Online Appendix
## Cultural Constraints and Policy Implementation: Effects of the
Beijing License Plate Lottery on the Environment

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Appendix A
Distribution of Numbers for All Digits from License Plate Reader
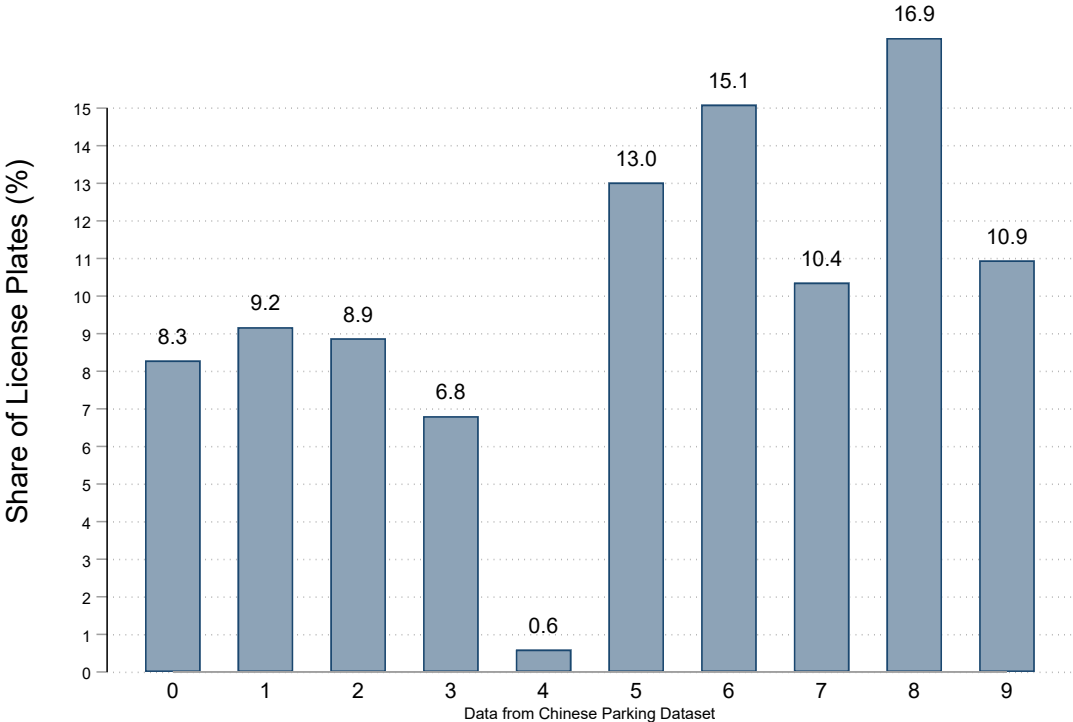
Appendix B: Relationship between Lucky Numbers and Emissions

Dependent Variables	Full Sample				2013		2014		2015		2016	
	CO	NO$_2$	CO	NO$_2$	CO	NO$_2$	CO	NO$_2$	CO	NO$_2$	CO	NO$_2$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lucky number off road	-0.02	-0.641			0.041	0.845	-0.025	-1.688	-0.005	-0.494	-0.056	0.371
	(0.005)	(0.197)			(0.013)	(0.369)	(0.011)	(0.236)	(0.006)	(0.194)	(0.010)	(0.258)
Pair (2,7)			-0.031	-0.792								
			(0.007)	(0.291)								
Pair (3,8)			-0.046	-1.785								
			(0.009)	(0.375)								
Pair (4,9)			-0.064	-3.229								
			(0.009)	(0.272)								
Pair (5,0)			-0.002	-1.261								
			(0.008)	(0.233)								
Station FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day of Week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.166	62.384	2.185	63.491	3.768	94.13	2.01	64.493	2.023	67.62	1.194	41.52
	(0.075)	(1.891)	(0.073)	(1.917)	(0.138)	(3.507)	(0.080)	(2.465)	(0.045)	(1.318)	(0.049)	(1.432)
Observations	9,937	9,937	9,937	9,937	2,632	2,632	2,926	2,926	2,952	2,952	1,427	1,427
R-squared	0.217	0.267	0.217	0.268	0.398	0.366	0.259	0.338	0.345	0.360	0.221	0.315
RME	0.881	24.94	0.881	24.92	0.808	24.82	0.819	24.80	0.890	21.73	0.646	20.67

Robust standard errors, clustered by station, in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Models 1-4 include every non-holiday or weekend daily station observation. Models 5-12 repeat the analysis restricting the analysis to indivdual years.

Appendix C: Lucky Numbers and Pollution over Time

Dependent Variables	Lucky		Pair (1,6)		Pair (3,8)		Pair (4,9)	
	CO	NO²	CO	NO²	CO	NO²	CO	NO²
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Number of road=1	0.246	3.503	0.136	2.981	0.125	2.94	0.115	-0.699
	(0.032)	(1.205)	(0.050)	(2.460)	(0.036)	(1.192)	(0.055)	(1.453)
Months after policy	-0.019	-0.605	-0.021	-0.632	-0.021	-0.628	-0.02	-0.632
	(0.004)	(0.245)	(0.004)	(0.245)	(0.004)	(0.240)	(0.004)	(0.243)
Number*Months	-0.004	-0.054	-0.001*	-0.013	-0.002	-0.047	-0.002	-0.021
	(0.000)	(0.015)	(0.001)	(0.032)	(0.000)	(0.014)	(0.001)	(0.020)
Station FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day of Week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.265	78.761	2.383	80.251	2.388	80.296	2.387	80.937
	(0.243)	(13.012)	(0.233)	(12.949)	(0.232)	(12.631)	(0.236)	(12.806)
Observations	9,937	9,937	9,937	9,937	9,937	9,937	9,937	9,937
R-squared	0.034	0.132	0.033	0.133	0.033	0.132	0.034	0.133
RME	0.979	27.13	0.979	27.12	0.979	27.13	0.979	27.12

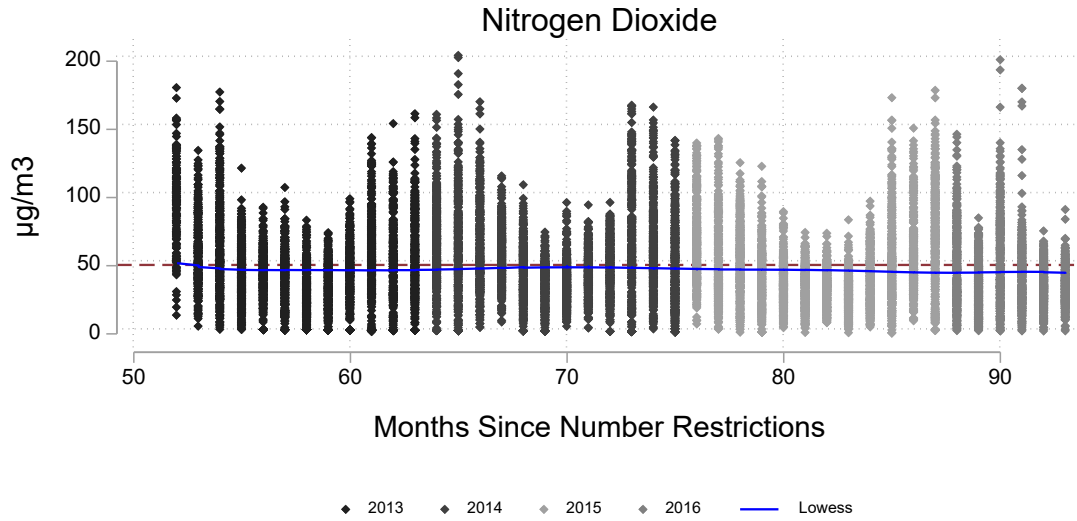Robust standard errors, clustered by station, in parentheses.

Appendix C1
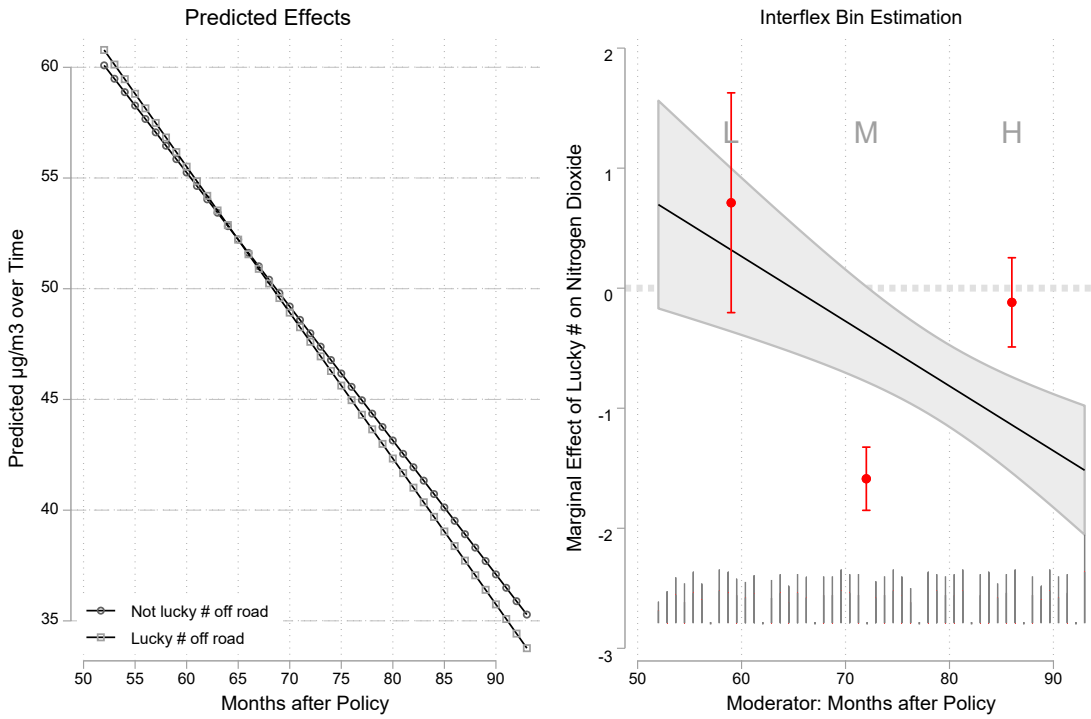Marginal Effects of Lucky Number Pairs on Carbon Monoxide over Time
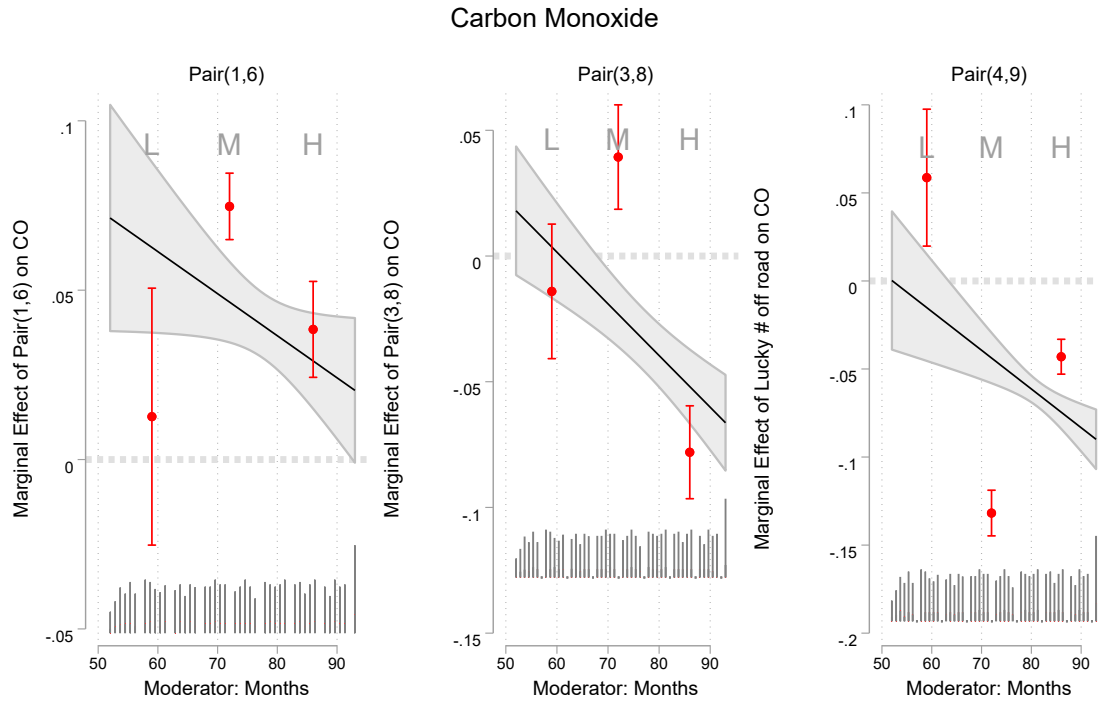
Full regression results available in Online Appendix C. Official CO readings began in January 2013 (i.e., month 50). Marginal effects and 95% CIs of regression with fixed effects for station, day of week, and the historical month. Standard errors clustered by measurement station.

Note: Official N0^2 readings only begin in January 2013 (i.e., month 50). Red line plots sample mean.
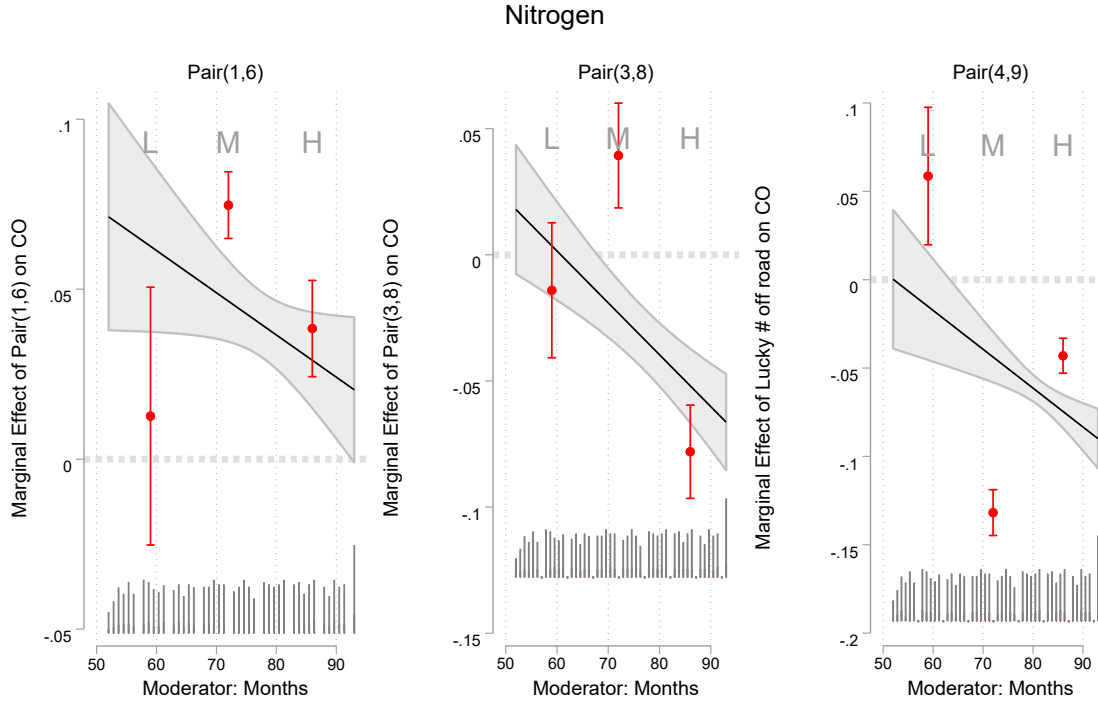
Appendix C3
Trends in Nitrogen Dioxide Emissions over Time

Full regression results available in Online Appendix C. Official N0^2 readings began in January 2013 (i.e., month 50). Regression with fixed effects for station, day of week, and year. Standard errors clustered by measurement station. P-value of Wald test of difference between linear interaction and bin estimator=0.00

Marginal Effects of Lucky Number Pairs on Nitrogen Dioxide over Time

Nitrogen

Full regression results available in Online Appendix C. Official N0^2 readings began in January 2013 (i.e., month 50). Marginal effects and 95% CIs of regression with fixed effects for station, day of week, and the historical month. Standard errors clustered by measurement station

Appendix D: Lucky Numbers and Pollution with Flexible Time Specification

Dependent Variables	Lucky		Pair (1,6)		Pair (3,8)		Pair (4,9)	
	CO	NO$_2$	CO	NO$_2$	CO	NO$_2$	CO	NO$_2$
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Number off road=1	0.051	1.574	0.060	2.465	-0.008	-0.165	0.025	0.106
	(0.014)	(0.445)	(0.017)	(0.770)	(0.014)	(0.430)	(0.023)	(0.388)
Year 2014=1	-0.020	8.750	-0.046	7.066	-0.056	6.794	-0.049	7.608
	(0.037)	(2.927)	(0.036)	(2.909)	(0.038)	(3.007)	(0.036)	(3.107)
Year 2015=1	0.001	1.915	-0.041	0.557	-0.068	-0.036	-0.034	0.728
	(0.043)	(2.024)	(0.044)	(2.036)	(0.044)	(2.095)	(0.042)	(2.089)
Year 2016=1	-0.284	-4.157	-0.407	-6.193	-0.340	-4.872	-0.354	-5.277
	(0.043)	(2.321)	(0.045)	(2.357)	(0.042)	(2.472)	(0.043)	(2.429)
NumberY2014	-0.060	-3.191	-0.054	-1.206	0.000	0.220	-0.037	-3.901
	(0.018)	(0.461)	(0.014)	(0.754)	(0.019)	(0.506)	(0.023)	(0.609)
NumberY2015	-0.097	-3.000	-0.084	-2.272	0.056	0.757	-0.118	-3.015
	(0.014)	(0.429)	(0.018)	(0.828)	(0.016)	(0.398)	(0.023)	(0.638)
NumberY2016	-0.167	-2.592	0.115	2.359	-0.225	-4.300	-0.151	-2.086
	(0.017)	(0.436)	(0.027)	(1.255)	(0.018)	(0.806)	(0.031)	(0.586)
Station FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day of Week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.520	79.400	2.520	79.429	2.520	62.261	2.520	79.429
	(0.093)	(4.773)	(0.093)	(4.772)	(0.093)	(1.929)	(0.093)	(4.772)
Observations	9,937	9,937	9,937	9,937	9,937	9,937	9,937	9,937
R-squared	0.034	0.132	0.033	0.133	0.033	0.267	0.034	0.133
RME	0.979	27.13	0.979	27.12	0.979	24.93	0.979	27.12

Robust standard errors, clustered by station, in parentheses.

Appendix D1

Marginal Effects of Lucky Number Pairs on Carbon Monoxide over Time (Flexible Model)
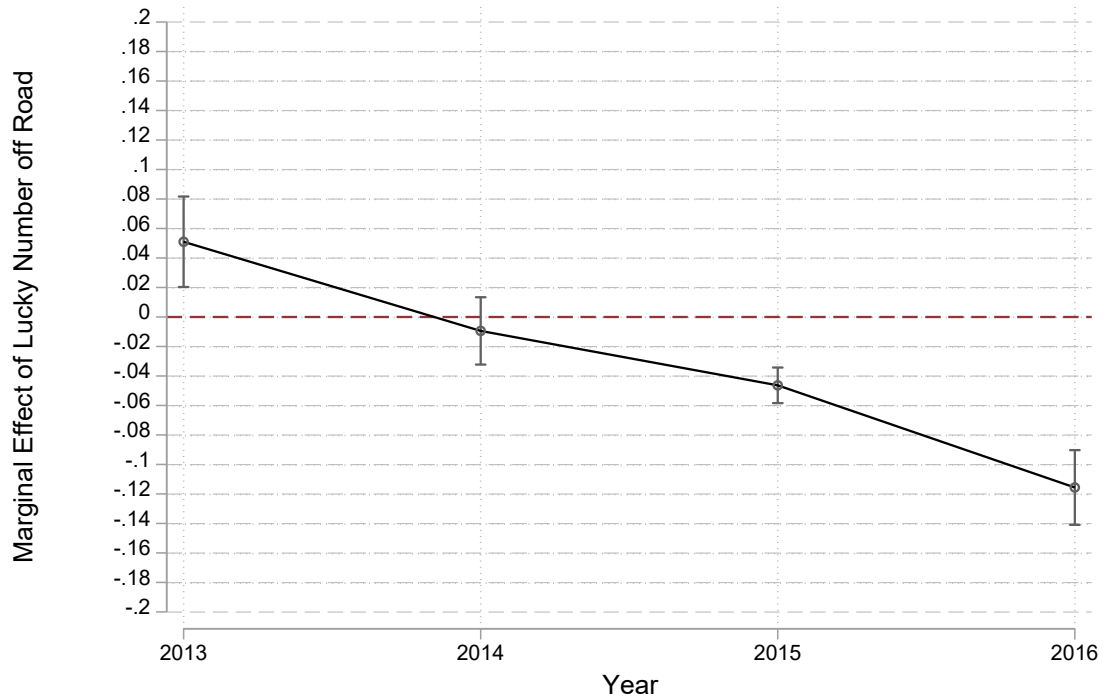
Full regression results available in ***Online Appendix D.*** Official CO readings began in January 2013 95% CIs of regression with interaction between year dummies and lucky number, fixed effects for station, day of week, and month. Standard errors clustered by measurement station.

Appendix D2
Marginal Effects of Lucky Number Pairs on Nitrogen Dioxide over Time (Flexible Model)
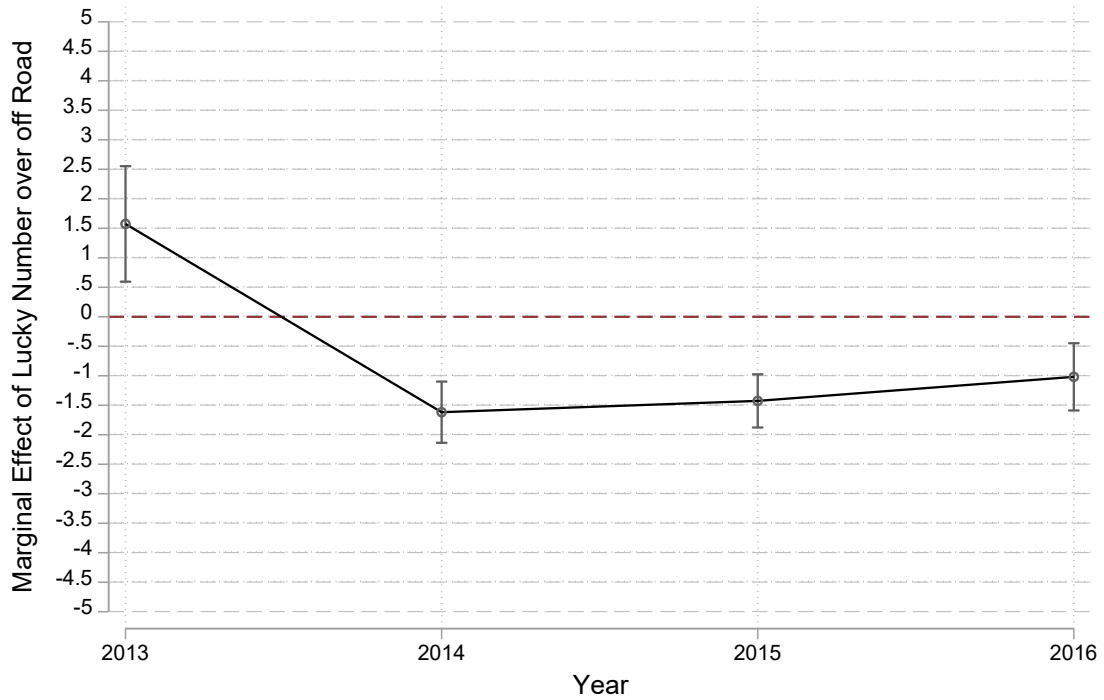
Full regression results available in Online Appendix D. Official NO_2 readings began in January 2013 95% CIs of regression with interaction between year dummies and lucky number, fixed effects for station, day of week, and month. Standard errors clustered by measurement station.

Appendix E: Time Trends Not Affected by Wealth

Dependent Variables	Full Sample CO	Full Sample NO₂	07.00h CO	07.00h NO₂
	(1)	(2)	(3)	(4)
Lucky Number	0.277	4.190	0.413	8.606
	(0.047)	(1.236)	(0.129)	(3.094)
Wealthy Address	0.256	3.666	0.448	0.169
	(0.256)	(12.201)	(0.265)	(11.968)
LuckyWealthy	-0.073	-1.664	-0.137	0.773
	(0.059)	(2.519)	(0.206)	(4.661)
Months after Policy	-0.018	-0.592	-0.035	-1.241
	(0.005)	(0.292)	(0.005)	(0.250)
LuckyMonths	-0.004	-0.062	-0.006	-0.112
	(0.001)	(0.017)	(0.002)	(0.046)
WealthyMonths	-0.003	-0.030	-0.006	0.013
	(0.003)	(0.134)	(0.003)	(0.151)
LuckyWealthyMonths	0.001	0.020	0.002	-0.022
	(0.001)	(0.030)	(0.003)	(0.063)
Station FE	No	No	No	No
Year FE	Yes	Yes	Yes	Yes
Day of Week FE	Yes	Yes	Yes	Yes
Historical Date FE	Yes	Yes	Yes	Yes
Constant	2.532	2.070	3.279	115.801
	(0.407)	(0.316)	(0.322)	(13.513)
Observations	4,136	5,801	9262	9258
R-squared	0.049	0.022	0.0178	0.0324
RMSE	0.993	0.969	1.2359	30.692

Robust standard errors, clustered by station, in parentheses.

Appendix F
Survey Design – Recruitment, Compensation, and Questions

Recruitment, Compensation, and Ethics-Related Principles:

We worked with Qualtrics, who helped us recruit respondents (restricted to Beijing drivers). Voluntary and informed consent was obtained at the beginning of the survey on a tablet. Respondents were informed it was a research study by *redacted* and *redacted* universities. All data was anonymously collected and cannot be matched to individuals. In addition, there was very little risk of harm because there was no experiment component. Moreover, respondents were asked simply questions about their car and beliefs in culturally common household behaviors (e.g., gifting someone a plate of oranges). No politically sensitive questions were asked. The survey took five minutes.

We did not (directly) compensate the respondents. We paid Qualtrics and used their sample frame – which they maintain and use for recruitment. While payment may be part of their relationship with the respondents, it was not specified by us or them. The gave us a non-itemized bill at the end of the survey data collection.

The survey was approved by the IRB at both *redacted* (protocol #) and *redacted* (protocol #).

Survey Questions (in English and Chinese):

1. How many cars are in your household?   _____Cars
   请问您的家庭拥有几辆车？ _____辆
2. Let us talk about your (first) car. What year did you buy the car?   _____
   请问您在哪一年购买您的第一辆车？
3. What is the manufacture year/make/model of the car?
   以下问题均针对第一辆汽车:
   请问您的第一辆汽车：
   Year car manufactured: _____
   出厂年份？
   Make: _____
   厂牌？
   Model: _____
   型号？
4. Is the vehicle a green (electric or hybrid) car?   ___ Yes   ___ No
   请问您的汽车是新能源汽车吗？ （包括纯电动汽车和混合动力汽车） ___是 ___否
5. How many kilometers has the car been driven thus far?   _____km
   请问您汽车的行驶里程是多少？ _____公里/千米
6. What is the last digit of the car?
   请问您汽车车牌号尾号是多少？

1	2	3	4	5	6	7	8	9	0

If respondent does not have a second car, skip to Question 8.

如果没有第二辆汽车，跳到第 8 题

7. Let us now talk about your most recent car purchase. What year did you buy that car? _____
   请问您上次购买汽车是在哪一年？_____

8. What is the manufacture year/make/model of the car?
   以下问题均针对第一辆汽车:

   请问您的第一辆汽车：

   Year car manufactured: _____
   出厂年份？
   Make:　　　　　　_____
   厂牌？
   Model:　　　　　　_____
   型号？

9. Is the vehicle a green (electric or hybrid) car?　___ Yes　___ No
   请问您的汽车是新能源汽车吗？（包括纯电动汽车和混合动力汽车）___是 ___否

10. How many kilometers has the car been driven thus far?　_____km
    请问您汽车的行驶里程是多少？_____公里/千米

11. What is the last digit of the car?
    请问您汽车车牌号尾号是多少？

1	2	3	4	5	6	7	8	9	0

12. Now, let us imagine you need another car. You have won the car lottery, and you can get a new plate. What number would you choose? Remember, Beijing plates are in the following format: in the first four digits, you must have two numbers and two English letters; and your last digit must be a number.
    假设您需要购入一辆新汽车并摇号成功，您的意向车牌号是？_____（车牌号的前四位需有两位英文字母，最后一位是数字）

13. It turns out that number is not available. But something similar is available. Would you accept the following derivatives?

	Yes	No
Same number but plate ends in a 1		
Same number but plate ends in a 2		
Same number but plate ends in a 3		
Same number but plate ends in a 4		
Same number but plate ends in a 5		
Same number but plate ends in a 6		
Same number but plate ends in a 7		

	是	否
Same number but plate ends in an 8		
Same number but plate ends in a 9		
Same number but plate ends in a 0		

如果您的意向车牌号已被占用，请问您是否愿意接受下列相似车牌号？

	是	否
尾号是 1，其余位数相同		
尾号是 2，其余位数相同		
尾号是 3，其余位数相同		
尾号是 4，其余位数相同		
尾号是 5，其余位数相同		
尾号是 6，其余位数相同		
尾号是 7，其余位数相同		
尾号是 8，其余位数相同		
尾号是 9，其余位数相同		
尾号是 0，其余位数相同		

14. Below is a list of behaviors. Identify which behaviors you have done or would be willing to do?

	Yes	No
Give someone a clock.		
Give someone a knife.		
Give someone a plate of oranges.		
Give a bride watermelon seeds.		
Eat pig feet noodles after a traumatic event.		
Eat a pear with your spouse at a wedding.		
Sweep your house on New Year's Eve.		
Wash your hair on New Year's Eve.		

Marry someone with the same last name as you.		
Put a mirror over your front door.		

下列行为中，请问您做过或者愿意去做的有：

	是	否
送给别人一个钟表		
送给别人一把刀		
送给别人一盘橙子		
送给一个新娘一把西瓜子		
在创伤后吃猪脚面		
在婚礼上和你的配偶吃一只梨		
在除夕夜打扫房间		
在除夕夜洗头		
和与你相同姓氏的人结婚		
在房门口放一面镜子		

15. What is your gender? ___ Male ___ Female
    请问您的性别是? __男 __女
16. What year were you born? _____
    请问您的出生年份是? _____
17. In which province were you born? _____
    请问您的出生省份是? _____
18. What was the highest level of education you reached?
    ☐ Elementary
    ☐ High School
    ☐ Bachelors
    ☐ Masters
    ☐ Doctorate
    ☐ Other (Please specify) _____
    请问您受过的最高教育是?
    ☐ 义务教育

☐ 高中

☐ 大学本科

☐ 硕士

☐ 博士

☐ 其他（请具体说明）_____

19. What is your current profession? _____
    请问您现在的职业是? _____

20. Please name the nearest metro station to your home. _____
    请问距离您家最近的地铁站是? _____

21. Please name the nearest metro station to your place of work. _____
    请问距离您工作单位最近的地铁站是? _____

22. Do you have fixed hours for work? ___Yes ___No
    请问您的工作是固定工作时间吗? ___是 ___否

23. If yes, what time do you arrive at work? _____
    如果是，请问您到达工作单位的时间是? _____

24. And what time do you leave work to return home? _____
    请问您离开工作单位的时间是? _____

Appendix G
Summary Statistics for Key Survey Variables

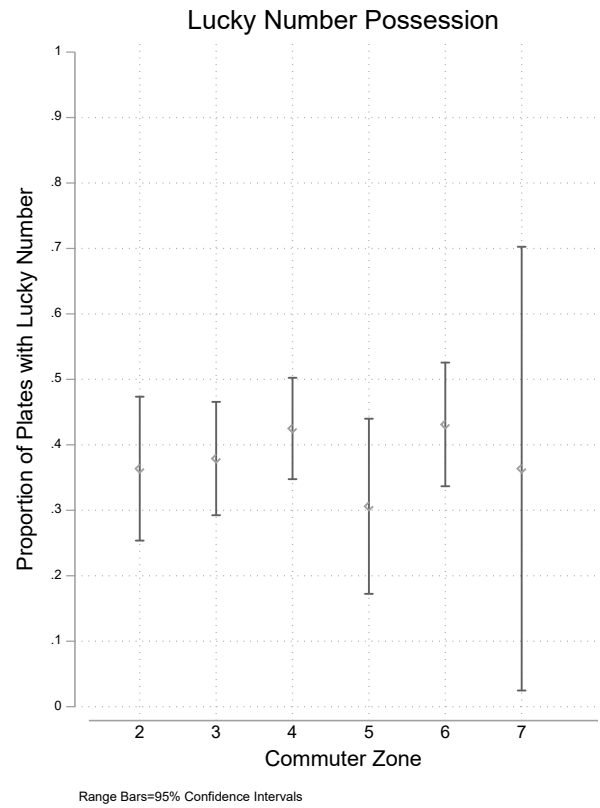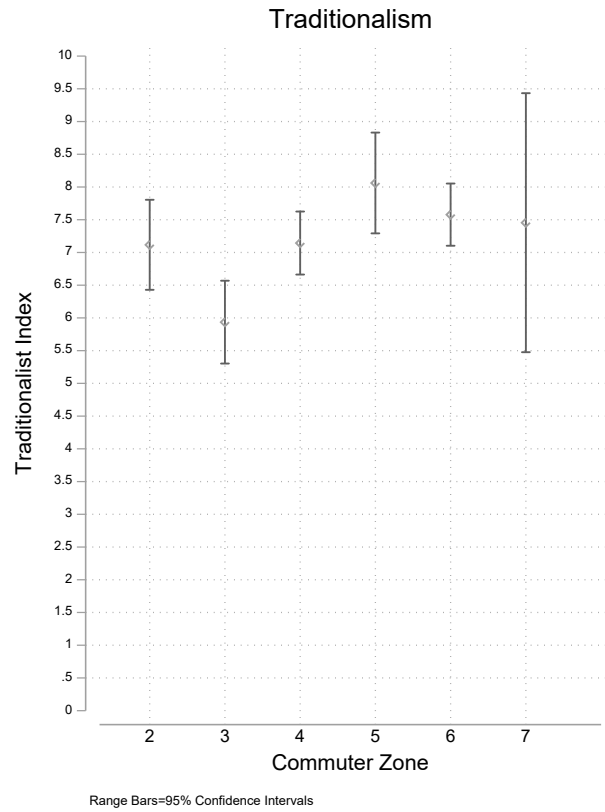|	*N*	*Mean*	*Std. Dev.*	*Min*	*Max*
Lucky last digit=1	1046	0.40	0.49	0	1
Traditionalist index	1046	6.63	3.67	0	10
Education level	1046	2.40	0.75	1	6
Male=1	1046	0.62	0.49	0	1
Age	1046	37.02	7.05	19	125

Appendix H
Distribution of Lucky Numbers by Plate Issue Date from Chinese City Parking Dataset

	2008-2012 {M, N, P}	Post-2012 {Q}
Non-Lucky Number	99 51.8%	52 64.2%
Lucky Number	92 48.2%	29 35.8%

Appendix I
Traditionalist Index and Lucky Number Distribution by Commuter Zone

Traditionalism

Lucky Number Possession

Range Bars=95% Confidence Intervals

Range Bars=95% Confidence Intervals

Appendix J
Distribution for the Age of a Respondent's Car from Survey Data