N. and Cottey, A. (2012) *Understanding Chinese Politics.* Manchester: Manchester University Press.

DeVaro, J. (2006) Strategic Promotion Tournaments and Worker Performance, *Strategic Management Journal.* 27(8): 721-740.

Edin M. (2003) Remaking the Communist Party-State: The Cadre Responsibility System at the Local Level in China. *China: An International Journal* 1(1): 1-15.

Fairburn, J. and Malcomson, J. (2001) Performance, Promotion and the Peter Principle, *The Review of Economic Studies.* 68(1,1): 45-66.

Fan, C. (2006) China’s Eleventh Five-Year Plan (2006-2010): From “Getting Rich First” to “Common Prosperity”. *Eurasian Geography and Economics* 47(6):708-723.

Ferrero, M. (2001) Political exchange in mass party regimes and the transition from socialism. *Economic Systems* 25(4): 365-379.

Guo, G. (2007) Retrospective Economic Accountability Under Authoritarianism: Evidence from China. *Political Research Quarterly* 60(3): 378-390.

Garcia-Izquierdo, A., Moscoso, S. and Ramos-Villagrasa, P. (2012) Reactions to the Fairness of Promotion Methods: Procedural Justice and Job Satisfaction, *International Journal of Selection and Assessment.* 20(4): 394-403.

Gouldner, A. (1957) Cosmopolitans and Locals: Toward an Analysis of Latent Social Roles.1, *Administrative Science Quarterly.* 2(3): 281-306.

Groot, W. and Van Den Brink, H. (1996) Glass Ceilings or Dead Ends: Job Promotion of Men and Women Compared, *Economic Letters.* 53(2): 221-226.

Halaby, C. (1978) Bureaucratic Promotion Criteria. *Administrative Science Quarterly* 23(3): 466-484.

Horn, M. (1995) *The Political Economy of Public Administration.* Cambridge: Cambridge University Press.

Kalleberg, A. and Van Buren, M. (1996) Is Bigger Better? Explaining the Relationship Between Organization Size and Job Rewards. *American Sociological Review* 61(1): 47-66.

Kim, Y. (2002) Executive Social Capital and its Impacts on Job Promotion. *Academy of Management Proceedings* 1:(J1-J6).

Lagerkvist, J. (2014) The Legacy of the 1989 Beijing Massacre: Establishing Neo-Authoritarian Rule, Silencing Civil Society. *International Journal of China Studies* 5(2): 349-369.

Landry. P. (2003) The Political Management of Mayors in Post-Deng China. *The Copenhagen Journal of Asian Studies* 17**:** 31-58.

Lau, C-M., Tse, D. and Zhou, N. (2002) Institutional Forces and Organizational Culture in China: Effects on Change Schemas, Firm Commitment and Job Satisfaction. *Journal of International Business Studies* 33(3):533-550.

Lee, H. (1991) *From Revolutionary Cadres to Party Technocrats in Socialist China.* Berkeley and Los Angeles: University of California Press.

Lee, S. (2017) An Institutional Analysis of Xi Jinping’s Centralization of Power. *Journal of Contemporary China* 26(105): 325-336.

Lemons, M. and Jones, C. (2001) Procedural Justice in Promotion Decisions: Using Perceptions of Fairness to Build Employee Commitment. *Journal of Managerial Psychology* 16(4): 268-281.

Li, H. and Zhou, L-A (2005) Political turnover and economic performance: the incentive role of personnel control in China. *Journal of Public Economics* 89(9-10): 1743-1762.

Li, Y. and Wei, D. (2010) The spatial-temporal hierarchy of regional inequality in China. *Applied Geography* 30(3)**:** 303-316.

Lin, C. (2008) Demystifying the Chameleonic Nature of Chinese Leadership. *Journal of Leadership and Organizational Studies* 14(4): 303-321.

Manion, M. (1985) The Cadre Management System, Post-Mao: The Appointment, Promotion, Transfer and Removal of Party and State Leaders. *The China Quarterly* 102: 203-233.

McLaughlin, K., Osborne, P. and Ferlie, E. (eds.) (2002) *New Public Management.* London: Routledge.

Nee, V. (1992) Organizational Dynamics of Market Transition: Hybrid Forms, Property Rights, and Mixed Economy in China. *Administrative Science Quarterly* 37(1):1-27.

O’Reilly, C., Chatman, J. and Caldwell, D. (1991) People and Organizational Culture: A Profile Comparison Approach to Assessing Person-Organization Fit. *Academy of Management Journal* 34(3):487-516.

Pudney, S. and Shields, M. (2000) Gender, Pay, Race and Promotion in the British Nursing Profession: Estimation of a Generalized Ordered Probit Model. *Journal of Applied Econometrics* 15(4): 367-399.

Qi, Y., Ma, L., Zhang, H. and Li, H. (2008) Translating a Global Issue into Local Priority: China’s Local Government Response to Climate Change. *The Journal of Environment and Development* 17(4): 379-400.

Quah, D. (1996) Empirics for economic growth and convergence. *European Economic* *Review* 40(6): 1353-1375.

Rokeach, M. (1973)*The Nature of Human Values.* New York: Free Press.

Ruderman, M., Ohlott, P. and Kram, K. (1995) Promotion Decisions as a Diversity Practice. *Journal of Management Development* 14(2): 6-23.

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

Spilerman, S. and Lunde, T. (1991) Features of Educational Attainment and Job Promotion Prospects. *American Journal of Sociology* 97(3): 689-720.

Su, F., Tao, R., Xi, L. and Li, M. (2012) Local Officials’ Incentives and China’s Economic Growth: Tournament Thesis Reexamined and Alternative Explanatory Framework. *China and World Economy* 20(4):1-18.

Tsui, K. and Wang, Y. (2004) Between Separate Stoves and a Single Menu: Fiscal Decentralization in China. *The China Quarterly* 177:71-90.

Tsui, A., Wang, H. and Xin, K. (2006) Organizational Culture in China: An Analysis of Culture Dimensions and Culture Types. *Management and Organization Review* 2(3): 345-376.

Walder, A. (2003) Elite Opportunity in Transitional Economies. *American Sociological Review* 68(6)**:** 899-916.

Wang, S. (1981) The Problem of Cadres in China. *China Report,* May/June: 3-12.

Weber, M. (1947) *The Theory of Social and Economic Organization.* A. Henderson and T. Parsons (eds.) Oxford University Press: New York.

Wei, Y. (2002) Beyond the Sunan Model: Trajectory and Underlying Factors of Development in Kunshan, China. *Environment and Planning A* 34(10): 1725-1747.

Xu, C. (2011) The Fundamental Institutions of China’s Reforms and Development. *Journal of Economic Literature* 49(4): 1076-1151.

Yeung, H. (2000) Local politics and foreign ventures in China’s transitional economy: the political economy of Singaporean investments in China *Political Geography* 19(7)**:** 809-840.

Zhang, Y. (2014) Testing Social Ties against Merits: the Political Career of Provincial Party Chiefs in China, 1990-2007. *Journal of Chinese Political Science* 19(3):249-265.

Zhang, Y. and Wan, G. (2005) China’s Business Cycles: Perspectives from an AD-AS Model. *Asian Economic Journal* 19(4): 445-469.

Zheng, Y. (2009) Can the Communist Party Sustain its Rule in China?’, in K. Lee, J-H Kim, and W. Woo (eds.), *Power and Sustainability of the Chinese State.* London: Routledge, 186-20

1. <http://cpc.people.com.cn/GB/64162/71380/71387/71591/4854975.html> [↑](#footnote-ref-1)
2. [↑](#endnote-ref-1)
3. Membership of the Central Advisory Commission, although at tier two could possibly be regarded as an honorary position and classified as retirement. However, historically its members possessed great political leverage, a legacy which justifies classifying such cases as promotion. The Commission was abolished during the leadership of Deng Xiaoping. However, since there is only one case – Duan Junyi - in the entire sample, classifying this case as promotion or not does not impact the results. Here, we classified this case as promotion to reflect the administrative ranking. [↑](#footnote-ref-2)
4. Note we explored some of the non-linear functional forms of provincial, regional,

   national and international GDP growth rates as potential economic performance measures, although we did not include the results due to insignificance of estimated coefficients. The details are available upon request. [↑](#footnote-ref-3)
5. Logistic regression does not have an equivalent to that found in OLS (ordinary least square), both Cox & Snell and Nagelkerke are pseudo , and are linked with the likelihood function. The difference between them is that Nagelkerke is corrected by the upper bound of Cox & Snell to ensure the upper bound is 1.0 as in the linear regression. [↑](#footnote-ref-4)