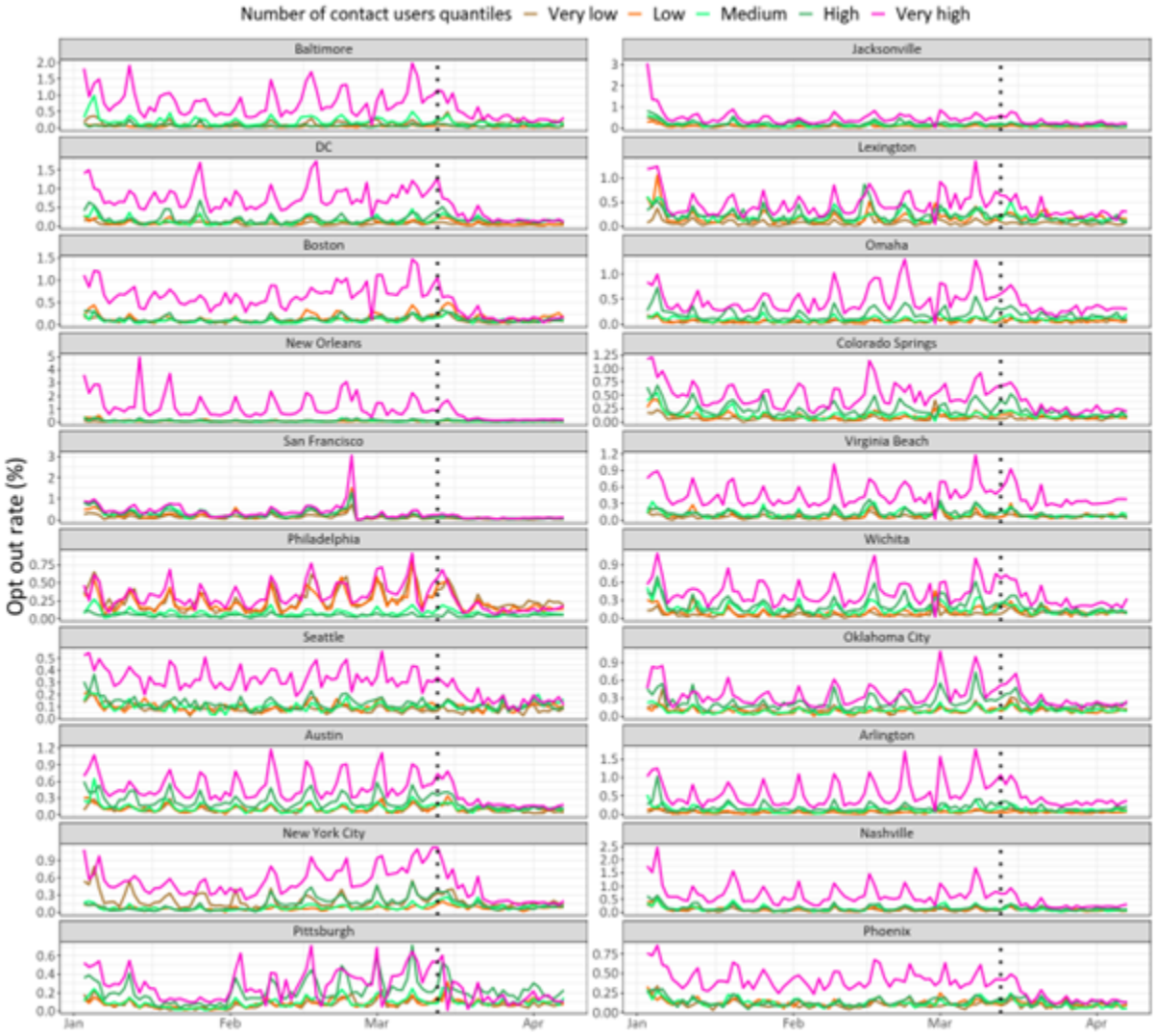
Appendix

Appendix A: City-by-City Results for Figure 2



Day Trend of City-level Opt-out Rate for Different *TotalContacts* Quantiles
(Left, Blue cities; Right, Red cities)

Day Trend of City-level Opt-out Rates for Different Income Quantiles
(Left, blue cities; Right, red cities; three quantiles – from highest to lowest income)

Day Trends of City-level Opt-out Rate for Males and Female
(Left, blue cities; Right, red cities)

Day Trend of City-level Opt-out Rate for Different Racial Diversities
(Left, blue cities; Right, red cities)

Appendix B: Infection Rate and Death Rate across Blue and Red Cities

Table B - COVID-19 Health Risks in Blue Cities versus Red Cities

	DV = Infection Rate	DV = Death Rate
Blue City	0.046****	0.011****
	(0.000)	(0.000)
R-squared	0.031	0.022
Observations	1,731,298	1,731,298

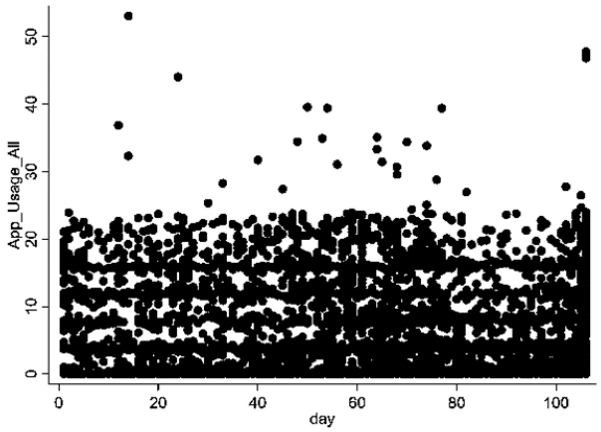
*p<0.10; **p<0.05; ***p<0.01;****p<0.001

Appendix D: Robustness Test with Controls for Spatially Adjacent Blocks

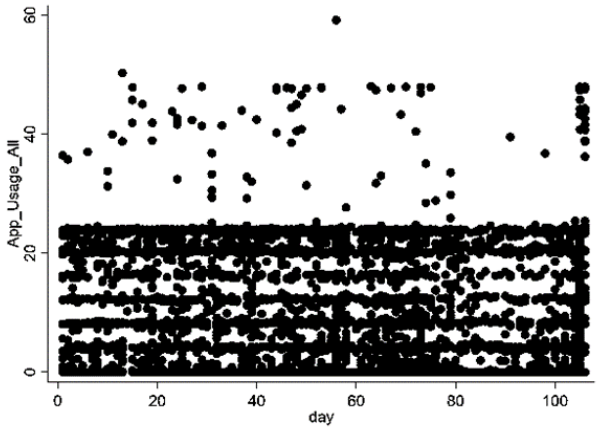
City = DC	(1) Main Effect	(2) Interaction w/ Daily Contacts
DV = CBG *OptOutCount* (Poisson)		
Shock	-0.199****	-0.322****
	(0.028)	(0.030)
Shock X NumContacts		0.145****
		(0.012)
NumContacts	0.214****	0.173****
	(0.007)	(0.007)
Daily Travel Distance	0.298****	0.289****
	(0.011)	(0.011)
Daily Avg. Travel Speed	0.071****	0.072****
	(0.001)	(0.001)
Time Trend	0.015****	0.015****
	(0.001)	(0.001)
Control Variables		
Focal Block Population	Yes	Yes
Focal Block Land Area	Yes	Yes
Focal Block Population Income	Yes	Yes
Focal Block Population Gender	Yes	Yes
Focal Block Population Race	Yes	Yes
Focal Block Number of Existing Users	Yes	Yes
Focal Block Number of Opt-in Users	Yes	Yes
Focal Block Mobile App Usage	Yes	Yes
1st Closest Block Population	Yes	Yes
1st Closest Block Land Area	Yes	Yes
1st Closest Block Population Income	Yes	Yes
1st Closest Block Population Gender	Yes	Yes
1st Closest Block Population Race	Yes	Yes
1st Closest Block Number of Existing Users	Yes	Yes
1st Closest Block Number of Opt-in Users	Yes	Yes
1st Closest Block Mobile App Usage	Yes	Yes
2nd Closest Block Population	Yes	Yes
2nd Closest Block Land Area	Yes	Yes
2nd Closest Block Population Income	Yes	Yes
2nd Closest Block Population Gender	Yes	Yes
2nd Closest Block Population Race	Yes	Yes
2nd Closest Block Number of Existing Users	Yes	Yes
2nd Closest Block Number of Opt-in Users	Yes	Yes
2nd Closest Block Mobile App Usage	Yes	Yes
3rd Closest Block Population	Yes	Yes
3rd Closest Block Land Area	Yes	Yes
3rd Closest Block Population Income	Yes	Yes
3rd Closest Block Population Gender	Yes	Yes
3rd Closest Block Population Race	Yes	Yes
3rd Closest Block Number of Existing Users	Yes	Yes
3rd Closest Block Number of Opt-in Users	Yes	Yes
3rd Closest Block Mobile App Usage	Yes	Yes
Week Fixed Effect	Yes	Yes
Day of Week Fixed Effect	Yes	Yes
Log likelihood	-41420.74	-41352.1
Observations	84,270	84,270

*p<0.10; **p<0.05; ***p<0.01;****p<0.001

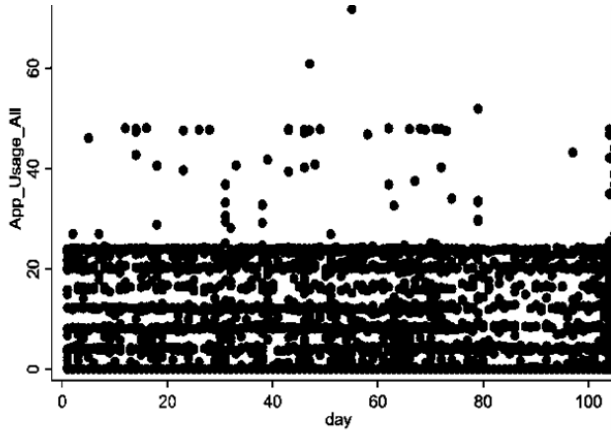
Appendix E: Additional Falsification Test



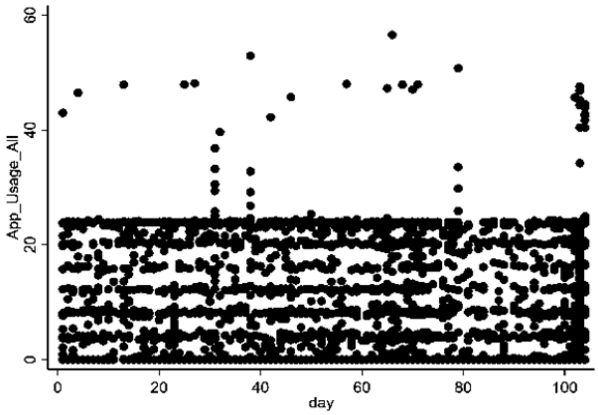
(a) Last Day of Observation



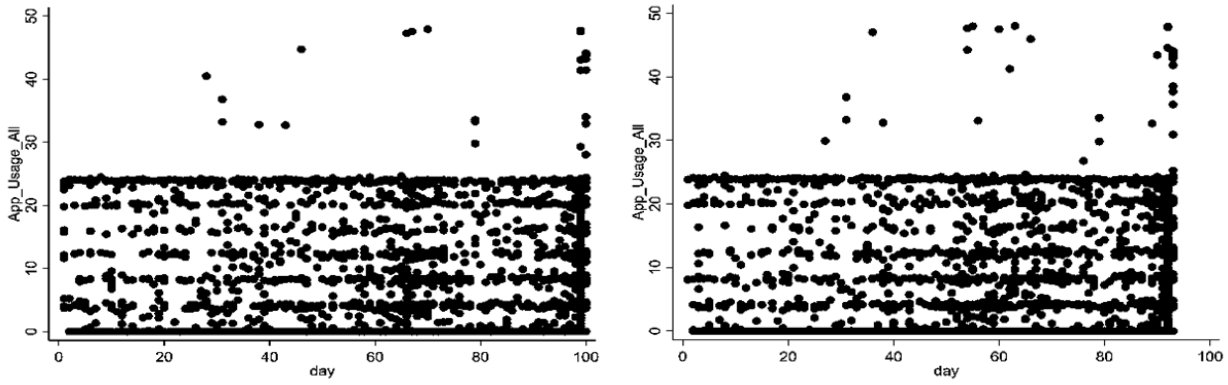
(b) 1 Day Before Last Day of Observation



(c) 2 Days Before Last Day of Observation



(d) 3 Days Before Last Day of Observation



(e) 7 Days Before Last Day of Observation (f) 14 Days Before Last Day of Observation

Distribution of *TotalAppUsage* for Each Opt-out Individuals on
(a) Zero; (b) One; (c) Two; (d) Three; (e) Seven; and (f) Fourteen Days Prior to Opt-out

Correlation between Opt-out and App Usage in Days Preceding Opt-out

	Lag 1 Day	**Lag 2 Days**	**Lag 3 Days**	**Lag 7 Days**
Opt-out and TotalAppUsage	0.0024 (0.7142)	-0.0109 (0.0929)	0.0064 (0.3237)	-0.0061 (0.3468)
Opt-out and Location-HeavyAppUsage	0.0015 (0.8143)	-0.0137* (0.0339)	0.0094 (0.1445)	-0.0050 (0.4366)
Opt-out and AppUsageCategory	0.0041 (0.5249)	-0.0112 (0.0844)	0.0052 (0.4187)	-0.0074 (0.2537)
Opt-out and Location-HeavyAppCategory	0.0024 (0.7142)	-0.0109 (0.0929)	0.0064 (0.3237)	-0.0061 (0.3468)

* = 5% significance level.

Appendix F: National Emergency versus City-specific Lockdowns as Shock

DV = CBG *OptOutCount* (Poisson)				
City	State	City-specific Lockdown Date	Main Effect (City-specific Lockdown)	Main Effect (National Emergency)
San Francisco	CA	19-Mar-20	-0.708****	-0.678****
			(0.029)	(0.030)
New York City	NY	22-Mar-20	-0.828**	-0.344****
			(0.028)	(0.027)
New Orleans	LA	23-Mar-20	-0.489****	-0.048*
			(0.032)	(0.028)
Seattle	WA	23-Mar-20	0.106****	-0.469****
			(0.031)	(0.031)
Boston	MA	24-Mar-20	-0.468****	-0.562****
			(0.025)	(0.026)
Lexington	KY	26-Mar-20	-0.095****	-0.580****
			(0.024)	(0.026)
Colorado Springs	CO	26-Mar-20	-0.015	-0.678****
			(0.025)	(0.026)
Oklahoma City	OK	28-Mar-20	-0.001	-0.188****
			(0.077)	(0.027)
Virginia Beach	VA	30-Mar-20	0.189****	-0.543****
			(0.032)	(0.029)
Baltimore	MD	30-Mar-20	-0.271****	-0.337****
			(0.026)	(0.027)
Wichita	KS	30-Mar-20	0.050	-0.239****
			(0.031)	(0.027)
Nashville	TN	31-Mar-20	-0.147****	-0.264****
			(0.030)	(0.027)
Phoenix	AZ	31-Mar-20	-0.002	-0.441****
			(0.016)	(0.030)
D.C.	DC	1-Apr-20	-0.075***	-0.279****
			(0.027)	(0.014)
Pittsburgh	PA	1-Apr-20	-0.001	-0.457****
			(0.033)	(0.029)
Philadelphia	PA	1-Apr-20	-0.122****	-0.476****
			(0.030)	(0.029)
Austin	TX	2-Apr-20	0.032	-0.312****
			(0.033)	(0.027)
Arlington	TX	2-Apr-20	0.076***	-0.215****
			(0.028)	(0.026)
Jacksonville	FL	3-Apr-20	0.044	-0.254****
			(0.035)	(0.030)
Omaha	NE	n/a#	-	-0.392****
				(0.028)
Control variables are the same as in Table 3				
*p<0.10; **p<0.05; ***p<0.01;****p<0.001				
# Nebraska never orders residents to stay home.				
Results are based on the main analyses using Poisson Model. We have also run the same analyses using Negative Binomial Model and the results remain highly consistent.				

We notice that the main effects are positive for Arlington and Virginia Beach, likely because the

lockdown orders in those two states (TX and VA) were issued relatively late (4/2 and 3/30, 2020). We do not have enough daily observations to fully observe the post-shock trend, as 4/15/2020 is the last day of our sample. The main effect is also positive for Seattle, calling for future research.

Appendix G: City-by-City Results

Tables G - Heterogeneous Effect of Policy Compliance on Privacy Choice for each City (DV and model are the same as in Table 4)

1 - Boston

City = Boston	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.562****	-0.615****
	(0.026)	(0.028)
Shock x		0.063****
NumContacts		(0.012)
NumContacts	0.310****	0.289****
	(0.007)	(0.008)
Controls	Yes	Yes
Observations	97,308	97,308
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

2 - D.C.

City = D.c.	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.262****	-0.416****
	(0.028)	(0.029)
Shock x		0.219****
NumContacts		(0.012)
NumContacts	0.265****	0.206****
	(0.006)	(0.007)
Controls	Yes	Yes
Observations	84,270	84,270
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

3 - Baltimore

City = Baltimore	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.337****	-0.520****
	(0.027)	(0.029)
Shock x		0.248****
NumContacts		(0.015)
NumContacts	0.257****	0.169****
	(0.008)	(0.010)
Controls	Yes	Yes
Observations	71,126	71,126
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

4 - Lexington

City = Lexington	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.580****	-0.936****
	(0.026)	(0.031)
Shock x		0.203****
NumContacts		(0.009)
NumContacts	0.259****	0.153****
	(0.006)	(0.007)
Controls	Yes	Yes
Observations	26,500	26,500
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

5 - Colorado Spring

City = Colorado Spring	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.678****	0.046
	(0.026)	(0.038)
Shock x		-0.216****
NumContacts		(0.008)
NumContacts	0.192****	0.319****
	(0.005)	(0.007)
Controls	Yes	Yes
Observations	33,496	33,496
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

6 - Virginia Beach

City = Virginia Beach	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.491****	-0.887****
	(0.029)	(0.039)
Shock x		0.127****
NumContacts		(0.008)
NumContacts	0.391****	0.320****
	(0.006)	(0.007)
Controls	Yes	Yes
Observations	30,422	30,422
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

7 - San Francisco

City = San Francisco	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.678****	-0.673****
	(0.030)	(0.030)
Shock x		-0.138*
NumContacts		(0.083)
NumContacts	0.313****	0.322****
	(0.020)	(0.021)
Controls	Yes	Yes
Observations	132,924	132,924
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

8 - Jacksonville

City = Jacksonville	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.195****	-0.556****
	(0.029)	(0.035)
Shock x		0.225****
NumContacts		(0.011)
NumContacts	0.318****	0.225****
	(0.007)	(0.008)
Controls	Yes	Yes
Observations	60,526	60,526
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

9 - New Orleans

City = New Orleans	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.027	-0.409****
	(0.028)	(0.034)
Shock x		0.196****
NumContacts		(0.010)
NumContacts	0.545****	0.489****
	(0.007)	(0.008)
Controls	Yes	Yes
Observations	45,156	45,156
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

10 - Omaha

City = Omaha	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
Shock	-0.392****	-0.628****
	(0.028)	(0.035)
Shock x		0.101****
NumContacts		(0.009)
NumContacts	0.335****	0.283****
	(0.005)	(0.007)
Controls	Yes	Yes
Observations	48,972	48,972
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

11 - NYC

City = NYC	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect	Interaction w/ Daily Contacts
	(Poisson)	(Poisson)
Shock	-0.344****	-0.493****
	(0.027)	(0.028)
Shock x		0.305****
NumContacts		(0.015)
NumContacts	0.373****	0.312****
	(0.008)	(0.008)
Controls	Yes	Yes
Observations	291,394	291,394
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

12 - Pittsburgh

City = Pittsburgh DV = *Individual OptOut* (Logit)	(1) Main Effect (Poisson)	(2) Interaction w/ Daily Contacts (Poisson)
Shock	-0.457****	-0.576****
	(0.029)	(0.031)
Shock x NumContacts		0.151**** (0.014)
NumContacts	0.300****	0.241****
	(0.007)	(0.009)
Controls	Yes	Yes
Observations	157,516	157,516
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

13 - Oklahoma City

City = Oklahoma City DV = *Individual OptOut* (Logit)	(1) Main Effect (Poisson)	(2) Interaction w/ Daily Contacts (Poisson)
Shock	-0.188****	-0.365****
	(0.027)	(0.030)
Shock x NumContacts		0.153**** (0.011)
NumContacts	0.262****	0.193****
	(0.006)	(0.008)
Controls	Yes	Yes
Observations	82,256	82,256
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

14 - Philadelphia

City = Philadelphia DV = *Individual OptOut* (Logit)	(1) Main Effect (Poisson)	(2) Interaction w/ Daily Contacts (Poisson)
Shock	-0.476****	-0.500****
	(0.029)	(0.029)
Shock x NumContacts		0.141**** (0.021)
NumContacts	0.240****	0.206****
	(0.010)	(0.011)
Controls	Yes	Yes
Observations	222,918	222,918
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

15 - Austin

City = Austin	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect (Poisson)	Interaction w/ Daily Contacts (Poisson)
Shock	-0.312****	-0.542****
	(0.027)	(0.031)
Shock x NumContacts		0.172****
		(0.011)
NumContacts	0.267****	0.202****
	(0.006)	(0.008)
Controls	Yes	Yes
Observations	65,190	65,190
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

16 - Seattle

City = Seattle	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect (Poisson)	Interaction w/ Daily Contacts (Poisson)
Shock	-0.469****	-0.494****
	(0.031)	(0.033)
Shock x NumContacts		0.034****
		(0.014)
NumContacts	0.268****	0.254****
	(0.008)	(0.009)
Controls	Yes	Yes
Observations	297,542	297,542
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

17 - Arlington

City = Arlington	(1)	(2)
DV = *Individual OptOut* (Logit)	Main Effect (Poisson)	Interaction w/ Daily Contacts (Poisson)
Shock	-0.215****	-0.799****
	(0.026)	(0.033)
Shock x NumContacts		0.250****
		(0.010)
NumContacts	0.386****	0.258****
	(0.006)	(0.008)
Controls	Yes	Yes
Observations	27,772	27,772
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

18 - Phoenix

City = Phoenix DV = *Individual OptOut* (Logit)	(1) Main Effect (Poisson)	(2) Interaction w/ Daily Contacts (Poisson)
Shock	-0.441****	-0.493****
	(0.030)	(0.033)
Shock x NumContacts		0.077**** (0.015)
NumContacts	0.245****	0.218****
	(0.008)	(0.010)
Controls	Yes	Yes
Observations	264,364	264,364
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

19 - Nashville

City = Nashville DV = *Individual OptOut* (Logit)	(1) Main Effect (Poisson)	(2) Interaction w/ Daily Contacts (Poisson)
Shock	-0.264****	-0.406****
	(0.027)	(0.029)
Shock x NumContacts		0.203**** (0.014)
NumContacts	0.279****	0.222****
	(0.007)	(0.009)
Controls	Yes	Yes
Observations	58,512	58,512
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

20 - Wichita

City = Wichita DV = *Individual OptOut* (Logit)	(1) Main Effect (Poisson)	(2) Interaction w/ Daily Contacts (Poisson)
Shock	-0.239****	-0.474****
	(0.027)	(0.039)
Shock x NumContacts		0.076**** (0.009)
NumContacts	0.252****	0.214****
	(0.006)	(0.007)
Controls	Yes	Yes
Observations	33,072	33,072
*p<0.10; **p<0.05; ***p<0.01;****p<0.001		

Appendix H: Heterogeneous Effect of Policy Compliance on Privacy Choice (Without App Usage Controls)

Table H - Heterogeneous Effect of Policy Compliance on Privacy Choice (Without App Usage Controls)

DV = CBG *OptOutCount* (Poisson)	(1) Main Effect (10 Red Cities)	(2) w/ Policy Compliance (10 Red Cities)	(3) Interaction w/ Policy Compliance (10 Red Cities)	(4) Main Effect (10 Blue Cities)	(5) w/ Policy Compliance (10 Blue Cities)	(6) Interaction w/ Policy Compliance (10 Blue Cities)	(7) Main Effect (20 Cities)	(8) Interaction w/ Policy Compliance (20 Cities)	(9) Three-way Interaction (20 Cities)
Shock	-0.339****	-0.289****	-0.62****	-0.499****	-0.427****	-0.576***	-0.477****	-0.631****	-0.471****
	(0.019)	(0.018)	(0.025)	(0.017)	(0.016)	(0.017)	(0.012)	(0.015)	(0.017)
NumContacts		0.064****	0.003		0.027****	-0.016**		-0.009****	0.001****
		(0.007)	(0.007)		(0.007)	(0.007)		(0.005)	(0.007)
Shock X NumContacts			0.154****			0.216****		0.178****	0.133****
			(0.008)			(0.008)		(0.006)	(0.008)
Shock X Blue									-0.301****
									(0.015)
NumContacts X Blue									0.003
									(0.011)
Shock X NumContacts X Blue									0.082****
									(0.012)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
CBG FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
# Obs.	595,084	595,084	595,084	1,136,214	1,136,214	1,136,214	1,731,298	1,731,298	1,731,298

*p<0.10; **p<0.05; ***p<0.01;****p<0.001

Appendix I: Additional Heterogeneity We explore the additional heterogeneous effects of the psychographics (political ideology) and demographics (income, gender, race) (Equation (6). As discussed, political ideology impacts the Americans' attitude toward institutional surveillance: with Republicans (Democrats) displaying a warmer (cooler) response[13]. Also, lower- versus higher-income populations might differ, for instance, in their abilities to protect personal information[14].

Demographics. Table I presents the heterogeneous effects of demographics across the 20 cities. We estimate these effects for each demographic variable separately for ease of interpretation. Additional city-by-city analyses also produce consistent results. Overall, the significant and negative effect of the crisis ($Shock$) is consistent with the earlier model-free evidence and the discovered main effect of the crisis: individuals irrespective of demographic heterogeneities have reduced opt-out after the crisis began. This effect is particularly strong (negative $Shock \times Demographics$) among the CBGs with higher proportions of the most affluent (Income >200k), least affluent(Income <60k), and Asian populations. [15]

Table I - Heterogeneous Effect of Demographics on Opt-out

DV = CBG *OptOutCount* (Poisson)	(1) Main Effect	(2) Interaction w/ Income	(3) Interaction w/ Gender	(4) Interaction w/ Race	(5) Interaction w/ Pooled
Shock	-0.326****	-0.530****	-0.922***	-0.251***	-0.941***
	(0.011)	(0.021)	(0.044)	(0.022)	(0.074)
Shock × Income 60-100K		0.796****			0.496***
		(0.066)			(0.088)
Shock × Income 100-150K		0.400***			-0.048
		(0.068)			(0.087)
Shock × Income 150-200K		0.369***			0.297*
		(0.110)			(0.136)
Shock × Income >200K		-0.908****			-0.361***
		(0.074)			(0.099)
Shock × Female			1.175***		1.176***
			(0.082)		(0.123)
Shock × Race Black				-0.159***	-0.195***
				(0.035)	(0.041)
Shock × Race Asian				-1.570***	-1.457***
				(0.095)	(0.094)
Shock × Race Native				0.346*	0.454**
				(0.148)	(0.156)
Shock × Race Other				0.476*	0.376
				(0.222)	(0.223)
Controls	✓	✓	✓	✓	✓
CBG FEs	✓	✓	✓	✓	✓
Log likelihood	-553647.35	-552826.27	-553429.17	-552691.92	-200093.99
# Obs.	1,731,298	1,731,298	1,731,298	1,731,298	1,731,298

* p <0.10, ** p <0.05, *** p <0.01, **** p <0.001.
Controls are same as those in Table 5.

Appendix J: Alternative Model Specifications

Table J - Main Effect Using CBG-level Linear Probability Model

	Main Effect
Shock	-0.090****
	(0.002)
# Obs.	1,731,298
Controls	✓
CBG FEs	✓
*p<0.10; **p<0.05; ***p<0.01;****p<0.001	

Appendix K: Main Effect Using Only Individuals Who Opted in Since Jan. 1

DV = *Individual OptOut* (Logit)	Effect (All 20 Cities)
Shock	-0.040***
	(0.014)
# Obs.	408,557
Controls	✓
*p<0.10; **p<0.05; ***p<0.01;****p<0.001	

Appendix L: Falsification Test: Alternative shock Dates

Falsification Test: Alternative Shock Dates

DV = CBG *OptOutCount* (Poisson)	Shock Jan. 17	Shock Jan. 24	Shock Feb. 14	Shock Feb. 28
Shock	0.069* (-0.040)	0.051 (-0.033)	-0.006 (-0.026)	0.038 (-0.024)
Controls	✓	✓	✓	✓
Log likelihood	-48213.46	-48213.73	-48214.89	-48213.72
# Obs.	84,270	84,270	84,270	84,270

* p < 0.10, ** p < 0.05, *** p < 0.01, **** p < 0.001.
Controls are same as those in Table 5.

Falsification Test: Alternative Shock Dates (Two Weeks Pre-Shock, D. C. Sample)

DV = *Individual OptOut* (Logit)	Mar. 1	Mar. 2	Mar. 3	Mar. 4	Mar. 5	Mar. 6
Shock	-0.010 (0.014)	0.008 (0.013)	0.015 (0.013)	0.025 (0.013)	0.035*** (0.014)	0.037*** (0.014)
Log likelihood	-669224.3	-669224.6	-669223.3	-669220.2	-669215.7	-669214.7
Controls	✓	✓	✓	✓	✓	✓
Individual FEs	✓	✓	✓	✓	✓	✓
# Obs.	1,395,904	1,395,904	1,395,904	1,395,904	1,395,904	1,395,904
* p < 0.10, ** p < 0.05, *** p < 0.01, **** p < 0.001.						
DV = *Individual OptOut* (Logit)	Mar. 7	Mar. 8	Mar. 9	Mar. 10	Mar. 11	Mar. 12
Shock	0.044*** (0.014)	0.042*** (0.014)	0.039*** (0.014)	0.027 (0.014)	0.013 (0.015)	0.001 (0.015)
Log likelihood	-669211.1	-669212.8	-669215.4	-669220.8	-669224.2	-669225.1
Controls	✓	✓	✓	✓	✓	✓
Individual FEs	✓	✓	✓	✓	✓	✓
# Obs.	1,395,904	1,395,904	1,395,904	1,395,904	1,395,904	1,395,904
* p < 0.10, ** p < 0.05, *** p < 0.01, **** p < 0.001.						

Appendix M: Demographics of Opt-in and Opt-out Users

	Opt-out users' mean	Opt-in users' mean	Opt-out users' mean before March 13th
Gender (Female)	0.489	0.503	0.485
Income (<60K)	0.486	0.481	0.482
Income (60-100K)	0.215	0.231	0.211
Income (100-150K)	0.143	0.155	0.142
Income (150-200K)	0.063	0.062	0.064
Income (>200K)	0.069	0.062	0.073
Race (White)	0.68	0.714	0.674
Race (Black)	0.15	0.136	0.149
Race (Asian)	0.07	0.062	0.075
Race (Native Indian)	0.008	0.009	0.007

Online Appendix

Self-reported societal considerations. The third metric of societal considerations is the individuals' self-reported tendency for societal considerations, collected from a survey among 879 qualified Amazon MTurkers. We acknowledge that the survey-based dataset may not be representative of the whole population and therefore can only provide partial evidence to support the role of prosocial tendencies in reducing opt-outs. Therefore, we do not claim that this survey provides undoubted evidence. Instead, the survey serves to support the main dataset by ruling out alternative explanations, such as time availability, or reduced privacy concerns due to stay-at-home or decreased travel.

This survey examines how individuals' attitude and behavior toward location data sharing have changed since the crisis commenced, and how these changes are related to their self-reported tendency for societal considerations. The survey comprises questions on smartphone usage, awareness of the use of location data to curb the pandemic, societal considerations during the pandemic and in broader contexts, and demographics (details in Online Appendix A). The summary statistics in Online Appendix B reveal that most respondents are aware of the tracking of location data (74.4%) and use of location data to curb the pandemic (81.6%); 48.4% acknowledge that they have become more willing to share location data to help combat the pandemic; 55.1% agree that people need to share location data to help combat the pandemic; a majority agrees that people should wear masks (87.2%), social distance (86.9%), and stay at home (83.6%) during the pandemic; and 36.6% agree that they opted out, changing the location setting from on to off, compared to 50.3% who disagree. These results corroborate with our earlier finding that individuals have opted out less, sharing more location data post-treatment.

We link the opt-out (ordinal *location.on.off*) to each respondent's self-reported societal considerations using both the Ordinal Logit and Ordinary Least Square (OLS) regressions, while controlling for the demographics. The results are consistent. Online Appendix C reveals that those with greater societal considerations, believing in the need to share location data to curb the pandemic (*share.location.prosocial*), wear masks (*wear.masks*), or social distance (*social.distancing*), are significantly less likely to opt out. To explore potential alternative mechanisms, we further link the opt-out (*location.on.off*) to a number of surveyed factors not readily observed in the location data, again using both the Ordinal Logit and OLS regressions. Both produce consistent results (Online Appendix D). We find that those reading privacy policies more carefully (*read.privacy.policies*) are more likely to opt out. The opt-out choice is unrelated to the reduced privacy concern due to increased stay-at-home (*share.location.home*), but more related to individuals' willingness to share location data to help combat the pandemic (*share.location.pandemic*). Overall, these results consistently support the earlier finding that individuals with greater societal considerations opt-out less

during the pandemic. Moreover, our subsequent robustness check confirms a significant association between individuals' societal considerations during the pandemic and such considerations across broader contexts, such as helping others, caring about social issues, or donating to charities (Online Appendix E).

Specifically, 40.9% (45.3%) of the respondents donate to charities (social causes); 72.6% (80.8%) agree that they deeply care about social issues (often help others). We average these responses into one variable (prosocial) and gauge associations with pro-social behavior and belief during the pandemic.

Online Appendix A: Survey

EmbeddedData
Random ID = ${rand://int/10000:99999}

Block: Consent Form (6 Questions)
Standard: Behavioral Questions (3 Questions)
Standard: Install (3 Questions)
Standard: Uninstall (3 Questions)
Standard: Off to On (3 Questions)
Standard: On to off (3 Questions)
Standard: General Perception (2 Questions)
Standard: Pro Social (2 Questions) Standard: Tech Savviness (1 Question) Standard: Demographics (8 Questions) Standard: Block 4 (1 Question)
Block: (0 Questions)

Start of Block: Consent Form

We are university researchers interested in how your attitude and behavior regarding smartphone location data sharing might have changed since the onset of the COVID-19 pandemic, particularly in the first few months of the pandemic. Thank you for your participation.

---

*

I am aged 18 or older

- ○ Yes (1)
- ○ No (2)

---

*

I am a fluent English speaker

- ○ Yes (1)
- ○ No (2)

*

I am a smartphone user

- Yes (1)
- No (2)

*

I have read and understood the information above

- Yes (1)
- No (2)

*

Are you aware that public authorities across the world are using smart phone data to curb the growth of the pandemic? (Examples : Contact tracing, tracking pandemic spread, opening/re-opening commercial spaces based on mobility)

- Yes (1)
- No (2)

End of Block: Consent Form

Break

Start of Block: Behavioral Questions

Please rate each of the following statements from 1 = strongly disagree to 5 = strongly agree.

Over the **first few months** of the COVID-19 pandemic

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
I have used my smartphone more heavily compared to before the pandemic. (1)	○	○	○	○	○
I have installed more apps on my smartphone compared to before the pandemic. (2)	○	○	○	○	○
I have used those smartphone apps that require my locations more heavily compared to before the pandemic. (10)	○	○	○	○	○
I have become more aware that my smartphone collects my location data. (4)	○	○	○	○	○

I have become more aware that location data are used to combat the pandemic. (Examples: Contact tracing, tracking pandemic spread, opening/re-opening commercial spaces based on mobility) (11)	○	○	○	○	○

Page Break

Over the **first few months** of the pandemic

	Strongly disagree (32)	Somewhat disagree (33)	Neither agree nor disagree (34)	Somewhat agree (35)	Strongly agree (36)
I have spent more time or become more careful reading the privacy policies before granting smartphone apps permission to collect my location data. (1)	○	○	○	○	○
I have become more willing to grant mobile apps permission to collect my location data, because I believe sharing location data can help combat the pandemic. (5)	○	○	○	○	○
I have become more willing to grant mobile apps permission to collect my location data, because I stayed home most of the time and did not care about my	○	○	○	○	○

location data being collected as much. (2)	

End of Block: Behavioral Questions

Start of Block: Install

During the pandemic,

	Strongly disagree (18)	Somewhat disagree (19)	Neither agree nor disagree (20)	Somewhat agree (21)	Strongly agree (22)
I have installed new apps that require location sharing. (1)	○	○	○	○	○

If so, for what application categories (Example : Games, Music, Online delivery). Enter NA if not applicable.

_____

Provide a short reason (optional)

_____

End of Block: Install

Start of Block: Uninstall

During the pandemic,

	Strongly disagree (20)	Somewhat disagree (21)	Neither agree nor disagree (22)	Somewhat agree (23)	Strongly agree (24)
I have uninstalled apps that required location sharing. (1)	○	○	○	○	○

If so, for what application categories (Example : Games, Music, Online delivery). Enter NA if not applicable.

_____

Provide a short reason (optional)

_____

End of Block: Uninstall

Start of Block: Off to On

During the pandemic,

	Strongly disagree (20)	Somewhat disagree (21)	Neither agree nor disagree (22)	Somewhat agree (23)	Strongly agree (24)
I have switched “location data sharing” from “Off” to “On” at least once for at least one mobile app on my phone. (1)	○	○	○	○	○

If so, for what application categories (Example : Games, Music, Online delivery). Enter NA if not applicable.

_____

Provide a short reason (optional)

_____

End of Block: Off to On

Start of Block: On to off

During the pandemic,

	Strongly disagree (20)	Somewhat disagree (21)	Neither agree nor disagree (22)	Somewhat agree (23)	Strongly agree (24)
I have switched "location data sharing" from "On" to "Off" at least once for at least one mobile app on my phone. (1)	○	○	○	○	○

If so, for what application categories (Example : Games, Music, Online delivery). Enter NA if not applicable.

_____

Provide a short reason (optional)

End of Block: On to off

Start of Block: General Perception

Please rate each of the following statements from 1 = strongly disagree to 5 = strongly agree.

During a pandemic,

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
People need to share their private information (such as their locations) if it contributes to the greater good of the public. (1)	○	○	○	○	○
People need to protect themselves and others by wearing masks during the pandemic. (2)	○	○	○	○	○
People need to protect themselves and others by practicing social distancing during the pandemic. (3)	○	○	○	○	○
People need to protect themselves and others by staying at home more often during the pandemic. (4)	○	○	○	○	○
Please go ahead and select Somewhat agree for this question (5)	○	○	○	○	○

End of Block: General Perception

Start of Block: Pro Social

Please rate your preference levels for the activities listed below.

	Do not prefer (28)	Prefer slightly (29)	Prefer a moderate amount (30)	Prefer a lot (31)	Prefer a great deal (32)
Donation to charities (1)	○	○	○	○	○
Donation to social causes (2)	○	○	○	○	○

Please rate each of the following statements from 1 = strongly disagree to 5 = strongly agree.

	Strongly disagree (9)	Somewhat disagree (10)	Neither agree nor disagree (11)	Somewhat agree (12)	Strongly agree (13)
I often help others (1)	○	○	○	○	○
I deeply care about social issues (2)	○	○	○	○	○

End of Block: Pro Social

Start of Block: Tech Savviness

Please rate your knowledge levels for the activities listed below

	Extremely knowledgeable (16)	Very knowledgeable (17)	Moderately knowledgeable (18)	Slightly knowledgeable (19)	Not knowledgeable at all (20)
Opting out of location sharing on my smart phone (1)	○	○	○	○	○
Clearing cookies on my browser and smart devices (2)	○	○	○	○	○

End of Block: Tech Savviness

Start of Block: Demographics

Your gender

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)
- ○ Other, please enter (5) _____

Your age

- ○ 18 - 24 (1)
- ○ 25 - 34 (2)
- ○ 35 - 44 (3)
- ○ 45 - 54 (4)
- ○ 55 - 64 (5)
- ○ 65 - 74 (6)
- ○ 75 - 84 (7)
- ○ 85 or older (8)

Your ethnicity

- ○ White (8)
- ○ Black or African American (9)
- ○ American Indian or Alaska Native (10)
- ○ Asian (11)
- ○ Native Hawaiian or Pacific Islander (12)
- ○ Hispanic (14)
- ○ Other (13)

In which state do you currently reside?

_____

What's the highest level of education that you have received?

- ○ Less than high school (1)
- ○ High school graduate (2)
- ○ Some college (3)
- ○ 2 year degree (4)
- ○ 4 year degree (5)
- ○ Professional degree (6)
- ○ Doctorate (7)

What is your annual household income before tax?

- ○ Less than $10,000 (1)
- ○ $10,000 - $19,999 (2)
- ○ $20,000 - $29,999 (3)
- ○ $30,000 - $39,999 (4)
- ○ $40,000 - $49,999 (5)
- ○ $50,000 - $59,999 (6)
- ○ $60,000 - $69,999 (7)
- ○ $70,000 - $79,999 (8)
- ○ $80,000 - $89,999 (9)
- ○ $90,000 - $99,999 (10)
- ○ $100,000 - $149,999 (11)
- ○ More than $150,000 (12)

What type of smartphone do you have?

- ○ Android (1)
- ○ Apple (2)
- ○ Others, please specify (3) _____

Are you an essential worker during the pandemic (i.e., workers who conduct operations and services that are essential for critical infrastructure operations, e.g., healthcare, food service, public transportation)

- ○ Yes (1)
- ○ No (2)

End of Block: Demographics

Start of Block: Block 4

Here is your Random ID for completion of the survey text : ${e://Field/Random%20ID}

Copy this value to paste it into MTurk.

When you have copied this ID, please click next to submit your survey.

Thanks for your participation!

End of Block: Block

Variable	Survey Question	Strongly Or Somewhat Agree	Neither Agree Nor Disagree	Somewhat Or Strongly Disagree
Mobile Usage	Used mobile more heavily during pandemic	71.5	14.2	14.3
	Installed more mobile applications during pandemic	57.7	12.9	29.4
	Used apps that require locations more heavily	52.7	18.3	29
Awareness	Location data being used to curb the growth of pandemic	81.6	10.0	8.4
	Smartphones collect location data	74.4	15.4	10.2
Behavior toward Societal Considerations	They are more willing to share location data to help combat pandemic (share.location.pandemic)	48.4	20.8	30.8
Tendency for societal considerations	People need to share location data to help combat the pandemic (share.location.prosocial)	55.1	19.6	25.3
	People need to wear masks (wear.masks)	87.2	8.3	4.5
	People need to social distance (social.distancing)	86.9	8.3	4.8
	People need to stay at home (stay.at.home)	83.6	11.0	5.4
Location Data Sharing	Changed location settings from ON to OFF (location.on.off)	36.6	13.1	50.3

Online Appendix B: Survey Summary Statistics (% of 879 respondents)

Online Appendix C: Heterogeneous Treatment Effect of Self-reported Societal Considerations on Privacy Choice

DV = location.on.off (OLS)	(1)	(2)	(3)	(4)
social.distancing	-0.189^{***}	-0.280^{***}	-0.246^{***}	-0.252^{***}
	(0.059)	(0.083)	(0.091)	(0.091)
wear.masks		0.127	0.154^{*}	0.169^{*}
		(0.082)	(0.087)	(0.087)
stay.at.home			−0.072	−0.051
			(0.079)	(0.080)
share.location.prosocial				-0.085^{**}
				(0.043)
Controls	✓	✓	✓	✓
# Obs.	879	879	879	879
R^2	0.094	0.097	0.098	0.102
Adjusted R^2	0.057	0.058	0.058	0.061
Residual Std. Error	1.469 (df = 843)	1.467 (df = 842)	1.468 (df = 841)	1.465 (df = 840)
F Statistic	2.502^{***} (df = 35; 843)	2.504^{***} (df = 36; 842)	2.458^{***} (df = 37; 841)	2.507^{***} (df = 38; 840)

*p<0.1; **p<0.05; ***p<0.01.
Controls include age, gender, ethnicity, education, income, and whether essential worker.

Online Appendix D: Impact of Alternative Factors on Privacy Choice

DV = location.on.off (OLS)	(1)	(2)	(3)
read.privacy.policies	0.171***	0.186***	0.190***
	(0.044)	(0.045)	(0.045)
share.location.home		−0.065	0.010
		(0.042)	(0.059)
share.location.pandemic			−0.105*
			(0.058)
Controls:	✓	✓	✓
# Obs.	879	879	879
R^2	0.099	0.102	0.105
Adjusted R^2	0.062	0.064	0.066
Residual Std. Error	1.464 (df = 843)	1.463 (df = 842)	1.461 (df = 841)
F Statistic	2.658*** (df = 35; 843)	2.655*** (df = 36; 842)	2.678*** (df = 37; 841)

*p<0.1; **p<0.05; ***p<0.01.
Controls include age, gender, ethnicity, education, income, and whether essential worker.

Online Appendix E: Robustness Checks for the Survey Results

	(1)	(2)	(3)	(4)	(5)
social.distancing	0.167***	0.042	-0.043	-0.019	-0.019
	(0.031)	(0.042)	(0.046)	(0.043)	(0.043)
wear.masks		0.176***	0.108**	0.081*	0.075*
		(0.042)	(0.044)	(0.042)	(0.042)
stay.at.home			0.179***	0.132***	0.125***
			(0.040)	(0.038)	(0.038)
share.location.pandemic				0.207***	0.178***
				(0.020)	(0.024)
share.location.prosocial					0.054**
					(0.024)
Controls					
(Same as above)	✓	✓	✓	✓	✓
Observations	876	876	876	876	876
R^2	0.168	0.185	0.204	0.295	0.299
Adjusted R^2	0.133	0.150	0.169	0.263	0.267
Residual Std. Error	0.762	0.754	0.746	0.702	0.701
	(df = 840)	(df = 839)	(df = 838)	(df = 837)	(df = 836)
F Statistic	4.842***	5.287***	5.796***	9.220***	9.154***
	(df = 35; 840)	(df = 36; 839)	(df = 37; 838)	(df = 38; 837)	(df = 39; 836)

*p<0.10; **p<0.05; ***p<0.01