An Analysis Of Corruption In Russia: Based On Evidence From License Plates

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Introduction

- The vanity plate phenomenon
- Administrative license plate data; 1994-2006

Figure 1: An example of vanity plates.

Model

Underlying intuition

- Agents care about conspicuous (vanity) consumption
- Therefore they care about the public perception that they paid a bribe for their vanity plate (rather than receiving it by luck)
- Problem: some vanity plates are received by luck $\rightarrow$ this blurs the signal a vanity plate sends about the agent's bribery ($\rightarrow$ wealth)
- Solution: the car's luxury complements the signal of the vanity plate
  - $\Rightarrow$ Correlation between luxury cars and vanity plates implies existence of corruption in the license plate entitlement.

Model

Components of the model

- Population: c corrupt agents, 1-c non-corrupt agents
- Utility of vanity consumption: U(vanity plate, luxury car)
- Timing:

  1) Agents receive their plate randomly.

  2) In case they did not receive a vanity plate by luck, corrupt agents can bribe to swap their plate for a vanity plate.

Model

Utility

- Trade-off corrupt agent, not yet in the possession of vanity plate

$$\alpha := \pi * U(1, \frac{r - p_{bribe}}{p_{lux}}) + (1 - \pi) * U(0, \frac{r - p_{bribe}}{p_{lux}})$$
$$\beta := U(0, \frac{r}{p_{lux}})$$

- r: resources, vanity budget to be spent on luxury car or vanity plate
- p_{bribe} and p_{lux} price of a bribe and a unit of luxury car respectively
- $\pi(lux)$: subjective probability in the eye of the public that plate-car combination is result of bribery (and not of luck)

Model

Defining $\pi(lux)$

- $\phi(lux) =$ share of vanity plates for given luxury level of vehicle
- $p =$ expected share of vanity plates by random allocation
- $\pi(lux) = \frac{\phi(lux)-p}{\phi(lux)}$

Finding equilibrium

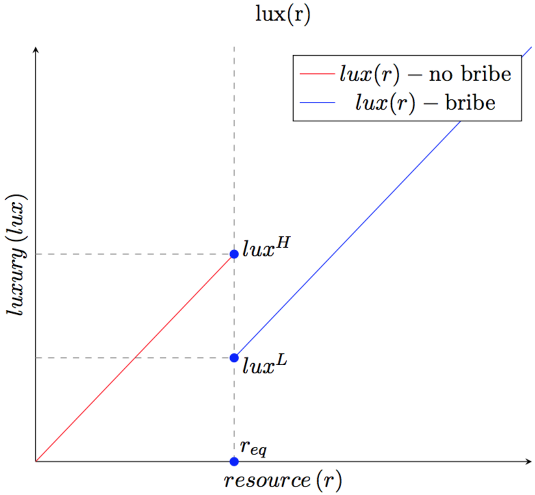
- $\frac{\partial(\alpha-\beta)}{\partial r} = 0 \Rightarrow r_{eq}$ (the level of resource for which an agent would be indifferent between bribing or not bribing)
- $lux^H = \frac{r_{eq}}{p_{lux}}$

  $lux^L = \frac{r_{eq}-p_{bribe}}{p_{lux}}$
- $\phi(lux) = p$ if $lux < lux^L$

  $\phi(lux) = p + (1-p) * c$ if $lux > lux^H$

Model

The equilibrium



Key Variables

- **Definition luxury car**
  - Luxury car list Russian government (for taxation) $\rightarrow$ lux1
  - Car class (European car segment) $\rightarrow$ lux2, lux3
  - Car brand $\rightarrow$ lux4, lux5, lux6
    - based on t-tests per car brand, selecting brands with statistically significant higher revealed levels of nvan1
- **Definition vanity plate**
  - Exploit distribution of engine power among subgroups
  - Separate analysis for numbers and letters $\Rightarrow$ two types of vanity plates *nvan* (e.g. '007') & *lvan* (e.g. 'CCC')

Key Variables

- Top number/letter sequences for vanity plates

nvan1	001, 002, 003, 004, 005, 007, 008, 009, 010, 012, 020, 030, 050, 070, 090, 100, 111, 200, 222, 300, 333, 400, 444, 500, 555, 600, 666, 700, 707, 777, 800, 888, 900, 999
lvan1	AAA, ABA, AMM, AMO, AMP, AOO, BAP, BEY, BMP, CCH, CCY, CEC, CPA, CXX, EAA, EAY, EHC, EHP, EKA, EKO, EMB, EME, EMO, EOT, EOY, EPA, EPH, EPO, EXB, EXO, EYK, EYP, HAC, HAT, KKK, KMP, KXA, MMM, MMP, MXB, MXO, MXT, MYX, OMP, PXY, TXA, TXM, XAE, XEP, XPC, XXY, YCY, YPX, YYX

- lvan2 is lvan1 without government reserved letter combinations.
- lvan3 are all identical letter combinations, e.g. "YYY"

Results: top brands

- Frequency of *nvan*1, numerical vanity, e.g. '007', among car brands

Car brand	freq(nvan1)
Ferrari	30.2%
Bentley	27.4%
Maserati	24.7%
Lamborghini	22.2%
Hummer	21.3%
Rolls Royce	20.0%
Aston Martin	20.0%

Table 1: nvan1 by car brands

Results: top car classes

- Frequency of *nvan*1, among car classes (European Car Segments)
  - E: Executive cars
  - F: Luxury cars
  - J: SUV's
  - S: Sports cars

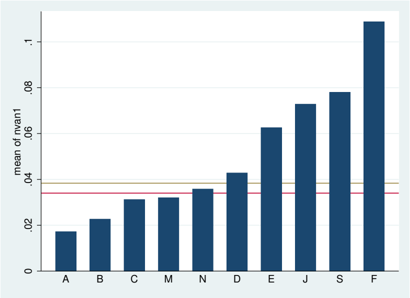


Figure 2: nvan1 by car class. Red line is theoretical mean of nvan1, brown line is empirical mean of nvan1

Results: t-tests and regressions

freq(van)=theoretical frequency($\Leftarrow \phi(lux) \equiv p$)

variable	expected mean	mean	std. dev.	t-stat	p-value (2-sided)	df
nvan1	0.0340	0.0358	0.1858	19.53	0.0000	4,244,294
lvan1	0.0336	0.0255	0.1575	-1.1e+02	0.0000	4,244,291
lvan2	0.0329	0.0266	0.1608	-80.73	0.0000	4,244,291
lvan3	0.00694	0.00637	0.0796	-14.76	0.0000	4,244,291

Table 2: **Ttests for vanity frequency in general population**: expected mean is the theoretical mean, mean is the empirical mean. df is the degrees of freedom for the t-test.

Results: t-tests and regressions

freq(van|lux)=freq(van)

variable	expected mean	mean	std. dev.	t-stat	p-value (2-sided)	df
nvan1	0.0340	0.0826	0.2753	54.43	0.0000	95,115
lvan1	0.0336	0.0634	0.2438	37.81	0.0000	95,115
lvan2	0.0329	0.0533	0.2246	28.07	0.0000	95,115
lvan3	0.00694	0.0267	0.1611	37.76	0.0000	95,115

Table 3: **Ttests for vanity frequency in luxury car subpopulation: lux1**

variable	expected mean	mean	std. dev.	t-stat	p-value (2-sided)	df
nvan1	0.0340	0.0686	0.2528	26.24	0.0000	36,775
lvan1	0.0336	0.0519	0.2217	15.82	0.0000	36,775
lvan2	0.0329	0.0477	0.2132	13.39	0.0000	36,775
lvan3	0.00694	0.0243	0.1539	21.60	0.0000	36,775

Table 4: **Ttests for vanity frequency in luxury car subpopulation: lux6**

Expected mean is the theoretical mean, mean is the empirical mean. df is the degrees of freedom for the t-test.

Results: t-tests and regressions

$$van_i = a + b * lux_i + e_i$$

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0347 (386.33)	0.0331 (364.51)	0.0309 (339.14)	0.0307 (312.96)	0.0330 (364.43)	0.0355 (393.58)
lux1	0.0659 (58.31)					
lux2		0.0378 (75.37)				
lux3			0.0358 (102.13)			
lux4				0.0192 (84.59)		
lux5					0.0354 (79.27)	
lux6						0.1060 (34.70)
p-value lux#	0.000	0.000	0.000	0.000	0.000	0.000
Observations	4,220,540	4,154,737	4,154,737	4,220,540	4,220,540	4,220,540

Table 5: **Regression of nvan1 on luxury variables**: t-stats are in parentheses

Results: government reserved plates

Constant	0.0358	
gov1	0.0019 (1.38)	CityAdm&State
gov2	0.0018 (0.63)	FedBailiff/CoI/Prosecutor
gov3	0.0017 (0.42)	FedDrugControl
gov4	-0.0028 (-0.90)	FedMigration
gov5	0.0062 (1.28)	GIBDD
gov6	0.0018 (0.46)	HigherAuth
gov7	-0.0083 (-1.74)	MIA
gov8	**0.0230** **(5.63)**	MIA/**StateSecurity**
gov9	-0.0029 (-0.87)	SupremeCourts
Observations	4,244,295	

Table 6: **Regression of nvan1 on gov1-gov9**: t-stats are in parentheses

Results: regional corruption

- Citizens of Moscow, different regions of birth
- $van_i = a + b_r * lux_i * (\text{region of birth dummies}_r) + e_i$
- create a rank of b_r's

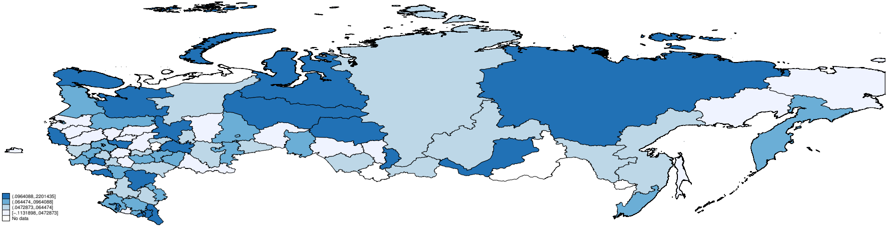


Figure 3: Map of corruption by region of birth, darker regions are more corrupt.

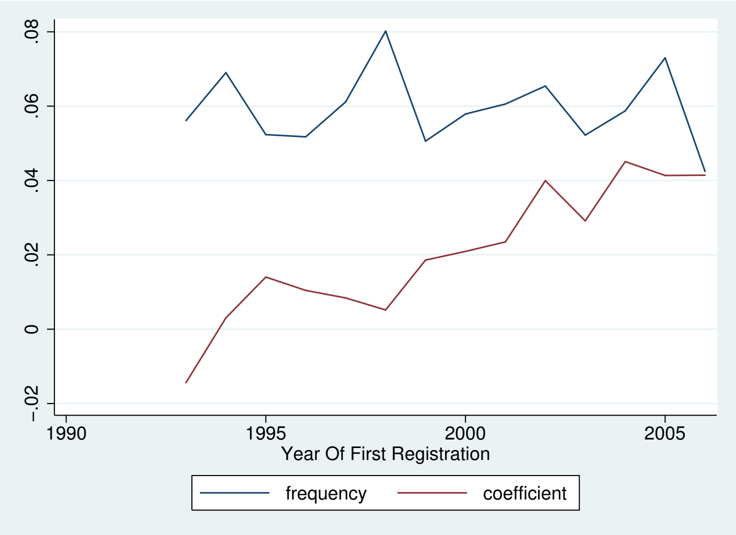
Results: validation

	nvan1 coeff	van coeff	lvan2 coeff	nvan1 freq	van freq	lvan2 freq	lvan3 freq	trust	trust police	bribe
nvan1 coeff	1									
van coeff	0.1545	1								
lvan2 coeff	-0.0720	0.9353	1							
nvan1 freq	-0.1988	0.7773	0.9214	1						
van freq	0.1835	-0.0026	0.0951	0.4136	1					
lvan2 freq	0.2785	-0.5229	-0.5110	-0.2118	0.8001	1				
lvan3 freq	0.1852	-0.5931	-0.7817	-0.7872	-0.0887	0.4433	1			
trust	**-0.3072**	-0.0174	**-0.1946**	-0.4114	-0.7647	-0.5134	0.4574	1		
police trust	**0.4656**	**0.2393**	**0.1031**	-0.2302	-0.6691	-0.6129	-0.2180	0.1699	1	
bribe	**0.2561**	**0.6870**	**0.4991**	0.1892	-0.5667	-0.7499	-0.3665	0.3864	0.7403	1

Table 7: On the Russian federal region level: nvan1 coeff, van(=1 if nvan=1 or lvan=1) coeff and lvan2 coeff, these measure corruption by regressing a vanity variable on a luxury variable. nvan1 freq, van freq and lvan2 freq measure the frequency of the respective vanity variables. From the WVS: generalized trust (higher levels more trust), trust in the police (higher levels more distrust) and acceptability of bribery (higher levels mean more acceptable to bribe)

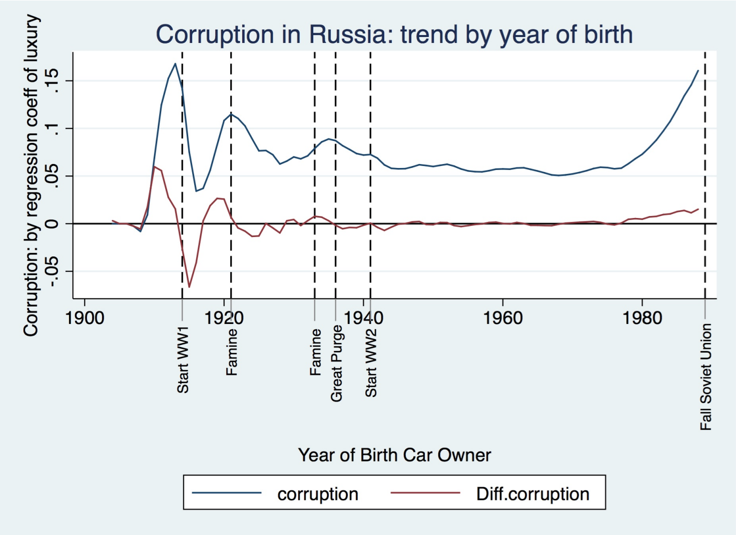
Results: trend over year of registration

- frequency of vanity plates fluctuates
- coefficient of vanity on luxury strengthens over time



Results: trend over year of birth

- $van_i = a + b_t * lux_i * (\text{years of birth dummies}_t) + (\text{year of registration effects}) + e_i$



Results: impact on traffic outcomes

- Multiple channels
  - signal to traffic police (power, rent-seeking)
  - $\rightarrow$ moral hazard effect on driving behavior (more risk-taking);
  - correlation vanity plates and luxury cars, plus correlation luxury cars risky driving behavior
- Cragg's double hurdle model
- variables:
  - likelihood and magnitude of fines,
  - likelihood and duration of losing driver license,

Results 1

Lower likelihood to be fined but higher conditional fine

	Coef.	z	$P > \|z\|$
Tier1			
lvan1	-0.04431	-6.54	0.000
lux1	-0.16651	-31.38	0.000
lvan1*lux1	0.00110	0.04	0.968
cons	0.46095	589.89	0.000
Tier2			
lvan1	0.02610	3.98	0.000
lux1	0.00054	0.10	0.921
lvan1*lux1	0.06212	2.22	0.026
cons	11.53818	1.6e+04	0.000

Table 8: fines lvan, obs 2878461

	Coef.	z	$P > \|z\|$
Tier1			
nvan1	-0.02601	-5.84	0.000
lux1	-0.16429	-30.25	0.000
nvan1*lux1	-0.02369	-1.24	0.213
cons	0.46117	584.77	0.000
Tier2			
nvan1	0.04868	11.38	0.000
lux1	-0.00474	-0.86	0.390
nvan1*lux1	0.07291	3.70	0.000
cons	11.53703	1.5e+04	0.000

Table 9: fines nvan

Results 2

Lower likelihood to loose license AND shorter period of withdrawal

	Coef.	z	$P > \|z\|$
Tier1			
lvan1	-0.08510	-5.39	0.000
lux1	-0.32793	-20.79	0.000
lvan1*lux1	-0.02883	-0.32	0.748
cons	-2.01708	-1200.37	0.000
Tier2			
lvan1	-0.01501	-0.78	0.438
lux1	-0.17892	-8.54	0.000
lvan1*lux1	-0.28458	-2.31	0.021
cons	2.53180	1264.77	0.000

Table 10: deprivation of license lvan

	Coef.	z	$P > \|z\|$
Tier1			
nvan1	-0.05986	-5.92	0.000
lux1	-0.32487	-20.21	0.000
nvan1*lux1	-0.04450	-0.72	0.473
cons	-2.01635	-1189.72	0.000
Tier2			
nvan1	-0.03549	-2.89	0.004
lux1	-0.18836	-8.83	0.000
nvan1*lux1	0.03266	0.39	0.700
cons	2.53260	1254.73	0.000

Table 11: deprivation of license nvan

Future research/Challenges

- **Challenges**
  - Dilemma between studying small samples and accurately measuring the corruption
  - Cultural preferences for vanity plates?, possibly correlated to regional gdp per capita?
- **Future research**
  - Historical roots of current corruption behavior (famine, civil war, gulags, monotowns, holocaust, $\cdots$)
  - Local government corruption
  - Variation in police department corruption levels
  - Impact of vanity plates on traffic accidents (and determine driving behavior effects of vanity plates)

Conclusion

- A simple model uses vanity consumption to detect corruption
- Empirical application of this model on Russian administrative license plate data
- Clear evidence for corruption
- place of birth variation in line with other place of birth corruption indexes ⇒ local cultures of corruption persist
- welfare costs in terms of driving behavior ⇒ lower likelihood of punishment suggests moral hazard
- Interesting time variation and year of birth variation ⇒ corruption increases during last decade