

## Supplementary Material 1: County Level Analyses

This section shows the standardized coefficient scores and confidence intervals along with two forms of  $R^2$ , conditional ( $R_c^2$ ) and marginal ( $R_m^2$ ), for the linear models for all significant LDA Topics, LIWC Categories, and phrases in rural and urban counties in China.  $R_m^2$  is the variance explained by fixed factors and  $R_c^2$  is the variance explained by both fixed and random factors (i.e., the entire model).

### LDA Topics

Table 1: List of top urban topics and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected. Top words are sorted by conditional probability,  $P(Topic|Word)$ , from the LDA model

Top Words in Topic	Top Words (Translated)	$\beta_1$	$R_c^2$	$R_m^2$
<b>Career</b>				
学生, 高考, 学习	student, college entrance exam, learn	0.034 (0.022, 0.047)	0.008	0.006
工作, 员工, 公司	jobs, employee, company	0.022 (0.009, 0.036)	0.023	0.021
<b>Family and Support</b>				
母亲, 父亲, 孩子	mother, father, child	0.022 (0.007, 0.036)	0.004	0.000
家庭, 年轻人, 房子	family, young people, house	0.018 (0.003, 0.032)	0.027	0.023
回家, 一年, 每天	come back home, one year, every day	0.015 (0.002, 0.028)	0.001	0.000
<b>Finance and Economics</b>				
大盘, 附近, 昨天	market index, nearby, yesterday	0.040 (0.025, 0.055)	0.006	0.002
板块, 个股, 反弹	plate, individual stocks, rebound	0.034 (0.020, 0.047)	0.006	0.004
价格, 增长, 行业	price, increase, industry	0.032 (0.018, 0.046)	0.039	0.036
今日, 反弹, 创业板	today, rebound, gem	0.029 (0.015, 0.044)	0.009	0.006
支撑, 上方, 黄金	support, above, gold	0.029 (0.014, 0.043)	0.009	0.005
黄金, 原油, 上方	gold, crude, above	0.027 (0.013, 0.042)	0.008	0.005
经济, 美国, 美元	economic, united states, usd	0.027 (0.014, 0.040)	0.027	0.025
银行, 公司, 亿元	bank, company, billion	0.026 (0.013, 0.040)	0.034	0.031
市场, a股, 资金	market, a share, funds	0.021 (0.007, 0.034)	0.022	0.020
吨, 库存, 价格	ton, in stock, price	0.021 (0.008, 0.033)	0.025	0.023
大盘, 反弹, 日线	stock market, rebound, daily line	0.020 (0.006, 0.034)	0.007	0.004
突破, 线, 趋势	breakthrough, line, trend	0.019 (0.004, 0.033)	0.012	0.009
<b>Miscellaneous</b>				
医生, 医院, 患者	doctors, hospital, patient	0.024 (0.011, 0.037)	0.005	0.003
顶住, 对手, 能力	withstand, opponent, ability	0.023 (0.010, 0.035)	0.008	0.007
<b>Politics and Governance</b>				
媒体, 称, 记者	media, claim, journalist	0.059 (0.043, 0.075)	0.038	0.033
中国, 美国, 国家	china, united states, country	0.046 (0.031, 0.061)	0.045	0.040
中国, 显示, 我国	china, display, our country	0.041 (0.026, 0.056)	0.046	0.042
中国, 社会, 国家	china, society, country	0.039 (0.023, 0.055)	0.050	0.044
经济, 中国, 发展	economy, china, development	0.031 (0.017, 0.045)	0.052	0.048
企业, 政府, 国家	enterprise, government, country	0.023 (0.008, 0.038)	0.054	0.050
社会, 这种, 行为	society, this kind of, behavior	0.021 (0.006, 0.036)	0.026	0.022
<b>Relativity and Time Terms</b>				
表示, 很大, 毫无	means, very big, nothing	0.048 (0.033, 0.062)	0.008	0.005
觉得, 很多, 之后	feel, a lot of, afterwards	0.061 (0.044, 0.079)	0.014	0.006
现在, 已经, 过去	now, already, past	0.022 (0.009, 0.034)	0.002	0.001

Table 2: List of top rural topics and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Top Words in Topic	Top Words (Translated)	$\beta_1$	$R_c^2$	$R_m^2$
<b>Achievement and Work Ethic</b>				
越来越, 变得, 不再	more and more, become, no longer	-0.061 (-0.081, -0.041)	0.019	0.007
努力, 坚持, 希望	work hard, persist, hope	-0.061 (-0.082, -0.039)	0.019	0.004
成功, 改变, 能力	success, change, ability	-0.059 (-0.078, -0.041)	0.017	0.007
自由, 欲望, 内心	freedom, desire, heart	-0.047 (-0.064, -0.030)	0.011	0.005
一天, 忙, 休息	one day, busy, rest	-0.030 (-0.045, -0.016)	0.007	0.004
需要, 时间, 事情	need, time, thing	-0.030 (-0.046, -0.013)	0.008	0.003
面对, 现实, 事	face, reality, thing	-0.028 (-0.043, -0.012)	0.005	0.001
快乐, 总是, 活着	happy, always, alive	-0.027 (-0.043, -0.011)	0.006	0.001
完成, 目标, 计划	accomplish, goal, plan	-0.021 (-0.035, -0.007)	0.005	0.002
付出, 生命, 成长	give, life, growing up	-0.020 (-0.034, -0.006)	0.003	0.000
工作, 每天, 职场	jobs, every day, workplace	-0.018 (-0.033, -0.004)	0.005	0.002
<b>Causality</b>				
导致, 原因, 造成	resulting in, reason, cause	-0.031 (-0.049, -0.014)	0.009	0.001
影响, 导致, 造成	influences, resulting in, cause	-0.024 (-0.039, -0.009)	0.011	0.007
<b>Dissatisfaction and Discrepancy</b>				
人生, 也许, 痛苦	life, maybe, pain	-0.057 (-0.076, -0.037)	0.015	0.004
不能, 承受, 责任	can't, bear, responsibility	-0.056 (-0.076, -0.037)	0.016	0.005
不会, 希望, 现在	will not, hope, now	-0.039 (-0.058, -0.019)	0.021	0.010
放下, 抱怨, 快乐	let go, complain, happy	-0.024 (-0.039, -0.008)	0.006	0.001
<b>Emotions, Experiences, and Perceptions</b>				
生活, 每天, 方式	life, every day, the way	-0.106 (-0.134, -0.078)	0.047	0.016
思念, 心里, 心中	miss, in the heart, in mind	-0.074 (-0.095, -0.054)	0.022	0.009
心情, 放松, 情绪	mood, relax, emotion	-0.068 (-0.090, -0.045)	0.022	0.005
人生, 快乐, 放下	life, happy, lay down	-0.065 (-0.083, -0.047)	0.014	0.005
生活, 享受, 快乐	life, enjoy, happy	-0.056 (-0.074, -0.039)	0.012	0.004
爱情, 感情, 婚姻	love, attachment, marriage	-0.054 (-0.073, -0.036)	0.019	0.010
情绪, 表达, 情感	emotion, expression, affection	-0.049 (-0.068, -0.029)	0.014	0.003
理解, 微笑, 面对	understanding, smile, face	-0.044 (-0.063, -0.026)	0.015	0.006
缓解, 减轻, 帮助	ease, lighten, help	-0.042 (-0.065, -0.019)	0.021	0.004
感觉, 空间, 轻松	feel, space, relaxed	-0.027 (-0.040, -0.014)	0.003	0.001
选择, 生活, 人生	select, life, life	-0.027 (-0.043, -0.011)	0.008	0.003
心理, 焦虑, 情绪	psychology, anxiety, emotion	-0.023 (-0.038, -0.009)	0.005	0.002
<b>Body and Mind</b>				
食物, 健康, 增加	food, health, increase	-0.056 (-0.075, -0.036)	0.014	0.003
心灵, 释放, 属于	soul, release, belong	-0.045 (-0.064, -0.027)	0.012	0.003
身体, 健康, 睡眠	body, health, sleep	-0.045 (-0.061, -0.028)	0.009	0.002
身体, 作用, 人体	body, effect, human body	-0.038 (-0.057, -0.018)	0.013	0.003
运动, 身体, 动作	sport, body, action	-0.037 (-0.060, -0.015)	0.019	0.001
出现, 症状, 疼痛	appear, symptom, pain	-0.036 (-0.053, -0.019)	0.009	0.002
肌肤, 皮肤, 使用	skin, skin, use	-0.035 (-0.053, -0.017)	0.012	0.003
<b>Recommendations</b>				
注意, 最好, 建议	note, best, suggest	-0.035 (-0.052, -0.018)	0.008	0.002
不要, 重要, 特别	don't, important, especially	-0.016 (-0.030, -0.002)	0.003	0.000
<b>Simplicity</b>				
越, 少, 简单	more, less, simple	-0.054 (-0.074, -0.034)	0.017	0.005
可能, 容易, 最大	may, easy, maximum	-0.054 (-0.071, -0.036)	0.012	0.004

## LIWC Categories

Note that 了 has no corresponding English word, it has many uses in Chinese, often to express completed action or perfective aspect. We represent the English translation of 了 as its Chinese pronunciation *le*.

Table 3: List of top urban LIWC categories and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Category	Top Words in Category	Top Words (Translated)	$\beta_1$	$R_c^2$	$R_m^2$
<b>Cognitive Processes</b>					
Insight	了, 想, 知道	le, think, know	0.031 (0.015, 0.047)	0.009	0.003
<b>Function Words</b>					
Specifying articles	上, 下, 前	on, under, before	0.032 (0.018, 0.046)	0.006	0.004
<b>Informal Language</b>					
Assent	了, 是, 对	le, yes, correct	0.043 (0.024, 0.062)	0.020	0.010
Nonfluencies	就是, 啊, 那	just is, what, that	0.031 (0.016, 0.046)	0.010	0.008
<b>Personal Concerns</b>					
Work	工作, 需要, 努力	jobs, need, work hard	0.039 (0.025, 0.053)	0.047	0.044
Money	元, 经济, 买	yuan, economic, buy	0.023 (0.008, 0.038)	0.032	0.030
<b>Pronouns</b>					
They	他们, 她们	they, they	0.405 (0.034, 0.775)	0.612	0.071
We	大家, 咱, 我们	everyone, we, we	0.026 (0.006, 0.046)	0.013	0.012
<b>Relativity</b>					
Time	时候, 后, 月	when, after, month	0.026 (0.014, 0.038)	0.001	0.001
Relativity	在, 大, 到	in, big, to	0.018 (0.005, 0.030)	0.010	0.008
Motion	到, 上, 去	to, on, go to	0.016 (0.003, 0.029)	0.002	0.001
<b>Social Processes</b>					
Family	孩子, 父母, 家庭	child, parents, family	0.018 (0.004, 0.033)	0.005	0.004
<b>Tenses</b>					
Tenses	了, 中, 着	le, in, ongoing	0.064 (0.045, 0.084)	0.016	0.005
Progressive tense	了, 已经, 已	le, already, already	0.048 (0.030, 0.065)	0.013	0.005
Future tense	将, 看, 后	will, look, after	0.037 (0.023, 0.050)	0.004	0.003

Table 4: List of top rural LIWC categories and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Category	Top Words in Category	Top Words (Translated)	$\beta_1$	$R_c^2$	$R_m^2$
<b>Affective Processes</b>					
Affect	压力, 对, 好	pressure, correct, good	-0.088 (-0.111, -0.064)	0.034	0.014
Positive emotions	好, 爱, 快乐	good, love, happy	-0.071 (-0.091, -0.051)	0.027	0.015
Negative emotions	压力, 负担, 疲惫	pressure, burden, exhausted	-0.070 (-0.092, -0.048)	0.022	0.006
Sadness	放弃, 累, 痛苦	give up, tired, pain	-0.043 (-0.062, -0.023)	0.014	0.004
Anxiety	压力, 烦恼, 焦虑	pressure, upset, anxiety	-0.030 (-0.053, -0.008)	0.018	0.002
Inhibition	等, 压抑, 保持	wait, depressed, maintain	-0.022 (-0.036, -0.008)	0.006	0.003
<b>Biological Processes</b>					
Biological processes	疲惫, 爱, 吃	exhausted, love, eat	-0.048 (-0.064, -0.032)	0.011	0.005
Health	疲惫, 生命, 健康	exhausted, life, health	-0.041 (-0.056, -0.026)	0.006	0.002
Sexual	爱, 女人, 欲望	love, woman, desire	-0.032 (-0.051, -0.014)	0.010	0.005
Body	感觉, 生命, 身体	feel, life, body	-0.028 (-0.043, -0.013)	0.006	0.003
<b>Cognitive Processes</b>					
Discrepancy	会, 要, 能	will, want, can	-0.064 (-0.084, -0.045)	0.017	0.006
Tentative	可以, 想, 如果	can, think, if	-0.027 (-0.047, -0.007)	0.013	0.002
Causation	让, 因为, 所以	let, because, so	-0.025 (-0.041, -0.009)	0.008	0.003
Cognitive mechanisms	了, 就, 不	le, then, no	-0.025 (-0.042, -0.007)	0.011	0.003
Certainty	大家, 真的, 每天	everyone, really, every day	-0.019 (-0.033, -0.005)	0.007	0.004
<b>Function Words</b>					
Auxiliary verbs	要, 能, 可以	want, can, may	-0.050 (-0.068, -0.032)	0.014	0.005
Multifunction	的, 是, 有	of, yes, have	-0.048 (-0.066, -0.029)	0.012	0.003
Negations	不, 没有, 不要	no, none, don't	-0.037 (-0.054, -0.019)	0.012	0.004
Conjunctions	就, 和, 也	then, and, also	-0.032 (-0.049, -0.016)	0.009	0.003
Quantifiers	多, 大, 更	many, big, more	-0.013 (-0.026, 0.000)	0.002	0.001
<b>Perceptual Processes</b>					
Perceptual processes	说, 沉重, 快乐	say, heavy, happy	-0.042 (-0.056, -0.028)	0.010	0.007
See	视频, 美好, 注意	video, beautiful, note	-0.034 (-0.052, -0.016)	0.010	0.004
Feel	沉重, 感觉, 皮肤	heavy, feel, skin	-0.024 (-0.039, -0.009)	0.005	0.003
<b>Personal Concerns</b>					
Achievement	工作, 需要, 努力	jobs, need, work hard	-0.033 (-0.051, -0.015)	0.026	0.018
Home	家庭, 睡, 睡觉	family, sleep, go to bed	-0.032 (-0.048, -0.016)	0.004	0.001
Leisure	容易, 健康, 喝	easy, health, drink	-0.028 (-0.043, -0.013)	0.005	0.001
<b>Pronouns</b>					
You	你, 您, 祢	you, you, you	-0.055 (-0.075, -0.036)	0.018	0.007
Pronouns	你, 我, 人	you, I, people	-0.047 (-0.067, -0.028)	0.028	0.018
Impersonal pronouns	人, 它, 那	people, it, that	-0.042 (-0.058, -0.026)	0.008	0.003
Personal pronouns	你, 我, 自己	you, I, oneself	-0.039 (-0.058, -0.020)	0.028	0.018
She/He	他, 她, 人家	he, she, people	-0.027 (-0.051, -0.004)	0.018	0.003
I	我, 自己, 人家	I, oneself, people	-0.018 (-0.036, -0.001)	0.023	0.015

## Phrases

Table 5: List of top urban phrases out of the top 100 most frequent occurring urban phrases and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Phrase	Phrase (Translated)	$\beta_1$	$R_c^2$	$R_m^2$
元	yuan	0.100 (0.063, 0.136)	0.017	0.008
教育	education	0.087 (0.048, 0.126)	0.007	0.007
吃饭	eat	0.070 (0.031, 0.109)	0.015	0.011
穿	wear	0.070 (0.032, 0.107)	0.015	0.012
啊!	what!	0.068 (0.038, 0.098)	0.008	0.007
么	what	0.063 (0.034, 0.092)	0.017	0.015
辛苦	hard	0.056 (0.018, 0.094)	0.021	0.012
经济	economic	0.056 (0.018, 0.094)	0.021	0.016
儿子	son	0.055 (0.012, 0.099)	0.006	0.003
解决	solve	0.054 (0.013, 0.096)	0.015	0.007
您	you	0.054 (0.013, 0.095)	0.012	0.002
话	words	0.052 (0.021, 0.084)	0.013	0.010
一点	a little	0.052 (0.024, 0.079)	0.022	0.016
地方	locality	0.051 (0.021, 0.081)	0.005	0.003
家人	family	0.051 (0.011, 0.091)	0.012	0.005
得到	get	0.050 (0.017, 0.083)	0.014	0.003
都有	both have	0.050 (0.017, 0.083)	0.012	0.006
休息	rest	0.049 (0.018, 0.081)	0.010	0.007
手机	cell phone	0.049 (0.009, 0.089)	0.012	0.006
力量	power	0.049 (0.013, 0.085)	0.012	0.005
都不	neither	0.048 (0.010, 0.087)	0.017	0.009
真是	really	0.048 (0.011, 0.085)	0.018	0.013
压力很大	so much pressure	0.047 (0.010, 0.085)	0.012	0.002
由	by	0.047 (0.009, 0.086)	0.014	0.004
看看	take a look	0.047 (0.012, 0.082)	0.013	0.005
要求	claim	0.047 (0.011, 0.082)	0.014	0.006
医生	doctors	0.047 (0.004, 0.089)	0.004	0.003
北京	beijing	0.047 (0.010, 0.083)	0.013	0.003
一年	one year	0.046 (0.010, 0.083)	0.006	0.003
恐惧	fear	0.046 (0.001, 0.091)	0.013	0.011
受	receive	0.046 (0.005, 0.087)	0.035	0.021
毫无	nothing	0.045 (0.016, 0.075)	0.008	0.004
大学	the university	0.045 (0.007, 0.083)	0.006	0.002
样子	look like	0.045 (0.005, 0.085)	0.011	0.008
各种	various	0.045 (0.014, 0.075)	0.017	0.008
找	find	0.045 (0.016, 0.073)	0.015	0.006
跑	run	0.043 (0.002, 0.084)	0.019	0.010
目前	currently	0.043 (0.007, 0.078)	0.005	0.002
家里	home	0.042 (0.006, 0.078)	0.012	0.007
活动	activity	0.042 (0.003, 0.080)	0.015	0.001

Table 6: List of top rural phrases out of the top 100 most frequent occurring rural phrases and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Phrase	Phrase (Translated)	$\beta_1$	$R_c^2$	$R_m^2$
就算	even if	-0.176 (-0.243, -0.110)	0.151	0.041
选	selected	-0.159 (-0.229, -0.088)	0.127	0.026
真	true	-0.137 (-0.195, -0.079)	0.141	0.036
有机会	have the opportunity	-0.133 (-0.192, -0.074)	0.081	0.026
也要	also want	-0.129 (-0.194, -0.065)	0.147	0.032
每次	each	-0.127 (-0.195, -0.059)	0.151	0.022
不了	no more	-0.122 (-0.180, -0.064)	0.111	0.015
看不到	can not see	-0.106 (-0.167, -0.044)	0.077	0.014
获得	obtain	-0.104 (-0.152, -0.056)	0.052	0.012
便	then	-0.098 (-0.146, -0.051)	0.071	0.023
即使	even if	-0.096 (-0.142, -0.051)	0.052	0.010
比你	than you	-0.092 (-0.152, -0.032)	0.064	0.008
眼泪	tears	-0.090 (-0.148, -0.031)	0.094	0.019
承诺	committed to	-0.083 (-0.139, -0.026)	0.061	0.014
上班	go to work	-0.082 (-0.142, -0.023)	0.081	0.018
依然	still	-0.082 (-0.132, -0.033)	0.057	0.008
至少	at least	-0.078 (-0.134, -0.022)	0.072	0.019
测试	test	-0.074 (-0.132, -0.016)	0.026	0.007
并	and	-0.073 (-0.105, -0.042)	0.034	0.008
昨天	yesterday	-0.071 (-0.123, -0.018)	0.064	0.008
房子	house	-0.067 (-0.131, -0.003)	0.051	0.007
机会	opportunity	-0.064 (-0.104, -0.025)	0.042	0.007
错	wrong	-0.062 (-0.116, -0.009)	0.048	0.004
努力	work hard	-0.058 (-0.092, -0.023)	0.029	0.003
你	you	-0.056 (-0.076, -0.037)	0.018	0.007
太多	too many	-0.056 (-0.104, -0.009)	0.066	0.007
有多	how much	-0.056 (-0.102, -0.009)	0.025	0.006
爱	love	-0.055 (-0.082, -0.027)	0.021	0.004
则	then	-0.054 (-0.095, -0.013)	0.016	0.004
让	let	-0.054 (-0.077, -0.030)	0.020	0.004
更多	more	-0.053 (-0.095, -0.012)	0.051	0.004
的	of	-0.053 (-0.072, -0.034)	0.014	0.004
焦虑	anxiety	-0.051 (-0.096, -0.007)	0.056	0.017
因为	because	-0.050 (-0.077, -0.023)	0.024	0.007
沉重的	heavy	-0.048 (-0.081, -0.015)	0.024	0.003
笑	laugh	-0.047 (-0.081, -0.013)	0.026	0.006
充满	full	-0.047 (-0.090, -0.004)	0.019	0.003
比	compare	-0.047 (-0.077, -0.016)	0.024	0.003
更好	better	-0.045 (-0.089, -0.002)	0.025	0.007
无论	regardless	-0.045 (-0.084, -0.006)	0.013	0.010

## Supplementary Material 2: Weibo Language Analyses on Provinces

We also replicated the language analyses for Weibo users at the province level, where we have a continuous urbanization outcome, namely percentage of individuals in urban areas per province. The model is defined in Eq. 1:

$$\begin{aligned} Feature_i = & \beta_1 * Province\%Urban \\ & + \beta_2 * Province_{LogGDP} \\ & + \beta_3 * User_{Gender} + \phi + \epsilon \end{aligned} \quad (1)$$

where  $\phi$  is the random effect for one of the 31 provinces and  $\epsilon$  is the error term. We used Benjamini-Hochberg p-correction and report  $\beta_1$  for all language features where correlations are significant at  $p < 0.05$ .

### LDA Topics

Table 7: List of top urban topics and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected. Top words are sorted by conditional probability,  $P(Topic|Word)$ , from the LDA model

Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
经济, 中国, 发展	economy, china, development	0.097 (0.026, 0.168)	0.052	0.049
银行, 公司, 亿元	bank, company, billion	0.097 (0.037, 0.157)	0.034	0.033
经济, 美国, 美元	economic, united states, usd	0.095 (0.037, 0.153)	0.027	0.026
企业, 政府, 国家	enterprise, government, country	0.095 (0.033, 0.157)	0.053	0.051
媒体, 称, 记者	media, claim, journalist	0.094 (0.018, 0.169)	0.033	0.031
中国, 美国, 国家	china, united states, country	0.091 (0.023, 0.160)	0.042	0.040
市场, a股, 资金	market, a share, funds	0.088 (0.023, 0.152)	0.023	0.021
价格, 增长, 行业	price, increase, industry	0.086 (0.021, 0.152)	0.039	0.037
吨, 库存, 价格	ton, in stock, price	0.080 (0.028, 0.131)	0.026	0.025
今日, 反弹, 创业板	today, rebound, gem	0.079 (0.015, 0.142)	0.008	0.007
公司, 产品, 企业	company, product, enterprise	0.079 (0.006, 0.151)	0.037	0.035
中国, 显示, 我国	china, display, our country	0.078 (0.007, 0.149)	0.043	0.041
突破, 线, 趋势	breakthrough, line, trend	0.070 (0.009, 0.131)	0.012	0.010
支撑, 上方, 黄金	support, above, gold	0.070 (0.001, 0.139)	0.008	0.006
板块, 个股, 反弹	plate, individual stocks, rebound	0.067 (0.010, 0.125)	0.005	0.004
市场, 指数, 震荡	market, index, shock	0.065 (0.002, 0.127)	0.009	0.008
医生, 医院, 患者	doctors, hospital, patient	0.058 (0.019, 0.098)	0.004	0.004
顶住, 对手, 能力	withstand, opponent, ability	0.047 (0.005, 0.089)	0.007	0.006

Table 8: List of top rural topics and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
生活, 每天, 方式	life, every day, the way	-0.152 (-0.30, -0.004)	0.025	0.011
越, 少, 简单	more, less, simple	-0.139 (-0.212, -0.066)	0.007	0.005
人生, 也许, 痛苦	life, maybe, pain	-0.134 (-0.236, -0.032)	0.012	0.007
心灵, 释放, 属于	soul, release, belong	-0.131 (-0.195, -0.066)	0.006	0.004
理解, 微笑, 面对	understanding, smile, face	-0.119 (-0.213, -0.024)	0.011	0.007
人生, 快乐, 放下	life, happy, lay down	-0.116 (-0.206, -0.026)	0.009	0.005
越来越, 变得, 不再	more and more, become, no longer	-0.114 (-0.225, -0.004)	0.014	0.007
努力, 坚持, 希望	work hard, persist, hope	-0.108 (-0.201, -0.016)	0.009	0.005
自由, 欲望, 内心	freedom, desire, heart	-0.108 (-0.189, -0.027)	0.008	0.005
生活, 享受, 快乐	life, enjoy, happy	-0.108 (-0.194, -0.022)	0.008	0.004
思念, 心里, 心中	miss, in the heart, in mind	-0.107 (-0.197, -0.018)	0.011	0.007
爱情, 感情, 婚姻	love, attachment, marriage	-0.107 (-0.191, -0.024)	0.012	0.008
不会, 希望, 现在	will not, hope, now	-0.101 (-0.197, -0.006)	0.016	0.011
成功, 改变, 能力	success, change, ability	-0.098 (-0.195, -0.001)	0.012	0.007
觉得, 苦, 路	feel, bitter, road	-0.095 (-0.159, -0.032)	0.007	0.006
情绪, 表达, 情感	emotion, expression, affection	-0.090 (-0.178, -0.003)	0.006	0.002
累, 真的, 不想	tired, really, don't want	-0.090 (-0.155, -0.026)	0.014	0.012
不要, 重要, 特别	don't, important, especially	-0.087 (-0.156, -0.018)	0.003	0.001
不能, 承受, 责任	can't, bear, responsibility	-0.083 (-0.164, -0.001)	0.007	0.004
事, 事情, 很多	thing, thing, a lot of	-0.078 (-0.139, -0.017)	0.012	0.011
一天, 忙, 休息	one day, busy, rest	-0.075 (-0.129, -0.020)	0.006	0.005
出现, 症状, 疼痛	appear, symptom, pain	-0.073 (-0.141, -0.005)	0.004	0.002
放下, 抱怨, 快乐	let go, complain, happy	-0.071 (-0.129, -0.013)	0.003	0.002
习惯, 觉得, 是不是	habit, feel, whether	-0.070 (-0.115, -0.024)	0.002	0.002
心情, 一天, 上班	mood, one day, go to work	-0.065 (-0.114, -0.016)	0.005	0.005
感觉, 空间, 轻松	feel, space, relaxed	-0.061 (-0.108, -0.014)	0.002	0.002
一点, 现在, 不能	a little, now, can't	-0.060 (-0.104, -0.016)	0.006	0.006
面对, 现实, 事	face, reality, thing	-0.050 (-0.099, -0.001)	0.002	0.001



## LIWC Categories

Table 9: List of top urban LIWC categories and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Category	Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
Money	元, 经济, 买	yuan, economic, buy	0.095 (0.032, 0.159)	0.033	0.031
Work	工作, 需要, 努力	jobs, need, work hard	0.075 (0.013, 0.138)	0.045	0.044
Prepend	上, 中, 下	on, in, under	0.056 (0.015, 0.098)	0.005	0.005

Table 10: List of top rural LIWC categories and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Category	Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
Affect	压力, 对, 好	pressure, correct, good	-0.165 (-0.300, -0.031)	0.023	0.012
Positive emotions	好, 爱, 快乐	good, love, happy	-0.144 (-0.258, -0.031)	0.022	0.014
Discrepancy	会, 要, 能	will, want, can	-0.143 (-0.240, -0.046)	0.012	0.007
You	你, 您, 你	you, you, you	-0.142 (-0.239, -0.046)	0.013	0.008
Negations	不, 没有, 不要	no, none, don't	-0.128 (-0.220, -0.036)	0.011	0.007
Sadness	放弃, 累, 痛苦	give up, tired, pain	-0.123 (-0.204, -0.041)	0.008	0.005
Negative emotions	压力, 负担, 疲惫	pressure, burden, exhausted	-0.120 (-0.220, -0.019)	0.010	0.004
Pronouns	你, 我, 人	you, I, people	-0.119 (-0.210, -0.029)	0.023	0.018
Humans	人, 自己, 孩子	people, oneself, child	-0.113 (-0.188, -0.038)	0.006	0.003
Impersonal pronouns	人, 它, 那	people, it, that	-0.107 (-0.180, -0.034)	0.007	0.004
Exclusive	就, 不, 没有	then, no, none	-0.103 (-0.177, -0.029)	0.008	0.006
Personal pronouns	你, 我, 自己	you, I, oneself	-0.099 (-0.187, -0.011)	0.022	0.018
Cognitive mechanisms	了, 就, 不	le, then, no	-0.097 (-0.164, -0.030)	0.006	0.003
Auxiliary verbs	要, 能, 可以	want, can, can	-0.094 (-0.175, -0.013)	0.008	0.005
Fillers	就, 就是, 等等	on, just is, and so on	-0.090 (-0.148, -0.032)	0.008	0.006
Biological processes	疲惫, 爱, 吃	exhausted, love, eat	-0.087 (-0.166, -0.009)	0.008	0.005
Verbs	是, 在, 有	yes, in, have	-0.079 (-0.152, -0.006)	0.005	0.002
Adverbs	就, 不, 也	then, no, also	-0.079 (-0.126, -0.032)	0.016	0.016
Conjunctions	就, 和, 也	then, and, also	-0.076 (-0.142, -0.011)	0.004	0.002
Social processes	你, 人, 自己	you, people, oneself	-0.075 (-0.138, -0.013)	0.006	0.005
Perceptual processes	说, 沉重, 快乐	say, heavy, happy	-0.073 (-0.115, -0.031)	0.006	0.006
I	我, 自己, 人家	I, oneself, people	-0.073 (-0.144, -0.001)	0.018	0.015
Function words	了, 不, 多	le, no, many	-0.071 (-0.119, -0.022)	0.003	0.002
Home	家庭, 睡, 睡觉	family, sleep, goto bed	-0.066 (-0.122, -0.010)	0.002	0.001
Health	疲惫, 生命, 健康	exhausted, life, health	-0.063 (-0.119, -0.007)	0.002	0.001
Ingestion	吃, 喝, 食物	eat, drink, food	-0.061 (-0.122, -0.001)	0.002	0.001
Feel	沉重, 感觉, 皮肤	heavy, feel, skin	-0.054 (-0.099, -0.008)	0.003	0.002
Present tense	中, 着, 现在	in, ongoing, now	-0.029 (-0.052, -0.005)	0.000	0.000

## Supplementary Material 3: Weibo Language Analyses With Post-stratification

### LDA Topics

Table 11: List of top urban topics and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected. Top words are sorted by conditional probability,  $P(\text{Topic}|\text{Word})$ , from the LDA model

Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
媒体, 称, 记者	media, claim, journalist	0.042 (0.025, 0.059)	0.180	0.172
表示, 很大, 毫无	means, very big, nothing	0.040 (0.026, 0.055)	0.076	0.072
中国, 美国, 国家	china, united states, country	0.037 (0.020, 0.053)	0.147	0.140
大盘, 附近, 昨天	market index, nearby, yesterday	0.034 (0.019, 0.049)	0.082	0.078
觉得, 很多, 之后	feel, a lot of, afterwards	0.034 (0.017, 0.051)	0.221	0.213
中国, 显示, 我国	china, display, our country	0.034 (0.018, 0.050)	0.183	0.177
板块, 个股, 反弹	plate, individual stocks, rebound	0.031 (0.017, 0.044)	0.063	0.061
中国, 社会, 国家	china, society, country	0.030 (0.012, 0.048)	0.179	0.169
价格, 增长, 行业	price, increase, industry	0.029 (0.015, 0.044)	0.121	0.117
学生, 高考, 学习	student, college entrance exam, learn	0.029 (0.015, 0.043)	0.056	0.053
支撑, 上方, 黄金	support, above, gold	0.026 (0.012, 0.041)	0.050	0.046
经济, 美国, 美元	economic, united states, usd	0.026 (0.013, 0.039)	0.074	0.072
今日, 反弹, 创业板	today, rebound, gem	0.026 (0.011, 0.040)	0.057	0.053
经济, 中国, 发展	economy, china, development	0.026 (0.010, 0.041)	0.135	0.130
吨, 库存, 价格	ton, in stock, price	0.024 (0.011, 0.036)	0.087	0.085
银行, 公司, 亿元	bank, company, billion	0.024 (0.010, 0.038)	0.084	0.081
黄金, 原油, 上方	gold, crude, above	0.023 (0.008, 0.037)	0.058	0.054
市场, a股, 资金	market, a share, funds	0.020 (0.006, 0.034)	0.091	0.088
工作, 员工, 公司	jobs, employee, company	0.020 (0.004, 0.035)	0.105	0.100
医生, 医院, 患者	doctors, hospital, patient	0.019 (0.005, 0.032)	0.064	0.061
大盘, 反弹, 日线	stock market, rebound, daily line	0.019 (0.004, 0.033)	0.068	0.064
顶住, 对手, 能力	withstand, opponent, ability	0.018 (0.004, 0.032)	0.092	0.088
企业, 政府, 国家	enterprise, government, country	0.018 (0.002, 0.034)	0.152	0.146
突破, 线, 趋势	breakthrough, line, trend	0.018 (0.003, 0.032)	0.062	0.059
家庭, 年轻人, 房子	family, young people, house	0.016 (0.000, 0.031)	0.141	0.135
支撑, 高, 附近	support, high, nearby	0.015 (0.001, 0.029)	0.082	0.080
市场, 指数, 震荡	market, index, shock	0.014 (0.001, 0.027)	0.055	0.052

Table 12: List of top rural topics and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
生活, 每天, 方式	life, every day, the way	-0.090 (-0.113, -0.067)	0.093	0.074
思念, 心里, 心中	miss, in the heart, in mind	-0.067 (-0.087, -0.047)	0.130	0.118
心情, 放松, 情绪	mood, relax, emotion	-0.064 (-0.086, -0.042)	0.111	0.095
人生, 快乐, 放下	life, happy, lay down	-0.059 (-0.076, -0.041)	0.076	0.068
生活, 享受, 快乐	life, enjoy, happy	-0.055 (-0.073, -0.037)	0.075	0.066
食物, 健康, 增加	food, health, increase	-0.054 (-0.072, -0.035)	0.059	0.049
越来越, 变得, 不再	more and more, become, no longer	-0.053 (-0.071, -0.035)	0.086	0.077
可能, 容易, 最大	may, easy, maximum	-0.052 (-0.070, -0.035)	0.045	0.037
不能, 承受, 责任	can't, bear, responsibility	-0.052 (-0.067, -0.036)	0.083	0.077
爱情, 感情, 婚姻	love, attachment, marriage	-0.050 (-0.068, -0.032)	0.077	0.067
情绪, 表达, 情感	mood, expression, affection	-0.050 (-0.069, -0.030)	0.112	0.100
人生, 也许, 痛苦	life, maybe, pain	-0.049 (-0.067, -0.031)	0.156	0.147
成功, 改变, 能力	success, change, ability	-0.049 (-0.066, -0.033)	0.169	0.161
心灵, 释放, 属于	soul, release, belong	-0.049 (-0.068, -0.030)	0.083	0.073
理解, 微笑, 面对	understanding, smile, face	-0.047 (-0.065, -0.029)	0.111	0.103
自由, 欲望, 内心	freedom, desire, heart	-0.047 (-0.063, -0.031)	0.101	0.095
努力, 坚持, 希望	work hard, persist, hope	-0.045 (-0.062, -0.027)	0.037	0.028
越, 少, 简单	more, less, simple	-0.044 (-0.063, -0.025)	0.061	0.050
运动, 身体, 动作	movement, body, action	-0.042 (-0.066, -0.019)	0.064	0.045
身体, 作用, 人体	body, effect, human body	-0.042 (-0.061, -0.022)	0.077	0.065
肌肤, 皮肤, 使用	skin, skin, use	-0.041 (-0.060, -0.022)	0.021	0.011
身体, 健康, 睡眠	body, health, sleep	-0.041 (-0.056, -0.025)	0.078	0.073
缓解, 减轻, 帮助	ease, lighten, help	-0.041 (-0.062, -0.019)	0.111	0.095
不会, 希望, 现在	will not, hope, now	-0.037 (-0.055, -0.019)	0.050	0.042
导致, 原因, 造成	resulting in, reason, cause	-0.037 (-0.055, -0.018)	0.062	0.053
注意, 最好, 建议	note, best, suggest	-0.036 (-0.054, -0.019)	0.104	0.095
出现, 症状, 疼痛	appear, symptom, pain	-0.035 (-0.053, -0.017)	0.068	0.059
面对, 现实, 事	face, reality, thing	-0.034 (-0.051, -0.017)	0.054	0.047
感觉, 空间, 轻松	feel, space, relaxed	-0.033 (-0.046, -0.020)	0.090	0.088
需要, 时间, 事情	need, time, thing	-0.032 (-0.047, -0.017)	0.171	0.165
一天, 忙, 休息	one day, busy, rest	-0.031 (-0.046, -0.016)	0.078	0.074
快乐, 总是, 活着	happy, always, alive	-0.028 (-0.044, -0.011)	0.067	0.061
心理, 焦虑, 情绪	psychology, anxiety, emotion	-0.028 (-0.042, -0.013)	0.076	0.072
放下, 抱怨, 快乐	let go, complain, happy	-0.026 (-0.042, -0.009)	0.036	0.029
选择, 生活, 人生	select, life, life	-0.025 (-0.041, -0.010)	0.203	0.197
完成, 目标, 计划	accomplish, goal, plan	-0.023 (-0.037, -0.009)	0.140	0.137
影响, 导致, 造成	influences, resulting in, cause	-0.023 (-0.040, -0.006)	0.149	0.141
很多, 其实, 真正	a lot of, in fact, real	-0.020 (-0.036, -0.004)	0.169	0.163
累, 真的, 不想	tired, really, don't want	-0.020 (-0.037, -0.002)	0.065	0.057
工作, 每天, 职场	jobs, every day, workplace	-0.017 (-0.031, -0.003)	0.115	0.112
付出, 生命, 成长	give, life, growing up	-0.017 (-0.032, -0.002)	0.038	0.034
关注, 动力, 低	attention, power, low	-0.016 (-0.030, -0.002)	0.019	0.017

## LIWC Categories

Table 13: List of top urban LIWC categories and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Category	Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
They	他, 她	they, they	0.346 (0.016, 0.676)	0.551	0.201
Tense	了, 中, 着	le, in, ongoing	0.035 (0.016, 0.054)	0.326	0.314
Work	工作, 需要, 努力	jobs, need, work hard	0.034 (0.019, 0.050)	0.303	0.296
Progressive tense	了, 已经, 已	le, already, already	0.026 (0.009, 0.044)	0.190	0.181
Future tense	将, 看, 后	will, look, after	0.026 (0.011, 0.041)	0.182	0.178
Money	元, 经济, 买	yuan, economic, buy	0.023 (0.008, 0.037)	0.167	0.164
Nonfluencies	就是, 啊, 那	just is, what, that	0.022 (0.008, 0.037)	0.096	0.094
We	大家, 咱, 我	everyone, we, we	0.021 (0.001, 0.042)	0.083	0.081
Specifying articles	上, 下, 前	on, under, before	0.021 (0.006, 0.036)	0.209	0.205
Time	时候, 后, 月	time, after, month	0.016 (0.001, 0.030)	0.366	0.361

Table 14: List of top rural LIWC categories and standardized effect sizes ( $\beta_1$  from equation 1) with confidence intervals with analysis on the province level. All correlations are significant at  $p < .05$ , two-tailed t-test, Benjamini-Hochberg corrected.

Category	Top words in topic	Top words (translated)	$\beta_1$	$R_c^2$	$R_m^2$
Affect	压力, 对, 好	pressure, correct, good	-0.063 (-0.080, -0.046)	0.409	0.399
Positive emotions	好, 爱, 快乐	good, love, happy	-0.057 (-0.074, -0.041)	0.231	0.224
Negative emotions	压力, 负担, 疲惫	pressure, burden, exhausted	-0.055 (-0.073, -0.038)	0.369	0.359
Discrepancy	会, 要, 能	will, want, can	-0.055 (-0.071, -0.039)	0.256	0.249
Biological processes	疲惫, 爱, 吃	exhausted, love, eat	-0.052 (-0.068, -0.037)	0.134	0.129
You	你, 您, 祢	you, you, you	-0.050 (-0.068, -0.032)	0.111	0.102
Auxiliary verbs	要, 能, 可以	want, can, may	-0.047 (-0.063, -0.032)	0.190	0.184
Pronouns	你, 我, 人	you, I, people	-0.045 (-0.061, -0.029)	0.172	0.166
Health	疲惫, 生命, 健康	exhausted, life, health	-0.043 (-0.059, -0.028)	0.131	0.127
Sadness	放弃, 累, 痛苦	give up, tired, pain	-0.043 (-0.062, -0.024)	0.124	0.115
Perceptual processes	说, 沉重, 快乐	say, heavy, happy	-0.040 (-0.054, -0.026)	0.221	0.217
Impersonal pronouns	人, 它, 那	people, it, that	-0.040 (-0.054, -0.025)	0.165	0.161
Personal pronouns	你, 我, 自己	you, I, oneself	-0.038 (-0.055, -0.022)	0.129	0.122
Multifunction	的, 是, 有	of, yes, have	-0.035 (-0.050, -0.020)	0.448	0.442
Body	感觉, 生命, 身体	feel, life, body	-0.034 (-0.049, -0.019)	0.096	0.093
Sexual	爱, 女人, 欲望	love, woman, desire	-0.033 (-0.050, -0.017)	0.087	0.083
Negations	不, 没有, 不要	no, none, don't	-0.033 (-0.048, -0.018)	0.241	0.236
Tentative	可以, 想, 如果	can, think, if	-0.032 (-0.048, -0.015)	0.272	0.264
See	视频, 美好, 注意	video, beautiful, note	-0.030 (-0.047, -0.014)	0.120	0.115
Feel	沉重, 感觉, 皮肤	heavy, feel, skin	-0.030 (-0.043, -0.016)	0.127	0.125
Conjunctions	就, 和, 也	then, and, also	-0.029 (-0.042, -0.016)	0.324	0.320
Leisure	容易, 健康, 喝	easy, health, drink	-0.028 (-0.043, -0.014)	0.159	0.155
Home	家庭, 睡, 睡觉	family, sleep, go to bed	-0.027 (-0.043, -0.012)	0.094	0.092
Anxiety	压力, 烦恼, 焦虑	pressure, upset, anxiety	-0.027 (-0.047, -0.007)	0.250	0.237
Causation	让, 因为, 所以	let, because, so	-0.027 (-0.042, -0.011)	0.267	0.261
Humans	人, 自己, 孩子	people, oneself, child	-0.026 (-0.044, -0.008)	0.197	0.187
She/he	他, 她, 人家	he, she, people	-0.024 (-0.046, -0.003)	0.085	0.073
Cognitive mechanisms	了, 就, 不	le, then, no	-0.024 (-0.038, -0.009)	0.520	0.513
Achievement	工作, 需要, 努力	jobs, need, work hard	-0.023 (-0.039, -0.008)	0.326	0.320
I	我, 自己, 人家	I, oneself, people	-0.022 (-0.038, -0.005)	0.080	0.073
Inhibition	等, 压抑, 保持	wait, depressed, maintain	-0.020 (-0.034, -0.005)	0.227	0.223
Ingestion	吃, 喝, 食物	eat, drink, food	-0.019 (-0.035, -0.003)	0.059	0.055
Certainty	大家, 真的, 每天	everyone, really, every day	-0.018 (-0.032, -0.005)	0.207	0.203
Adverb	就, 不, 也	on, no, also	-0.018 (-0.031, -0.005)	0.301	0.298
Interjunction	的, 了, 也	of, le, also	-0.017 (-0.031, -0.003)	0.463	0.457
Verb	是, 在, 有	yes, in, have	-0.016 (-0.031, -0.002)	0.457	0.451
Social processes	你, 人, 自己	you, people, oneself	-0.015 (-0.028, -0.002)	0.319	0.315
Quantity	多, 大, 更	many, big, more	-0.015 (-0.028, -0.002)	0.273	0.270