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**DIFFUSION AND ASSIMILATION OF GOVERNMENT
MICROBLOGGING: Evidence from Chinese Cities**

Liang Ma

School of Humanities, Economics, and Law, Northwestern Polytechnical University,
China

Nanyang Centre for Public Administration, Nanyang Technological University,
Singapore

Email: ken0821@gmail.com

Homepage: <http://liangma.weebly.com/>

Abstract

Internationally, the public sector is adopting social media applications (e.g. Twitter and social networking services) to harness cutting-edge information technology developments, but we know little about what drives the diffusion of these applications. In this paper, I adapt the Berry-Berry policy and innovation diffusion model to explain the diffusion and assimilation of government microblogging, supplementing its four dimensions (learning, competition, upper-tier mandate and public pressure) with organizational resources and capacity. Data on 282 prefecture-level cities in China are employed to test several theoretical hypotheses empirically. Horizontal competition is found to be significantly and positively associated with the assimilation of government microblogging, although the other three dimensions are found not to be its key antecedents. Consistent with the study's hypotheses, the results support the significantly positive effects of fiscal resources and IT capacity. Municipal wealth, size and administrative ranking are also positively and significantly correlated with the number of government microblogs.

Key words

Microblogging, innovation diffusion, e-government, municipalities, China.

INTRODUCTION

At the cutting edge of information technology (IT) development, Web 2.0 technologies and social media applications (e.g. Twitter, social networking services [SNS] and so forth) are enabling netizens and organizations to communicate and collaborate freely, openly and actively (McAfee, 2009). The rapid development of social media applications is also helping governments to better communicate with their peers and citizens (Reddick and Wigand, 2010; Hrdinová *et al.*, 2010), and many scholars and government officials have posited Government 2.0 as the new shape of government (Eggers, 2007). The public sector in numerous countries and regions has adopted and leveraged these technologies to improve public service quality and elicit public participation, and government agencies in China are pioneers in this regard (Thomler, 2011). Government agencies at all levels throughout the country have launched official microblogs in the past two years (Ma, forthcoming). As of the end of 2011, government agencies and civil servants had launched 50,561 official microblogs on China's four dominant microblogging platforms, a 776.58 per cent increase over the beginning of the year, according to the *2011 China Government Microblog Assessment Report* released on 8 February 2012 by the E-Government Research Center (2012) at the China National School of Administration.¹ If 2010 can be regarded as Year One of the microblogging era, then 2011 is the first year of the government microblogging era in China. The unprecedented interest in and enthusiasm for microblogging amongst Chinese government agencies raises an

interesting research question. What is driving the rapid diffusion and widespread assimilation of government microblogging in China?

As a technology that is new to public organizations, the spread of microblogging lends itself to investigation from the perspective of innovation adoption and diffusion (Rogers, 2003). However, because microblogging and other social media applications are new to the Chinese government, their diffusion has yet to be studied systematically, with two notable exceptions. Mergel analyzed the diffusion of social media applications amongst federal departments and agencies in the United States based on interview data, and found both upper-tier mandates and peer learning to be driving their spread (Mergel, 2011). Ma examined the diffusion of microblogging across Chinese municipal police bureaus, and his findings partially support the significant effects of government size, the Internet penetration rate, regional diffusion effects and upper-tier pressure (Ma, forthcoming).

In this paper, I further investigate the assimilation of government microblogging, which is defined as the process of deploying this new technology by organizational parties and members after its initial acquisition. Organizations may adopt an innovation but not fully deploy it, and it is thus essential to examine the post-adoption behavior of organizations and the assimilation of innovation by their members (Fichman and Kemerer, 1999). One of the paper's major contributions is its development of a comprehensive model to test diverse explanations of government microblogging diffusion. The theories of organizational IT innovation adoption (Jeyaraj *et al.*, 2006) and policy diffusion (Berry and Berry, 1999; Berry and Berry,

2007; Lee *et al.*, 2011; Walker *et al.*, 2011) are synthesized into a conceptual framework in which learning, competition, public pressure, upper-tier mandate, and organizational resources and capacity are argued to be positively associated with such diffusion. Data on more than 280 prefecture-level cities in China are employed to test five theoretical hypotheses empirically, and the findings partially support the theoretical framework. I also compare the findings with prior studies of e-government and other IT innovations, revealing government microblogging to have both similar and distinct attributes.

As this is the first empirical study of the diffusion and assimilation of microblogging amongst local governments, its findings have both theoretical and practical implications. The results extend and confirm the theoretical arguments of policy and innovation diffusion, in that the spread of government microblogging is driven by similar antecedents to other technology and policy innovations (Berry and Berry, 1999; Berry and Berry, 2007). I also find distinct explanations for government microblogging diffusion, thus offering a foundation for its differentiation and comparison in future examinations. My empirical findings also have policy implications for governments that wish to advance the spread of microblogging and other social media technologies across the public sector.

The remainder of the paper is structured as follows. I first introduce the theories of innovation adoption and diffusion and propose several hypotheses deserving of empirical testing. I then report the data and methods employed in the study, followed by a discussion of its primary findings. After presentation of the study's theoretical

contributions and policy implications, the paper concludes with a discussion of its limitations and of future research avenues.

THEORY

An innovation is something new to its adopters (herein public organizations), no matter how many of their peers have previously adopted it (Walker, 1969). Innovation diffusion is the process by which an innovation spreads over time across the members of a social system (e.g. organizations or jurisdictions) (Rogers, 2003). Organizations may adopt an innovation symbolically rather than using it in reality, thus resulting in an adoption-implementation gap. Innovation assimilation is the actual use and deployment of an innovation by organizational members after its adoption (Fichman and Kemerer, 1999). Going beyond the mainstream innovation adoption research paradigm to analyze the assimilation of an innovation is crucial, because it is the actual deployment of an innovation that may affect organizational performance (Anderson *et al.*, 2004).

Many theories have been developed to further understanding of innovation adoption, and it is vital that we also integrate diverse theoretical perspectives to explain fully what drives innovation diffusion and assimilation (Crossan and Apaydin, 2010). Berry and Berry (2007) synthesized the literature on policy and innovation diffusion across diverse disciplines and developed a theoretical model that comprehensively explains the diffusion of government innovation. Their model comprises four dimensions, namely, learning, competition, mandate or norms, and

citizen pressure (Berry and Berry, 2007). Motivation and pressure deriving from peers, competitors, upper-tier authorities and jurisdictional citizens drive governments to adopt specific policies and innovations. Interestingly, the global explanation of policy and innovation diffusion coincides with the upward, downward and outward outreach of the Moore government strategic management framework (Moore, 1997). The Berry-Berry model has received extensive support from recent empirical studies on the development and diffusion of cross-country e-government (Lee *et al.*, 2011) and British local government innovations (Walker *et al.*, 2011). Thus, I believe it is appropriate to employ the model to explain the diffusion and assimilation of government microblogging.

I adapt the Berry-Berry framework to propose theoretical hypotheses to explain such diffusion and assimilation across government agencies. All four of its dimensions concern the external motivational bases of policy and innovation diffusion, thus failing to incorporate the underlying intra-jurisdictional characteristics that transform motivation and pressure into adoption action. Mohr argued that organizational innovation is a multiplicative function of motivations, resources and barriers (Mohr, 1969). Although motivation and a propensity to innovate are crucial for adoption decision-making, the resources to overcome barriers are also important antecedents (Berry, 1994). Accordingly, I supplement the Berry-Berry framework with intra-governmental attributes, specifically organizational resources and capacity, to better understand the diffusion of government microblogging. Meta-analysis has identified Organizational resources and capacity, particularly IT infrastructure and

large-scale investment, as key antecedents to organizational IT innovation adoption (Jeyaraj *et al.*, 2006). Evidence from South Korea also suggests that management capacity has positive effects on government innovation (Kim and Lee, 2009). In sum, to explain the diffusion and assimilation of government microblogging in fully, it is essential that we incorporate organizational resources and capacity into the theoretical model.

1) *Competition.* Governments compete with one another to attract the flow of financial and human capital necessary to fuel economic growth (Dobbin *et al.*, 2007). The interdependence of governments may drive the convergence of policy and practice, which is the key determinant of policy and innovation diffusion (Berry and Baybeck, 2005). When neighboring or socioeconomically similar peers have adopted specific innovations, governments may be inclined to adopt these or similar practices to regain advantages or mitigate disadvantages (Berry and Berry, 1999; Berry and Berry, 2007). In addition to intergovernmental competition in the economic arena, this study also examines the career tournament amongst government officials from the political perspective. China's authoritarian party-state system grants central and upper-tier party committees the personnel management authority to appoint local officials, and thus the career tournament amongst local governments within a specific jurisdiction may trigger intense political and economic competition (Bo, 2002; Landry, 2008). Accordingly, local government officials may treat their counterparts in the same jurisdiction as competitors and threats to career advancement (Li and Zhou, 2005). With regard to the adoption decision, I employ the average number of

microblogs launched by other cities within the jurisdiction (excluding the focal city) to capture intergovernmental competition effects.

H1: The average number of government microblogs launched in adjacent cities within a jurisdiction is positively correlated with the number of government microblogs launched in the focal city.

2) *Learning*. Social learning is a key process by which governments adopt policy and innovation, because it reduces the extraordinary risk and cost of innovation (Berry and Berry, 2007), and learning and imitation are key drivers of international policy transfer and convergence (Dobbin *et al.*, 2007). Social learning is distinct from economic competition, and disentangling these two dimensions is important for theoretical development (Boehmke and Witmer, 2004). Economic competition is restricted to jurisdictions' adjacent counterparts, whereas IT developments allow governments to overcome geographic limitations to learn from many sources other than their peers (Rogers, 2003). Prior studies employ the number of international organizations in which a country participates to capture its national government's potential to learn from abroad (Lee *et al.*, 2011). Successful practices generate followers and spur spread, and governments in developing countries and regions are keen to learn from their developed counterparts. China is no exception, with its governments eager to learn from more developed countries and regions internationally, particularly the United States and Hong Kong (Chien and Ho, 2011; Christensen *et al.*, 2008). International sister city agreements facilitate municipal cooperation and exchange in a variety of fields, with participants benefitting from the learning and

imitation of their twinned counterparts (Cremer *et al.*, 2001). Similar to previous studies, I employ the number of international sister cities to gauge the learning orientation and channels of municipal governments.

H2: The number of international sister city relationships enjoyed by a municipality is positively correlated with the number of government microblogs launched by that municipality.

3) *Vertical mandate*. Upper-tier mandates or political norms play a key role in shaping a government's propensity to adopt specific policies and practices (Berry and Berry, 2007). Coercion from international organizations and upper-tier governments may push governments lower down the scale to adopt the innovations these power holders advocate (Dobbin *et al.*, 2007). I posit that vertical mandates are important for policy and innovation diffusion in China, as the country's authoritarian unitary system renders lower-level governments heavily dependent on the policies and grants of upper-tier authorities (Chung, 2000). Satisfying the requirements of upper-level governments may also help government officials to win the cut-throat career tournament in which they are engaged (Li and Zhou, 2005). If upper-tier authorities advocate, support or adopt social media applications, then lower-tier governments are likely to introduce microblogging quickly. I employ the number of microblogs launched by provincial government departments to measure the degree of the top-down mandate.

H3: The number of microblogs launched by provincial government departments is positively correlated with the number of government microblogs launched by the

cities within that province.

4) *Public pressure*. When particular policies have been adopted in neighboring jurisdictions, informed citizens may demand that their government immediately adopt similar policies if they believe them to be beneficial to their welfare (Berry and Berry, 2007). Public pressure plays a key role in policy and innovation diffusion, and citizens may push governments to adopt the innovations they prefer. Furthermore, the network externality effect of IT applications requires a vast Internet population (Katz and Shapiro, 1986), and a large percentage of highly educated netizens is pivotal to the success of any social media application. Although both enterprises and individual citizens are crucial constituencies for governments, this paper focuses on the public because the majority of microbloggers are individual citizens (Ma, forthcoming). A municipality's Internet penetration rate and human capital are used to measure public pressure, as they are two of the key components of public pressure (Lee *et al.*, 2011).

H4a: The municipal Internet penetration rate is positively correlated with the number of government microblogs launched in a city.

H4b: Municipal human capital is positively correlated with the number of government microblogs launched in a city.

5) *Organizational resources and capacity*. Resources and capacity are interrelated but distinct concepts. Resources are the tangible and intangible assets available for organizational use (Barney, 1996), whereas capacity (or capabilities) refers to an organization's ability to acquire and deploy resources (Teece *et al.*, 1997). Slack resources have been identified as a key antecedent to organizational innovation

(Damanpour, 1991), and fiscal health is also reported to be positively associated with the adoption of public management innovation (Berry, 1994). Large-scale investment in IT infrastructure is crucial to the development and success of e-government and other IT applications (Jeyaraj *et al.*, 2006), and wealthy governments with abundant resources are likely to adopt IT innovations earlier (Moon and Norris, 2005). Institutional capacity has also been identified as important to e-government development (Tolbert *et al.*, 2008). Management capacity as an umbrella concept is also one of the most important drivers of government innovation (Kim and Lee, 2009). As microblogging is at the cutting edge of IT development and application, its adoption requires sufficient resources and support in addition to managerial reorientation and restructuring (Ma, forthcoming). The transformation from Government 1.0 to 2.0 is also dependent on the level of e-government development (Eggers, 2007). Here, I employ the fiscal health and performance of urban e-government to gauge a municipal government's level of resources and capacity, respectively.

H5a: Municipal fiscal health is positively correlated with the number of government microblogs launched in a city.

H5a: Municipal e-government performance is positively correlated with the number of government microblogs launched in a city.

METHODS

Sample and Data

I test the foregoing hypotheses in the context of local governments in China. China is a unitary country with a strongly authoritarian governance system and is structured into five administrative tiers. The central government coordinates 23 provinces (including Taiwan), four municipalities (Beijing, Shanghai, Tianjin and Chongqing), five autonomous regions (of which Tibet is one) and two special administrative regions (Hong Kong and Macau). Below the provinces are more than 280 prefectures and prefecture-level cities (e.g. Suzhou), followed by almost 3000 counties, county-level cities and districts. Towns and sub-districts are at the lowest administrative level, and beneath them are highly autonomous villages and communities. The country's dramatic transformation in the wake of the reform and opening-up policy launched in the late 1970s has seen the extensive delegation of authority from the central government to local governments, with governments at each level afforded the ability to make relatively more independent decisions than in the past (Chung, 2000). Local governments have adopted numerous technological and administrative innovations in the past few decades and have achieved marked improvements in public service performance (Wu *et al.*, forthcoming). Thus, local governments can be treated as independent innovation adopters in examination of their official microblogging launch behavior.

I employ data from the full population of Chinese prefecture-level cities to examine the drivers of microblogging diffusion empirically. These cities are appropriate for the current study because they provide a sufficiently large sample, exhibit a high degree of involvement in government innovation and allow reasonable comparability (Chien,

2010). Although China is also home to provincial- and county-level cities, its prefecture-level cities enjoy greater equivalence and are thus more conducive to assessment and comparison (China Association of Mayors, 2010). Policy diffusion researchers have called for studies that go beyond mainstream state-level analysis to dig more deeply into local governments, where innovations emerge and spread relatively frequently and rapidly (Berry and Berry, 2007; Zhang and Yang, 2008). Most prior studies on e-government development and the adoption and diffusion of other innovations focus on city-level governments (Moon and Norris, 2005), thus affording ease of comparison with the findings of the current study.

I obtain the government microblogging data from weibo.com (Sina), a dominant microblogging platform in China that lists all authenticated government microblogs by functional sector (e.g. police or public health) and region (province or prefecture-level city) and is updated in a timely fashion, thus enabling me to collect data on their distribution.² Although it would be ideal to collect these data by monitoring all accessible microblogging platforms, doing so is not possible.³ In any case, previous studies have reported weibo.com to be the predominant microblogging platform in China, accounting for more than half of all registered microbloggers (Ma, forthcoming). A sample survey also revealed that government agencies that launch a microblog on one platform (e.g. weibo.com) usually mirror it on another (e.g. t.qq.com [Tencent]) to encompass netizens registered on different platforms.⁴

The data on the study's independent variables come primarily from the *China City Statistical Yearbook* compiled by the National Bureau of Statistics of China (NBSC)

(2011) and from relevant statistics and reports. The data on the dependent variable were collected at the end of 2011, whereas most of the independent variables were measured at the end of 2010, the most recent year for which these data were available. Such an approach was also helpful in mitigating the reverse causality problem. There were 283 prefecture-level cities at the time of data collection, but the final sample for analysis includes 282 cities owing to missing data on Lhasa, the capital of Tibet. The conceptualization, operationalization and data sources of all variables are reported in the appendix (see Table A1).

Dependent Variable

The dependent variable is the assimilation of government microblogging at the municipal level. Different from the traditional dichotomy of innovation adoption, I employ the actual use of IT innovation as my measure of assimilation. Assimilation of a specific innovation is usually measured by the percentage of the social system or organizational members who have adopted it (Rogers, 2003; Fichman and Kemerer, 1999; Zhang and Yang, 2008). The total number of microblogs launched by municipal government agencies and approved by the microblogging service provider is employed to measure the assimilation of government microblogging in each city. The underlying assumption of my measurement approach is that the potential population of microblogging adopters in each city is equivalent and comparable because of China's unitary administrative system and the similar structuring of local governments nationwide.

Independent Variables

1) *Competition*. As previously noted, cities may be inclined to compete with their counterparts in the same jurisdiction to win the economic and political competition between them. I employ the average number of microblogs launched by other cities in the province (excluding the focal city) to measure the effects of intergovernmental competition.⁵ Although some scholars suggest employing geographic information systems or spatial models to examine inter-jurisdictional competition (Berry and Baybeck, 2005), the methods used herein dominate the mainstream research (Boehmke and Witmer, 2004; Berry and Berry, 2007). A recent test of the Berry-Berry model in the global e-government development arena applied the same measure (Lee *et al.*, 2011). Hence, I believe my measure satisfactorily captures the competition effects of government microblogging diffusion.

2) *Learning*. The government sectors of cities with more overseas sister cities have relatively more channels through which to communicate with and learn from their international counterparts. Similar to other studies (Lee *et al.*, 2011), the current study employs the number of international sister cities recorded by the China International Friendship Cities Association (CIFCA) to gauge the learning orientation and channels of urban governments.⁶ The CIFCA updates these statistics annually, and I use the latest accumulative data to calculate the measure. It would be ideal to compile data on communications and learning amongst Chinese cities to measure these learning effects, but such data are not accessible. In any case, learning is a propensity that is inherited in specific cities (Dobbin *et al.*, 2007), and it can thus be assumed that municipalities with more international sister cities have a greater tendency to connect

with and learn from other domestic cities.

3) *Vertical mandate*. The intermediate upper-tier authority for city governments, that is, provincial government departments, exerts the strongest influence on policy decision-making. The attitude and propensity of these departments towards microblogging may thus affect municipal governments' adoption decisions to a large extent. If provincial government departments have launched official microblogs, then municipal governments may be more inclined to follow their example.⁷ Accordingly, I use the number of microblogs launched by provincial government departments to measure the top-down mandate. Provincial government microblogs are geographically registered in provincial capital cities, and I thus employ the total number of government microblogs launched in these cities minus the number of city-level government microblogs as the number of provincial government microblogs. Accordingly, the number of government microblogs in provincial capital cities is the total number of government microblogs minus the number of provincial government microblogs.

4) *Public pressure*. Informed citizens with a high level of human capital may be the dominant force pushing the government to innovate. I thus adopt the Internet penetration rate and percentage of highly educated citizens to measure public pressure, in line with prior studies (Lee *et al.*, 2011).

5) *Organizational resources and capacity*. I create two measures to gauge municipal government resources and capacity. First, fiscal health is measured by the difference between fiscal revenue and expenditure divided by fiscal expenditure, the

methods developed by Berry (1994). The larger the measure, the healthier the municipal fiscal system. Second, municipal e-government performance is employed to gauge government IT capacity based on the government website performance assessment results compiled by the China Software Testing Center (CSTC, 2011). The most authoritative e-government assessment body in China, the CSTC assesses the websites of governments across diverse levels and regions annually in terms of the key dimensions of online service, interactive properties and information disclosure. I use its comprehensive score to measure municipal e-government performance.

Control Variables

Several geographic, socioeconomic and demographic attributes of the sample cities are taken into account in estimating the models discussed in the Results section. First, municipal gross domestic product (GDP) per capita as a measure of economic wealth is controlled in the model. Generally speaking, wealthier governments are more inclined to adopt innovations owing to their resource endowment (Mohr, 1969; Tolbert *et al.*, 2008).

Second, I control the total municipal population size as a proxy of jurisdictional size. Prior studies suggest that government size plays an important role in eliciting innovation adoption (Moon and Norris, 2005; Tolbert *et al.*, 2008; Ma, forthcoming). Larger cities with more public sector departments may have the potential to launch more microblogs.

Third, several strategically important cities in China (e.g. Shenzhen) are granted extra authority by the central government, although they are also prefecture-level

cities (Chien, 2010; Chung and Lam, 2004). Similarly, provincial capital cities may also enjoy greater autonomy owing to their proximity to provincial authorities. Greater administrative authority may enable municipal governments to adopt innovations more autonomously or, conversely, it may render them more cautious and risk-averse. I create two dummies for the 15 sub-provincial cities⁸ and 27 provincial capital cities in the sample to control for the effects of a city's administrative rank.

Finally, cities located in particular geographic regions, namely, the coastal and inland provinces, enjoy distinct resources and opportunities, and this disparity may affect their innovative propensity. To control for these geographic effects, I create two dummies for the eastern and western regions, taking the central region as the reference group.⁹

Analytical Methods

Multivariate regression analysis is applied to test the hypotheses proposed herein, and several controls are included to eliminate alternative explanations. The dataset is cross-sectional in nature, and the dependent variable is a count outcome. Linear regression models (e.g. ordinary least squares [OLS]) may result in biased estimates when the dependent variable is a count outcome because of the violation of the normal distribution assumption, and these models are thus inappropriate for analysis in this study (Long and Freese, 2006). Models specifically designed for regressions with count data are preferable, and many alternatives could have been employed.¹⁰ The Poisson regression model is unsuitable for analysis, however, because it does not take heterogeneity into account. The negative binomial regression model resolves this

problem and is thus appropriate for our purposes (Long and Freese, 2006). The government sectors of all prefecture-level cities can launch official microblogs, and the sample covers the entire population. Thus, the number of government microblogs launched by municipal governments does not suffer from the dispersion problem deriving from left-censoring and sampling bias, rendering zero-inflated and zero-truncated models unsuitable for the current analysis (Long and Freese, 2006). For all of these reasons, I employ the negative binomial regression model to test the study's hypotheses.

RESULTS

The descriptive statistics and correlations of the variables are reported in Table A2 of the appendix. The distribution of the number of municipal government microblogs exhibits substantial variance across cities. Some cities, such as Chengdu in the northwestern province of Sichuan, have launched more than 400 such blogs, whereas others, such as Songyuan in the northeastern province of Jilin Province, have yet to adopt any. The average number of government microblogs launched by prefecture-level cities is 34, and its standard deviation is over 50, thus implying a large variation deserving of further explanation. There are also substantial variations amongst the independent variables, which could be employed to explain the variance in government microblogging assimilation.

The correlation metrics reported in Table A2 show the number of government microblogs to be positively and significantly correlated with all of the independent

variables, providing preliminary support for the hypotheses. Generally speaking, the independent variables are weakly interrelated, and all of the correlations are less than 0.700. The variance inflation factors (VIFs) of the independent variables are all less than 3.00, much lower than the standard value of 10.00 recommended for diagnosis of regression multicollinearity (Belsley *et al.*, 2004).

I first enter all of the control variables into Model 1. I then enter the four dimensions of the Berry-Berry model (Model 2) separately and add the resources and capacity dimension (Model 3) without the control variables. The four dimensions with the control variables are entered into Model 4, and the full model (Model 5) is finally used to test the hypotheses. The preliminary results reported in Table 1 show that the theoretical framework is partially supported by the empirical test. The LR χ^2 for all five models are statistically significant at the 0.0000 level, thus suggesting that the models' explanatory power is non-zero. When the other variables are omitted in Model 2, the four dimensions advocated by Berry and Berry (1999, 2007) all have significantly positive effects on the diffusion of government microblogging, thus strongly supporting their predictive power. Their explanatory power is reduced when alternative explanations are taken into account, as evidenced by Models 3-5. The pseudo R^2 for the models with the four dimensions are 0.0593 (Model 2) and 0.0755 (Model 4), whereas those for the models that include organizational resources and capacity improve substantially to 0.0698 (Model 3) and 0.0825 (Model 5), respectively. Thus, the findings support my adaptation of the Berry-Berry model to explain the diffusion and assimilation of government microblogging.

Insert Table 1 about here

In all five models, horizontal competition measured by the average number of government microblogs launched by adjacent cities in the same province has significantly positive effects on the number of municipal government microblogs, thus providing support for H1.

Horizontal learning measured by the number of international sister cities is positively and significantly associated with government microblogging assimilation in Models 2 and 3, but its effects become insignificant when the control variables are entered simultaneously in Models 4 and 5. The sign of horizontal learning is even reversed in Model 5, becoming negative, because of its high degree of correlation with some of the control variables (e.g. the sub-provincial city dummy). Thus, H2 is not supported by the results.

Upper-tier mandate measured by the number of microblogs launched by provincial governmental departments is significantly and positively correlated with the dependent variable in Models 2 and 3, in which the control variables are omitted, but its effects become insignificant in those that incorporate these variables (i.e. Models 4-5). I thus fail to find evidence supportive of H3.

Municipal human capital is positively associated with the number of government microblogs, but this association is statistically significant only in Model 2. Its sign even reverses, turning negative, when the organizational resources and capacity

dimension and the control variables are added in Models 3 and 5. Similarly, the municipal Internet penetration rate is positively and significantly correlated with the dependent variable only in Model 2, although its sign is consistently positive in Models 3-5. The two public pressure hypotheses, H4a and H4b, thus obtain no support from the results.

Finally, both measures of organizational resources and capacity, that is, municipal fiscal health and e-government performance, have significantly positive effects on the number of government microblogs. The regression coefficients of both measures are statistically significant at the 0.01 level, thus indicating that they are powerful predictors of the assimilation of government microblogging. These findings provide strong support for H5a and H5b.

The control variables in Model 1 explain a small portion of the variance in the dependent variable. Municipal wealth measured by per capita GDP is positively and significantly correlated with the number of government microblogs, but its effects become insignificant when other independent variables are entered (Model 5). Jurisdictional size measured by the total population size is found to be positively and significantly associated with government microblogging assimilation in all five models. The two dummy variables measuring municipal administrative ranking have different effects on the number of government microblogs. The provincial capital city dummy is found to have significantly positive effects, and the sub-provincial city dummy to have insignificant and unstable effects. Finally, a city's geographical attributes matter little with regard to its adoption of government microblogging, and

the two dummies for eastern and western cities are insignificantly correlated with the dependent variable in all of the models except for the eastern city dummy in Model 1.

DISCUSSION

The results reported in this paper show the diffusion and assimilation of government microblogging in the Chinese municipal context to be driven by diverse antecedents. Of the four dimensions summarized in the Berry-Berry model, intergovernmental competition provides the best explanation of such diffusion and assimilation. The intense competition amongst local governments in China is shaped by both the economic and political contests (Li and Zhou, 2005; Landry, 2008), which provide substantial incentives for governments to adopt innovation in pursuit of competitive advantage.

Intergovernmental learning is found to have no significant effects on government microblogging assimilation, which can be attributed to the limitations of its measurement. The number of international sister cities a municipality has constitutes only an available channel of learning. Whether its government actually deploys that channel depends on other exogenous factors. Furthermore, although they lag behind in other arenas, Chinese governments have been pioneers in harnessing social media applications, in contrast to governments in Western countries such as Australia, which still treat microblogging tools with skepticism if not outright scorn (Thomler, 2011). Accordingly, international learning channels may be a poor predictor of the former's adoption of new technologies. The development of differentiated measures for

specific types of innovation is pivotal to disentangling and comparing the effects of social learning and economic competition (Boehmke and Witmer, 2004; Lee *et al.*, 2011).

Although both vertical and horizontal diffusion effects are found to influence the diffusion of government innovation, I find horizontal competition to outperform vertical mandate. Statistics show China's central ministries and provincial government departments to have launched official microblogs later and much less frequently than their counterparts at lower levels (e.g. prefecture, county and town) owing to political sensitivity and risk aversion (E-Government Research Center, 2012). It is local governments at lower levels that are driving the government microblogging bandwagon. In other words, bottom-up emergence is relatively more important than top-down promotion in explaining the spread of government microblogging in China (Ma, forthcoming). It is recommended that future studies explore the competing effects of both vertical diffusion mechanisms when relevant data become available (Shipan and Volden, 2006).

The two public pressure hypotheses explain little of the diffusion and assimilation of government microblogging, which can be attributed to the characteristics of IT innovation. The boundless nature of the Internet and its applications means that government microblogs can attract numerous followers from every corner of the globe rather than being restricted to their own jurisdictions. As an increasingly important source of breaking news, microblogs have also become a platform for the gathering of diverse populations. For instance, when the official microblog of the

Beijing Police Department debuted on 1 August 2010, it attracted more than 230,000 followers, but only about one-fifth of them were from Beijing, with the remainder coming from all over the country and even from abroad, according to media reports.¹¹ Thus, jurisdictional pressure from the citizenry is not the sole external driver of government microblogging assimilation. It is left to future research to develop more accurate measures of the size and propensities of microbloggers. Another explanation for the public pressure hypotheses' lack of explanatory power is the authoritarian nature of the Chinese government system, which lacks an effective bottom-up accountability mechanism. The results imply that the country's authoritarian municipal government officials respond actively to the upper-tier authorities who are in charge of their fiscal grants and career prospects, but do not feel accountable to their citizens who are *de facto* ignored by the current government system (Landry, 2008). This explanation coincides with recent observations of local government dysfunction in public service delivery and calls for a more citizen-centered and service-orientated public management approach.

The Berry-Berry model is well able to explain the diffusion of different types of government innovation, for example, policy, management and technological innovations, although it originates in the policy diffusion research tradition. Recent studies suggest that the model is able to explain some types of innovation but not others, which this study's findings confirm. For example, although the model is able to explain the diffusion of total innovation satisfactorily, its performance becomes unsatisfactory for specific types of organizational innovation (Walker *et al.*, 2011). In

addition, it can predict the development of e-government but not that of e-democracy (Lee *et al.*, 2011). I find robust support for the Berry-Berry model's explanatory power in the diffusion and assimilation of government microblogging, but when fiscal resources and IT capacity are considered that power is substantively reduced. Competition, vertical mandate and learning are found to have significant effects, but public pressure must be dropped from the list. The model's explanatory power is further weakened when jurisdictional control variables are taken into account, with competition alone found to make a difference. As noted, I find intergovernmental competition to be the most important predictor of government microblogging diffusion, with learning and upper-tier and public pressure having little effect on its variance.

The diffusion and assimilation of government microblogging are driven by different components of the variables considered herein, and the results imply that future studies would be advised to expand the Berry-Berry framework to better predict the dynamics of innovation diffusion. My adaptation of the framework constitutes a first step, and future research should further refine this study's models to capture the authentic nature of such diffusion. The results show the addition of organizational resources and capacity to improve the Berry-Berry model's explanatory power considerably, thus supporting my adaptation of and confirming the importance of organizational resources and capacity for IT innovation adoption (Jeyaraj *et al.*, 2006). Although microblogging is a free IT innovation, its healthy operation requires large-scale investments in managerial attention, time, and energy and organizational

human capital and infrastructure (Ma, forthcoming). Fiscal health and IT capacity play different roles in eliciting the diffusion of government microblogging. Resource slack is an essential prerequisite of IT innovation, whereas IT capacity is one of the key components of innovation success (Tolbert *et al.*, 2008). Finally, government microblogging's dependence on organizational resources and capacity also explains the significantly positive effects of municipal wealth and size.

Several limitations of this study merit discussion and suggest directions for future research. As a temporal dynamic process, public sector post-adoption behavior would better be examined separately to distinguish the different phases and contingencies of innovation diffusion. The diffusion and assimilation of government microblogging could be analyzed with a time-series dataset to mitigate the estimation limitations of the cross-sectional dataset used here, and future studies could retest my findings when such a dataset becomes available. Furthermore, I do not examine the interaction effects of the independent variables on the diffusion of government microblogging, and it is suggested that future studies analyze the issue as a multiplicative function (Mohr, 1969). Finally, the microblogging linkages of government agencies may evoke large-scale diffusion and assimilation, the effects of which should be examined in future research. For instance, Internet opinion leaders and the microblogs of well-known governments and officials with great influence may also serve as effective catalysts to spur an extensive and rapid spread (Ma, forthcoming).

CONCLUSION

The diffusion and assimilation of government microblogging is examined empirically in this paper, and the Berry-Berry model of innovation and policy diffusion is adapted and tested using data on more than 280 prefecture-level cities in China. The findings suggest that horizontal competition is significantly and positively correlated with the number of government microblogs, whereas intergovernmental learning, upper-tier mandate and public pressure have only insignificant effects. Fiscal health and IT capacity are also found to have significantly positive effects on the assimilation of government microblogging. My findings confirm my rationale for adapting the Berry-Berry model to better understand the diffusion of IT innovation amongst municipal governments in China. They also suggest that governments that face intense horizontal competitive pressure and are equipped with sufficient resources and capacity are much more likely to adopt microblogging. I believe this study contributes to the literature by offering a robust explanation of the rapid but uneven spread of microblogging across governments and to practice by helping governments to better understand the diffusion of new IT technologies.

NOTES

¹ Due to Internet censorship, Facebook and Twitter are not accessible in China. The country's four dominant government microblogging platforms are weibo.com (Sina), t.qq.com (Tencent), t.people.com.cn (*People's Daily* Online) and t.home.news.cn (Xinhua News Agency). My interview with a rapporteur from the E-Government Research Center in April 2012 revealed that Sina and Tencent are the two most prominent platforms, and, accordingly, the center plans to drop the other two from future assessments. As of the end of 2011, the total number of official microblogs launched by government agencies and officials in China had reached 32,358 and 18,203, respectively, increasing from 27,400 and 17,393 at the beginning of the year.

² The list of all verified government microblogs on the weibo.com platform is accessible at <http://verified.weibo.com/gov/>. To search the microblogging portal comprehensively, I use Teleport Pro, excellent webspidering software developed by Tennyson Maxwell Information Systems, Inc. This software can be obtained from

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- <http://www.tenmax.com/teleport/pro/home.htm>.
- ³ My interview with a rapporteur from the E-Government Research Center (2012) revealed the center to have collaborated with the four microblogging platforms to obtain these data, which are kept secret by bilateral agreement. Furthermore, data at the city level are also not classified or reported.
- ⁴ This strategy is also adopted by most US federal agencies, as reported by Mergel (2011).
- ⁵ I treat the competition effects of cities with no peers in the same province (e.g. Xining) as equal to zero.
- ⁶ The CIFCA dataset, which is sponsored by the Chinese People's Association for Friendship with Foreign Countries (CPAFFC), is accessible at <http://english.cifca.org.cn/default.aspx>.
- ⁷ My interviews with local officials also revealed that risk-reverse government sectors may be reluctant to launch official microblogs unless upper-tier authorities also launch microblogs or permit them to do so.
- ⁸ Five ordinary cities (Dalian, Qingdao, Ningbo, Xiamen and Shenzhen) and 10 provincial capital cities (Harbin, Changchun, Shenyang, Jinan, Nanjing, Hangzhou, Guangzhou, Wuhan, Chengdu and Xi'an) constitute the 15 sub-provincial cities.
- ⁹ The standard socioeconomic trichotomy divides China into eastern, central and western regions. The 11 eastern provinces, Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin and Zhejiang, are commonly regarded as developed regions, whereas the 12 western provinces, Chongqing, Gansu, Guangxi, Guizhou, Inner Mongolia, Ningxia, Qinghai, Shaanxi, Sichuan, Tibet, Xinjiang and Yunnan, are relatively less developed. The eight central provinces, Anhui, Heilongjiang, Henan, Hubei, Hunan, Jiangxi, Jilin and Shanxi, fall between their eastern and western counterparts geographically and socio-economically.
- ¹⁰ For instance, the Poisson regression model, negative binomial regression model, zero-inflated Poisson regression model, zero-inflated negative binomial regression model, zero-truncated Poisson regression model and zero-truncated negative binomial regression model are all relevant to the count data regression model.
- ¹¹ Beijing police microblog draws much attention, 29 November 2010, *China News*: http://www.china.org.cn/china/2010-11/29/content_21442622.htm.

NOTES ON CONTRIBUTOR

Liang Ma is a lecturer at the MPA Education Center, School of Humanities, Economics, and Law, Northwestern Polytechnical University, China. He earned his PhD from the School of Management, Xi'an Jiaotong University. His research interests are public organizational innovation and performance management, and he has published research in *Public Management Review* and *Public Administration*.

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Table 1: Results of negative binomial regression models

<i>Variable</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
Competition		0.00951*** (0.00228)	0.00719*** (0.00228)	0.0113*** (0.00306)	0.00881*** (0.00301)
Learning		0.0774*** (0.0148)	0.0380** (0.0161)	0.00994 (0.019)	-0.00779 (0.0189)
Mandate		0.0160*** (0.00425)	0.00906** (0.00426)	0.00282 (0.0047)	0.000157 (0.00459)
Human capital		0.00745* (0.00446)	-0.0003 (0.00437)	0.00169 (0.00469)	-0.00089 (0.00457)
Netizens		1.701*** (0.561)	0.692 (0.578)	0.285 (0.637)	0.142 (0.62)
Fiscal health			0.933*** (0.319)		1.028*** (0.366)
e-government			0.0206*** (0.00518)		0.0156*** (0.00522)
GDP per capita	0.106*** (0.02)			0.0869*** (0.0233)	0.0391 (0.0242)
Population size	0.571*** (0.0852)			0.479*** (0.0938)	0.461*** (0.0934)
Sub-provincial city	0.029 (0.257)			-0.0331 (0.276)	-0.152 (0.275)
Provincial capital city	0.833*** (0.193)			0.928*** (0.241)	0.677*** (0.244)
Eastern city	0.536*** (0.126)			0.138 (0.157)	0.14 (0.155)
Western city	-0.171 (0.126)			-0.126 (0.128)	0.0471 (0.131)
Constant	-0.642 (0.525)	1.657*** (0.193)	2.120*** (0.364)	-0.554 (0.535)	-0.0781 (0.565)
Ln α	-0.475*** (0.0861)	-0.391*** (0.0848)	-0.486*** (0.0864)	-0.536*** (0.0871)	-0.599*** (0.088)
<i>N</i>	282	282	282	282	282
Log likelihood	-1199.612	-1211.7175	-1198.1507	-1190.8726	-1181.8224
LR χ^2	177.01***	152.79***	179.93***	194.48***	212.58***
Pseudo R ²	0.0687	0.0593	0.0698	0.0755	0.0825

Notes: Standard errors are in parentheses; ***p < 0.01, **p < 0.05, *p < 0.10.

Appendix Tables

Table A1: Summary of the variables

<i>Category</i>	<i>Variable</i>	<i>Description</i>	<i>Source</i>
Dependent variable	Microblogs	The number of municipal government microblogs registered in a city.	Sina platform and author's calculation
	Competition	The average number of microblogs launched by other cities in the same province.	Sina platform and author's calculation
	Learning	The accumulative number of international sister cities.	CIFCA
Independent variables	Mandate	The number of microblogs launched by provincial government departments.	Sina platform and author's calculation
	Human capital	The percentage of highly educated municipal citizens.	NBSC
	Netizens	Internet penetration rate, measured by the number of households with Internet access divided by the total population.	NBSC
	Fiscal health	The difference between fiscal revenue and expenditure divided by fiscal expenditure.	NBSC
	e-government	The total score of the municipal government website performance assessment.	CSTC
	GDP per capita	GDP divided by total population size. The values are divided by 10,000 when entered in the regressions.	NBSC
	Population size	Total year-end population size.	NBSC
Control variables	Sub-provincial city	Dummy variable = 1 for sub-provincial cities and 0 for other cities.	/
	Provincial capital city	Dummy variable = 1 for provincial capital cities and 0 for other cities.	/
	Eastern city	Dummy variable = 1 for cities located in the eastern region and 0 for other cities.	/
	Western city	Dummy variable = 1 for cities located in the western region and 0 for other cities.	/

Table A2: Descriptive statistics and correlation metrics

	<i>N</i>	<i>Mean</i>	<i>S.D.</i>	<i>Min</i>	<i>Max</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>	<i>13</i>	
1. Microblogs	283	34.922	50.323	0	435	1													
2. Competition	283	34.932	23.613	0	111.583	0.319	1												
3. Learning	283	3.855	4.625	0	28	0.460	0.249	1											
4. Mandate	283	30.212	13.480	3	58	0.155	0.330	0.062	1										
5. Human capital	282	11.690	13.816	1.010	100	0.328	0.238	0.393	0.169	1									
6. Netizens	283	0.266	0.108	0.1	0.728	0.391	0.220	0.626	0.116	0.367	1								
7. Fiscal health	282	-0.532	0.235	-0.933	0.091	0.465	0.447	0.582	0.279	0.560	0.538	1							
8. e-government	283	38.763	12.961	12.570	80.720	0.482	0.346	0.577	0.305	0.414	0.491	0.566	1						
9. GDP per capita	282	3.548	3.651	0.519	36.870	0.349	0.228	0.413	0.190	0.655	0.483	0.649	0.437	1					
10. Population size	282	5.842	0.669	3.082	7.110	0.264	0.184	0.296	0.311	-0.088	0.158	0.023	0.294	-0.198	1				
11. Sub-provincial city	283	0.053	0.224	0	1	0.395	0.063	0.663	0.042	0.346	0.501	0.335	0.468	0.379	0.216	1			
12. Provincial capital city	283	0.095	0.294	0	1	0.332	-0.151	0.563	-0.076	0.263	0.492	0.336	0.332	0.158	0.198	0.460	1		
13. Eastern city	283	0.346	0.477	0	1	0.318	0.677	0.282	0.497	0.361	0.255	0.541	0.363	0.321	0.161	0.159	-0.034	1	
14. Western city	283	0.297	0.458	0	1	-0.149	-0.317	-0.209	-0.329	-0.155	-0.185	-0.364	-0.337	-0.131	-0.228	-0.085	0.079	-0.473	1

Notes: The absolute values of correlations larger than 0.130 are statistically significant at the 95% level.

