Investigate Regional Prejudice in China through the Lens of Weibo

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Abstract. Regional prejudice is prevalent in Chinese cities where native residents and migrants from other parts of China lack mutual trust. Weibo users actively discuss and argue about the issue of migration, which provides a good source of data to examine the communication network regarding regional prejudice. We are interested in the posts and reposts related to the topic on migrants. In a Weibo repost, one can add new content in addition to the original post. Then both original and new content as a whole can be read by others. In particular, we focus on the reposts in response to native residents' complaints about migrants. Based on the sentiment (negative or non-negative) and the direction (native resident→migrant or migrant→native resident), we classify the reposts into four categories. We find evidence of homophily in regional prejudice in the Weibo communication network: 72.7 percent of the time, native residents' complaints trigger more complaints from other native residents. What interests us most are the socioeconomic factors that can reverse the sentiment or direction of the original posts. A multinomial regression model of the reposting patterns reveals that in a city with better housing security and a larger migrant population, migrant Weibo users are much more likely to argue with native residents who hold a negative view about migrants. One important implication from our findings is that a secure socioeconomic environment facilitates the communication between migrants and native residents and helps break the self-reinforcing loop of regional prejudice.

Keywords: Weibo, regional prejudice, social network, sentiment analysis

1 Introduction

On New Year's Eve of 2015, 49 people were injured and 36 died in a stampede in Shanghai when more than a million visitors rushed to the observation

deck nearby Chen Yi Square on the Bund. This accident caught great attention from the public and triggered heated discussions on Weibo (a Chinese Twitter-equivalent) – the topic was mentioned 559,120 times within 10 days[1]. Although the criticisms were mostly cast toward local officials for their inadequate preventive actions, many Shanghai natives blamed visitors from other regions. They also complained that migrants brought a number of social problems to Shanghai. Shanghai, one of the most developed cities in China, is infamous for the problem of regional prejudice. Regional prejudice is rooted in distrust and conflicts between native residents and migrants, which is also a problem prevalent in Beijing and many other Chinese cities.

Using data from Sina Weibo, this study investigates regional prejudice among Chinese people. As the most popular micro-blog in China, Weibo's monthly active users reached 222 million in September, 2015, with 100 million active users on a daily average[3]. Like Twitter, Weibo allows users to publish short and instant posts to share personal stories and exchange opinions on various topics. With such valuable data of public opinion, we focus on Weibo posts that are relevant to the topic of migrants in Chinese cities. Our previous work [2] developed a machine learning algorithm to identify posts that express regional prejudice. Based on these posts, we build a repost network among users who publish posts on regional prejudice.

In this study, we investigate from Weibo data the spread of regional prejudice and explore the factors associated with opinion change. Specifically, we intend to answer the following three research questions:

- Regional prejudice can be detected by looking at three dimensions of Weibo posts: Who publishes a post, a native resident or a migrant? Does this post talk about migrants, native residents, or both? What is the sentiment of the post, negative or not? Our first research question is to find the frequent patterns of these three dimensions.
- One can include new content in a repost in addition to the reposted content. When a Weibo post is reposted, will the direction and sentiment change? In other words, will the reposter continue or reverse the original author's opinion?
- What socioeconomic factors are likely to reverse the sentiment or the direction of the original posts with regard to migrants?

The paper is organized as follows. The next section reviews related works on Weibo. Then, we introduce a repost network regarding regional prejudice. We proceed to explore the socioeconomic factors that are likely to affect the reposting patterns. Finally, we conclude by summarizing and discussing our findings.

2 Related Works

Weibo has drawn much attention from researchers who study public opinion [5, 13, 14, 17]. Weibo posts are not independent because a post is likely to be

[1] http://data.Weibo.com/report
[3] http://ir.Weibo.com/

triggered by another post from a friend, opinion leader, or organization. Previous research has shown that opinion diffuses via Weibo users networks [4]. The mostly studied type of social media networks is "follower-followee" network [6, 15, 20]. Other networks that have been well studied include bipartite networks of Weibo users and posts [10] and "post-repost" network of bloggers [11]. One limit of these studies is that they only focus on basic network attributes such as in/out degrees and the number of follower/followees but ignore the rich content of Weibo posts.

Unlike Twitter, where only 35 percent of its posts are retweets, 65 percent of Weibo are reposted contents [19]. Repost in Weibo allows a user to publish a message up to 140 words. Including 140 words of the original post, 280 words in total can be read by followers of the reposter as a new post. For better understanding the spread of information on this platform, it is more reasonable to study a post-based network. In other words, we hope to capture the path of information flow by observing reposting behavior. Many studies have analyzed the reposting behavior of Weibo users [15], but failed to consider the shift of opinions in posts.

Beliefs vary with Weibo users' demographic and socioeconomic backgrounds. For example, in central and eastern China, higher socioeconomic status leads to a larger number of active Weibo users than the other areas. Wang, Paul, and Dredze [17] analyzed air-pollution-related Weibo posts from 74 cities, and found that the number of pollution-related posts is significantly correlated with the particle pollution rate reported by the local government.

Our study is the first one to explore the relationship between regional prejudice and socioeconomic status via Weibo data. Regional prejudice represents unreasonable resentment and distrust towards people from a different place. It is a widespread problem across Chinese cities. Analyzing data from Weibo provides a valuable alternative to traditional social science research methods, such as surveys and experiments, in studying prejudice and other public opinion questions. People are more likely to convey their true opinions on Weibo than in a face-to-face social settings. The concepts of prejudice, discrimination, and intolerance are hard to be directly measured with good precision, because they are subject to social desirability effects [8]. By contrast, Weibo users can post controversial or provocative posts under an anonymous identity, so they are less restrained to say what they truly believe.

3 Repost network of regional prejudice

To investigate regional prejudice content and its diffusion pattern on Weibo, we construct a network to capture information flow between individuals.

3.1 Data

To the best of our knowledge, there is no publicly available corpus for regional prejudice. We compiled our own corpus. To gather Weibo posts and user information, we built a Weibo webpage crawler. Based on 13 key phrases related to

migrants: "native" (本地), "permanent population" (常住人口), "census register" (户籍), "registered permanent residents" (户口), "resident permit" (居住证), "floating population" (流动人口), "settle in a new place" (落户), "migrant workers" (农民工), "non-native" (外地), "coming from a different town" (外来), "people from other provinces" (外省人), "transient population" (暂住人口), and "temporal residential permit" (暂住证), we retrieved related posts over four months from December 14, 2014 to April 15, 2015. These 13 key phrases can be divided into two groups. One group of phrases, including "census register," "resident permit," and "temporal residential permit," are related to internal migration policies. The other group are labels indicating residential status. It is interesting that some of the labels, such as "permanent population," "floating population," and "transient population," were created by the Chinese government. Other labels, such as "native," "non-native," and "migrant workers" are common words when people mention migrants. We kept the posts that contained at least 1 of the 13 key phrases. In total, we collected 4,641,398 Weibo posts. To build a repost network, we only kept the reposts following other original posts. As a result, we obtained 285,707 posts, including 34,187 original posts and 251,520 reposts.

3.2 Detecting regional prejudice from texts

Due to the high volume of data, we have to rely on automatic text classification. We randomly selected 5,000 posts and asked five coders to annotate them via Crowdsdom[4], a Chinese annotation platform similar to Amazon Mechanical Turk. The Kappa statistic of the labeling process was 0.63, indicating a reliable result. In our previous paper [2], we proposed a new approach, Distributed Keyword Vectors, to recognize polarity and direction of Weibo posts. Performance and practicability of the sentiment classifier and direction recognition classifier were elaborated in that paper. With the classifiers, we obtained three types of labels for each post as follows:

- Owner Type (OT): Who published this post, native residents (NR) or migrants (M)?
- Direction (DR): What is the direction of this post, towards migrants (M) or native residents (NR)?
- Sentiment (SEN): What is the sentiment of this post, negative (Neg) or non-negative (Non-neg)?

For each label, there is an "unknown" category. For example, a Weibo post published by a government account talking about a new migration policy is labeled as "unknown" for both OT and SEN. Some posts cut multiple categories. For instance, a post aiming at both native residents and migrants has its DR labeled as "NR&M". We split such a post into two separate posts–one with DR as NR and the other with DR as M. Table 1 offers 4 examples of post labels. The distribution of assigned labels across different categories is shown in Table 2.

[4] http://crowdsdom.com/

Table 1: Example of Weibo posts and their labels

Weibo post	Translation	OT	DR	SEN
#上海踩踏事件调查报告#网上的心态啊，其实只要做到一点灾难就不会发生，那就是，让外地人回外地，哪儿来的回哪儿去，把上海留给上海人。。一切都完美了。。。	#The Shanghai Trampling Report# What are people thinking on the Internet! This tragedy could have been avoided by just doing one thing, that is, have the migrants go back to wherever they came from and give Shanghai back to the Shanghaiese... Everything will be perfect ...	–	M	Neg
早高峰高速路匝道堵了，都是外地车害的，大楼着火了，都是外地临时工害的，外滩踩踏了，估计也有不少外地人，外地人、外地车你们什么时候不是害上海之马！？	Because of migrants, there are traffic jams. Because of migrant workers, the buildings were on fire. There must have been many migrants in the trampling on the Bund too. When will you stop bringing Shanghai down, migrants and your cars?	NR	M	Neg
外地人，本地人，来到温江一家人。	Whether you are migrants or native residents, we are families when you come to Wenjiang.	NR	–	Non-neg
同在一座城，请彼此包容也许你来自远方，也许你从一出生就在这里，也许你是深圳人，也许你是外来的新深圳	We are living in the same city. Please be tolerant of one another. Maybe you come here from far away. Maybe you were born here. Maybe you are a Shenzhen native. Maybe you are a newcomer to this city.	–	NR&M	Non-neg

3.3 The repost network

To understand how information spreads on a social media platform, one way is to build a directed user network and observe who replies or makes a repost. Reposts appear in the feeds board and thus can also be seen by followers of the reposter. The goal of our study is to discover the diffusion pattern of regional prejudice on Weibo. The repost network is utilized for our analysis of regional prejudice in Chinese cities.

Different from many previous studies that focus on users as vertices, we built a "repost network." This approach can rule out the impact of users' versatility. A user might have published multiple Weibo posts with different labels, but no single post is able to represent the user's general attitude. For example, a local user in Beijing may show sympathy towards migrants in the Shanghai stampede accident, but cast criticisms towards migrants in Beijing. In addition, we only kept posts with complete labels in all three categories and removed those with one or more "unknown" labels.

Table 2: Distribution of posts across different categories

	labels	number of posts
OT	NR	75,481
	M	16,884
	–	193,342
DR	NR& M	13,987
	NR	6,873
	M	18,460
	–	246,387
SEN	Neg	114,477
	Non-neg	171,230

All the networks examined are ego-networks. We take an original Weibo post as a focal vertex (ego), linked to one or more reposts (alters). Figure 1 is an example of ego-network. In an ego-network, 1-hop neighbors are direct reposts, and 2-hop neighbors are reposts of 1-hop neighbors. Table 3 shows the attribute distribution of original posts, 1-hop reposts, and 2-hop reposts. Along with reposting, negative sentiment becomes increasingly more prevalent: 81.54 percent of the original posts contain a negative tone, while the percentage increases to 82.84 percent among the 1-hop reposts and 89.80 percent among the 2-hop reposts). More than 80 percent of posts examined aim at migrants. Weibo users from different cities may repost posts of each other. Figure 2 illustrates the distribution of the number of cities involved in a repost ego network. It shows that more than 75 percent of the repost ego networks cross multiple cities.

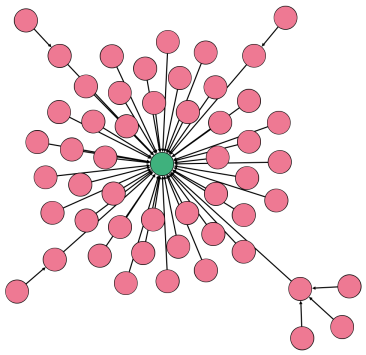

Fig. 1: Example of Ego-network (Green: Ego; Red: Alter)

Table 3: Total numbers of posts in each category

	%	OT (NR)	DR (NR)	DR (M)	SEN (Neg)
Original	–	69.01%	69.23%	83.96%	81.54%
1-Hop	–	73.30%	56.19%	88.83%	82.80%
2-Hop	6%	89.80%	73.47%	89.80%	89.80%

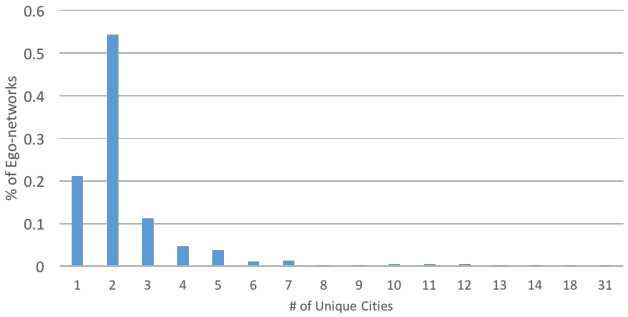

Fig. 2: Distribution of ego-networks with different number of unique cities

4 Socioeconomic Environments and Regional Prejudice

4.1 Reposting patterns

In this section, we analyze two dimensions of reposts – direction and sentiment. Since prejudice is unreasonable mistrust between different social groups [1], we are interested in the exchange of posts between native Weibo users and the users who identify themselves as migrants, rather than the communication within a single group. We focus on the original posts that are published by native residents with a negative attitude towards migrants. Such posts are closely related to regional prejudice and most prevalent in our collected data. Furthermore, we investigate how socioeconomic environments affect people's attitudes toward migrants and shift the patterns of online discussion on the issue of migration. After being filtered, 909 pairs of posts and reposts remained in our sample.

Based on sentiment and direction, the reposts can be classified into four types (Figure 3): (1) a native resident complaints about migrants (NR→M, Neg); (2) a native resident discusses migrants with a neutral or positive tone (NR→M, Non-neg); (3) a migrant criticizes native residents (M→NR, Neg); (4) and a migrant holds a neutral or positive view about native residents (M→NR, Non-neg). The first type of reposts are consistent with the original posts and show a clear pattern of regional prejudice. Such reposts are dominant, making up 72.7 percent in the filtered sample. Negative sentiment toward migrants is more likely to be sustained than reversed, as the reversal type of reposts only constitutes 11.1 percent. Unfortunately, the discussion of migrants on Weibo lacks voices from migrants. Among the filtered reposts, only 16.1 percent come from migrants,

Fig. 3: Regional Prejudice Patterns

among which 1.5 percent contain a non-negative tone towards native residents while 14.6 percent show regional resentment.

The exchange of migrant-related posts on Weibo supports previous research, finding that the online community is highly polarized and segmented [12]. Compared to face-to-face settings, the Internet provides many platforms where a person can easily find a group that shares his or her beliefs and ideologies, and block or avoid those with conflicting opinions. People have a tendency to seek evidence that justifies their established opinions while neglecting challenging evidence [9]. In the case of Weibo, homophily is a major mechanism underlying the link formation of the repost network. Homophily refers to the tendency of individuals to bond with each other. On one hand, native residents' complaints about migrants often trigger more complaints from other native residents. On the other hand, migrants and the native residents who get along well with migrants tend to avoid arguments with those holding strong regional prejudice. In consequence, regional prejudice becomes a self-reinforcing process.

Distrust between natives and migrants is likely to be a result of inadequate communication. Previous research has shown that inter-group contact and communication can help overcome racism [18] and cultural conflicts [16]. Although most reposts retain native Weibo users' criticisms of migrants, we are more interested in the reposts that alter either the sentiment or the direction of an original post.

The reposting patterns reflect the dynamics of regional prejudice. We proceed to identify the factors that can explain the different patterns of reposting. The reposting pattern is thus the dependent variable in our explanatory model. Since there are a very few reposts in which migrants speak positively about native residents, these reposts are excluded, leaving 895 cases for analysis. These cases are most relevant to our research interest on regional prejudice in an online communication network.

We regard the reposting pattern as a nominal variable with three categories, NR→M (Neg), NR→M (Non-neg), and M→NR (Neg). We model the three reposting patterns using multinomial regressions. Naturally, NR→M (Neg) is treated as the baseline category, because it is consistent with the original post. Concerned with regional heterogeneity, in making statistical inferences, we rely on standard errors clustered on the pairs of the locations of the original posts and reposts.

4.2 Socioeconomic environment

Socioeconomic contexts have substantial impacts on the relationship between different social groups. Interpersonal trust is likely to prevail in a wealthy society where people have no worry about food, housing, and other basic needs for survival [7]. Some economic resources are limited and indivisible, and the competition for such resources resembles a zero-sum game. Therefore, when one's current political power or economic well-being is threatened, he or she is likely to show hostility toward new competitors and out-group members. However, increased presence of migrants does not necessarily lead to a more intense relationship between native residents and migrants. In a region with a good socioeconomic environment, when a large number of newcomers arrive, local people may not feel insecure, but instead they may become more tolerant of diverse social groups via frequent interactions.

In explaining the reposting patterns, the key independent variables capture the differences in general socioeconomic status across Chinese cities. Socioeconomic status means the social standing of an individual or group. We retrieve six indicators of general socioeconomic status from the 2010 Census of China, the most recent census. The first indicator is %urban that measures the percentage of urban residents in a city. The level of educational attainment is measured by %high school graduate and %college graduate. %unemployed measures the percentage of unemployed adults in the population that is over 16 years old. Two separate indicators are used to measure the percentage of house owners, because rural residents often build a house whereas urban residents often buy or rent houses.

We collect Weibo authors' profiling locations as their cities and compare the indicators of socioeconomic status between the city where a repost was written and the city where the original post was sent. Specifically, we construct an independent variable by subtracting the latter city's indicators from the former city's indicators. For the cases missing the city identifier, we use the provincial indicators of socioeconomic status as a proxy for the city-level indicators.

The issue of regional prejudice is most salient in cities with a large migrant population. Therefore, we control for the percentages of migrants in the exploratory model. The 2010 Census distinguishes between two types of migrants. Within-province migrants live in a new city but in their home province. Cross-province migrants have left their home provinces to find a job. The two types of migrants have similar impacts on the local economy and labor market. However, due to distinct dialects, living styles, and even looks, cross-province migrants are more likely to receive higher prejudice from native residents. In addition, we control the distance between locations of posts and reposts using three binary variables: same province, neighboring provinces, and non-contiguous provinces.

We focus on the regional variations at the city level. In general, cross-city differences outweigh within-city differences. Moreover, urban residents often travel across districts in a city, and actual district boundaries are often not clear. Urban residents' perceptions towards migrants are thus more likely to be based on the migrant population at the city level instead of the district level.

4.3 Multinomial regression analysis of the reposting patterns

The multinomial regression model has the following functional form:

$$Pr(y_i = k) = \frac{exp(w_k^T x_i)}{exp(w_0^T x_i) + exp(w_1^T x_i) + exp(w_2^T x_i)} \quad (1)$$

where $k = 0, 1, 2$. w_0, w_1, and w_2 correspond to the coefficients for the reposting patterns NR→M (Neg), NR→M (Non-neg), and M→NR (Neg), respectively. To guarantee that w_1 and w_2 are identifiable, the constraint $w_0 = \mathbf{0}$ is added to the model.

Table 4 shows the results of the multinomial regression analysis. Among all the indicators of general socioeconomic status, only Δ%House Built has a statistically significant effect on the reposting pattern NR→M (Non-neg). The effect of Δ%House Built, however, is in an unexpected direction: as this independent variable increases, native residents are less likely to hold a neutral or positive view of migrants.

With regard to the reposting pattern M→NR (Neg), urbanization level, education level, and unemployment rate do not have a statistically significant impact. But in a city with more secure housing, migrants are more likely to criticize native residents in response to their negative posts about migrants. As Table 4 shows, both Δ%House Built and Δ%House Bought raise the probability of M→NR (Neg) in comparison to the probability of NR→M (Neg), and the effects are statistically significant at the 95% confidence level.

We find that migrants are empowered by their numbers. With regard to M→NR (Neg), Δ%Within-Province Migrant and Δ%Cross-Province Migrant are statistically significant at the 90% confidence level. In cities with a larger migrant population, migrant users become more engaged in the debate on Weibo with local users who complain about migrants. The magnitudes of the coefficients for the two migrant-related variables are fairly close. It appears that regardless of their origins, migrants living in the same city form a common identity as opposed to the native. We also find that resentful reposts toward native residents are most likely to be sent by Weibo users in a neighboring province.

Table 4 presents the statistical significance of the independent variables which shows whether the observed effects are systematic or largely by chance. But a statistically significant effect may be trivial, only accounting for a tiny portion of the variation in the dependent variable. Thus, it is also necessary to compare the substantive significance, which refers to whether an observed effect is large enough to be meaningful. There are multiple metrics for substantive significance, such as first difference and marginal effect. Figure 4 compares the marginal effects of each independent variable in the multinomial regression model. Margin effect is defined as $\frac{\partial Pr(y=k)}{\partial x_j}$. For a multinomial regression, a marginal effect is such that it is dependent on the combination of the values of all the independent variables. Average marginal effect takes the average of the marginal effects at all the data points. Therefore, we rely on average marginal effect to measure the overall substantive effect of a variable.

Table 4: Multinomial Regression Analysis of Locations and the Dynamics of Regional Prejudice

	NR→M (Non-neg)	M→NR (Neg)
Δ%Urban	-0.06	0.05
	(0.07)	(0.09)
Δ%High School Graduate	0.09	-0.22
	(0.10)	(0.21)
Δ%College Graduate	0.01	0.04
	(0.04)	(0.06)
Δ%Unemployed	0.37	-0.53
	(0.51)	(0.60)
Δ%House Built	-0.24*	0.28**
	(0.14)	(0.13)
Δ%House Bought	-0.16	0.20**
	(0.12)	(0.10)
Δ%Within-Province Migrant	-0.17	0.24*
	(0.17)	(0.13)
Δ%Cross-Province Migrant	-0.18	0.20*
	(0.14)	(0.11)
Same Province (Baseline Category)		
Neighboring Province	-0.06	1.58*
	(1.63)	(0.88)
Other Province	-0.40	0.09
	(0.34)	(0.27)
Constant	-1.82***	-1.79***
	(0.08)	(0.09)
N	895	
Log-Likelihood	-641.10	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Figure 4, the blue lines represent the confidence intervals of the average marginal effects at the 90% confidence levels; the vertical red line indicates a zero average marginal effect. If the confidence interval is broken by the red line, the corresponding average marginal effect is not statistically significant. Marginal effect is meaningful only when it is systematic across random samples. Here we focus on the four average marginal effects (Δ%House Built, Δ%House Bought, Δ%Within-Province Migrant, and Δ%Cross-Province Migrant) with regard to the reposting pattern NR→M (Neg). The average marginal effects are approximately the same, with 0.036 for Δ%House Built, 0.027 for Δ%House Bought, 0.031 for Δ%Within-Province Migrant, and 0.027 for Δ%Cross-Province Migrant. On average, as the gap in one of these four socioeconomic indicators increases by one percent, the probability of the reposting pattern NR→M (Neg) rises by about 3 percent, which is substantial.

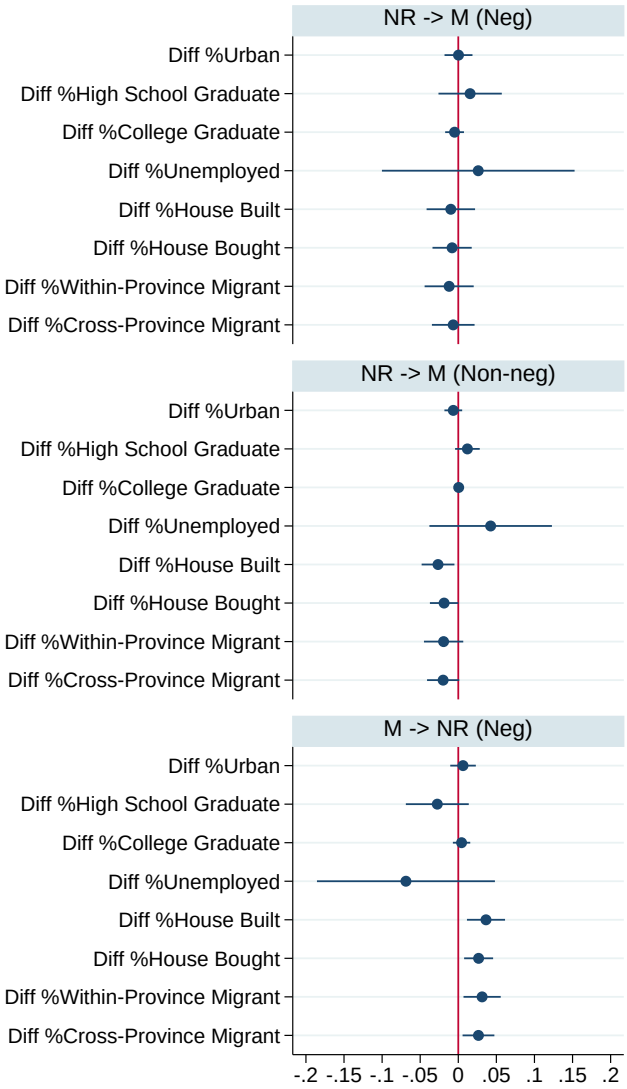

Fig. 4: Average Marginal Effects of Socioeconomic Differences on Reposting Patterns

5 Discussion and Conclusion

We are interested in understanding how Weibo users respond to the posts related to regional prejudice. First, we show the evidence of regional prejudice expressed in social media. In particular, we focus on the reposts of Weibo posts that contain

a clear tone of regional prejudice – native residents' complaints about migrants. These reposts are classified based on the direction (native resident→migrant or migrant→native resident) and the sentiment (negative or non-negative). First, we found that homophily is the major mechanism impacting users' opinion in the repost network. This finding is only limited to our observation of the repost network, while cross-group and confrontational communications are more likely to occur through communication activities such as directly replying [3].

Second, we discovered the frequent patterns of regional prejudice on Weibo: native residents' complaints about migrants lead to more negative posts about migrants from other native residents, and only a few reposts changed the initial direction by migrants who criticized native residents. Last but not least, we found the sentiment and direction of posts about migrants are related to socioeconomic status of the author's location. Secure socioeconomic environments breed mutual trust among different social groups. Specifically, in the regions with housing security and a large migrant population, migrant Weibo users are much more likely to get engaged in the argument with native residents who hold a negative view about migrants.

In many cases, regional prejudice is a result from inadequate communication between native and migrant residents. Regional prejudice is thus likely to be weakened when both native residents and migrants get engaged in the debate over the issue of migration. Further studies are needed to understand the factors that encourage communication across different social groups. Moreover, public opinion is dynamic and big social events often ignite heated online discussion. We will continue to explore regional prejudice via Weibo and treat time as an important factor.

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