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Abstract

Analyzing law enforcement data on corruption incidents for a panel of 79 Russian regions for the period 2004-2007, we find that the relative salaries of bureaucrats determine corruption levels: Corruption declines as relative salaries rise up to a turning point, beyond which corruption rises again. Other important determinants are the strength of law enforcement, available rents through government budgets and natural resources, education levels, unemployment rates, and income inequality.

Key words: Corruption, Russia, bureaucracy, law enforcement

JEL classification: K42; H10; P26

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1. Introduction

Low salary levels of public officials have long been regarded as one of the root causes for corruption among public officials.[1] Underpaid civil servants seeking to make ends meet or to achieve an income comparable to that of their peers may be tempted to accept bribes in exchange for favors, such as government contracts, non-prosecution, easier licensing and so forth.[2] This observation has made increases in remuneration of public officials a key element of anti-corruption strategies in many countries.[3] The prime example is Singapore, which became one of the world's least corrupt countries after having raised the salaries very significantly and introduced complementary measures (Quah 2001).

Most theoretical contributions have supported the negative relationship between relative salaries of public officials and the level of corruption. Starting with Becker and Stigler (1974), they have made "efficiency wage" types of arguments – better paid civil servants have more to lose (Cadot 1987, Andvig and Moene 1990, and Bond 2008) and a higher motivation and loyalty as they are treated more fairly (Akerlof 1982, Akerlof and Yellen 1986). Bond (2008) suggests that high pay attracts honest individuals, thus improving the pool of candidates for public positions.

Yet, Besley and McLaren (1993) show that increasing civil service pay may actually increase corruption under certain conditions. 'Superauditors', responsible for detection and prosecution of corruption, may be corruptible themselves. When civil service is better paid, the 'superauditors' can extract higher rents when agreeing not to prosecute corrupt officials and thus may be more inclined to engage in this type of corruption. This may lead to a lower detection probability and higher overall corruption levels. Sosa (2004) shows that higher salaries can lead to more corruption if higher income reduces risk aversion sufficiently (and penalties are not too high). It has long been recognized in labor economics that increased wealth may erode work incentives. For instance, Thiele and Wambach (1999) show in a principal-agent model that wealthier agents will create a smaller surplus for the principal, if the absolute risk aversion of the agent is relatively high compared to the degree of absolute prudence of the principal. Gneezy and Rustichini (2000) provide empirical evidence for a non-monotonic relationship between productivity and wages. Since the opportunity cost effect and the risk attitude effect of higher wages are not mutually exclusive, the net effect is not clear a priori and it may change sign over the relevant range. Mookherjee (1997) provides a model in which the wage-effort relationship has an inverted U-shape. His reasoning suggests for our context a U-shaped relationship between relative salaries of public officials and corruption level. Thus, from a theoretical point of view, the tradeoff between salary levels and corruption levels is still not entirely clear, making the question essentially an empirical issue.

Surprisingly, there is no clear consensus in the empirical literature either. Van Rijckeghem and Weder (2001) find a significant negative relationship in a panel data set comprising 31 developing countries and the period 1982-94. This relationship, however, disappears when they look at within-country

[1] Inter alia, Palmier (1985), Mauro (1997), World Bank (1997), and Kaufmann (1997).

[2] Governments lacking adequate funds to pay their employees may actually rely on civil servants to supplement their incomes through corrupt activities (Besley and McLauren 1993). McLeod (2008) argues that civil servants in Indonesia under Soeharto were deliberately underpaid and expected to raise their income through corruption, which made them a part of a corrupt system that benefitted the ruling family.

[3] For instance, Peru, Argentina, Georgia, Nepal, Ghana (Tanzi 1998; TI Georgia Report, 2011; TI Nepal Report, 2001; Chand and Moene 1999).

variations (fixed effects regressions). They use manufacturing wages as reference remuneration and corruption perceptions assembled in the International Country Risk Guide as a measure for corruption. Other cross-national studies by Treisman (2000), Rauch and Evans (2000), and Pellegrini and Gerlagh (2008) find no significant effect. While insightful, these studies may potentially suffer from unobserved heterogeneity — countries may differ in dimensions not (sufficiently) controlled for that affect corruption and are correlated with the variables of interest, such as the quality of institutions, general attitudes, customs, and traditions. Moreover, they use corruption perceptions as measures of corruption for want of better internationally comparable data. Perception data have been widely criticized for the lack of validity (Knack and Keefer 1995, Golden and Picci 2005, Seligson 2006). Perceptions on what constitutes corruption and how severe it is, whether they are by experts or by the population at large, strongly vary across countries and are influenced by culture, traditional norms, and individual attitudes (Bertrand and Mullainathan 2001). Unsurprisingly, corruption perceptions have been shown to reflect only very inaccurately the actual extent of corruption (Mocan 2008, Donchev and Ujhelyi 2011). In a natural experiment, Olken (2009) finds that corruption perceptions of Indonesian villagers in a road construction project are only weakly correlated with more objective measures of missing expenditures (especially for material inputs). These findings cast doubt on the validity of perception-based studies on the determinants of corruption. Recently, a small literature has emerged that analyzes the determinants of corruption at the national or sub-national level using law enforcement data. This approach has two distinct advantages: First, studies using within-country variations suffer much less from unobserved heterogeneity and thus from omitted variable biases, as unobserved determinants of corruption like institutions, tradition, histories etc. are much more similar, if not equal. Second, law enforcement data are much more reliable as they do not suffer from perception biases. Goel and Rich (1989) use conviction rates of corrupt officials at federal, state, and local levels in the U.S. and find that differences between salaries of public officials and middle grade accountants affect the conviction rate. Goel and Nelson (1998) employ a U.S. cross-state dataset of convictions among public officials and find high salaries to reduce corruption. Glaeser and Saks (2006) use federal corruption conviction rates in the 50 U.S. states and find that states with a richer and better educated population are less corrupt, as are those with lower inequality and lower racial dissimilarity. They do not include a measure of civil servants relative salary. Contrary to the studies by Goel and Rich (1989) and Goel and Nelson (1998), Karahan et al. (2006) find that corruption among the supervisors responsible for governance of 82 counties in Mississippi State (USA) is significantly positively correlated with their remuneration. Finally, Alt and Lassen (2013) find inconclusive support for a relationship between public officials pay and corruption across American states, a significant negative relation is found only in the absence of fixed effects in the model.

While most of the literature studies the U.S., Di Tella and Schargrodsky (2003) analyze corruption in public procurement in Argentina and find that, conditional on monitoring effort, high civil servants' wages decrease corruption. Monte and Papagni (2007) analyze the determinants of corruption in Italy and find that government consumption, level of development, and political culture influence corruption. Dong and Torgler (2012) provide evidence for a significant negative impact of public salaries on provincial conviction rates in China.

Our paper contributes to this literature, but differs in important aspects. First, we investigate the determinants of corruption in the Russian Federation using law enforcement data. Russia is a particularly interesting case: It is the ninth largest country in the world and a former superpower,

and it is geographically and socio-economically very diverse. Corruption is rampant. In the recent Corruption Perception Index by Transparency International, Russia ranks 133 out of 176 countries surveyed.[4] Its federal structure and its large geographical differentiation allows for a sound econometric analysis at the sub-national level. Even though, very little has been written on corruption in Russia from an economic perspective. Dininio and Orttung (2005) use the experience-based corruption data to measure corruption but do not include the relative salary of public officials in their regressions. Due to their small sample size of 40 observations in a cross-section approach for 2002 and the missing variable of interest, their findings are of limited use for our purposes.

Second, we investigate whether a non-monotonic relationship between public officials' relative salaries and corruption exists. Even though the notion of a U-shaped relationship between public wages and corruption has been suggested by theory (Besley and McLaren 1993, Mookherjee 1997, Thiele and Wambach 1999, Sosa 2004, see above), it has not been empirically tested hitherto. We provide such an analysis. Our data not only allow for a panel analysis, we are also able to use measures of relative salary that are much more precise than the broad measures used in cross-country analyses. We compare public officials' remuneration to the salary of business counseling — an occupation that requires a skill set very similar to that of public officials.

We use a data set that we assembled from various government sources, including corruption incidents at the regional level, which were recently made available to us by the Russian Ministry of the Interior. We use corruption incidents registered by the police as our primary measure of corruption in a Russian state or region. We argue that – unlike in the U.S. – convictions may be open to political influence and thus less reliable than registration with the police. However, we use conviction rates as an alternative measure of corruption. In a panel approach covering 79 Russian regions and the period 2004-2007, we find that corruption is negatively related to the level of civil servants' salaries — up to a point beyond which corruption increases again. We thus provide evidence for a non-monotonous relationship between the remuneration of public officials and the level of corruption, which is very robust with respect to the corruption measure, the salary concept, and the inclusion of different sets of controls. Moreover, corruption is determined by the quality of law enforcement, it increases with the existence and size of rents in form of natural resources and public budgets and decreases with lower income inequality and higher education.

Our paper proceeds as follows. In the next section, we introduce our data. Section 3 presents the results of pooled OLS and fixed effects panel regressions. Section 4 reports several robustness checks, notably we use conviction rates as alternative measure for corruption. Section 5 concludes.

2. The Data

We investigate differences in corruption among regions in Russia for the period 2004-2007. The period is characterized by stable economic growth; the national economy had recovered from the financial crisis of 1998 and enjoyed a large trade surplus owing to a high oil price. It covers the second term of the second Russian President, Vladimir Putin, and is thus characterized by a stable

[4] http://www.transparency.org/cpi2012/results (accessed 14.2.2013). The score ranges from 0 (most corrupt) to 100 (not corrupt); Russia's score is 28.

political environment. Likewise, no major anti-corruption reform was introduced during the time studied.

The data-set covers 79 Russian regions that account for 99.2% of the population.[5] All regions exhibit ample socio-economic heterogeneity but are homogenous in terms of official language, legislation, taxation system, and business regulations. Some regions have the status of a republic. While they have a similar legal status, they have their own constitution in addition to the national and are de facto more independent. They have a strong non-Russian minority or even majority with its own official regional language, receive larger transfers from the center, and show stronger support for Russia's ruling party than the average (Jarocinska 2010). To account for unobserved factors that might influence corruption levels in the pooled OLS regressions, we create a dummy variable REPUBLIC.

2.1 Measuring Corruption

As corruption is clandestine and illegal, it cannot be measured accurately; however, the empirical literature suggests two possible corruption proxies. Corruption perception indexes have been widely used, especially in cross-national analyses, as they are readily available. Yet, perception-based measures of corruption have been strongly criticized for being subjective and biased (inter alia, Knack and Keefer 1995, Bertrand and Mullainathan 2001, Seligson 2006, Mocan 2008, Olken 2009, Donchev and Ujhelyi 2011). The second proxy is criminal data reported by law-enforcement agencies. They are more objective as they are not based on perceptions but on convictions or other measures of legal action. Yet, these criminal data measure not only corruption incidents but are at the same time affected by the quality of law enforcement. For this reason, they are only appropriate in within-country studies with the police force under central authority, where legal system, operating procedures, and determination of law enforcement are the same across all units of observation.[6] These proxies have been used for the 50 U.S. states (Glaeser and Saks 2006, Goel and Nelson 2011, Alt and Lassen 2013); we use similar data for the 79 Russian regions. In Russia, the police is under central control and thus operating procedures and determination are similar across regions; yet we control for differences in resources and efficiency of law enforcement (see below).

Our primary corruption measure (CORR) is the number of registered bribe-acceptance incidents in the region per 100,000 population. The Russian Criminal Code (Article 290) defines bribery as the acceptance of money, securities, or other valuables by a public official (personally or through an intermediary) for his/her performance as an action or inaction for the benefit of a giver or an affiliated person, if such action implies that the public official exploits his/her position or his/her

[5] The Russian Federation currently has 83 administrative regions, but our data set comprises only 79. Chechenya is omitted due to the ongoing military conflict; three regions are autonomous, but have been aggregated with neighboring regions for the official statistics due to data limitations. (Nenets Autonomous District belongs to Arkhangelsk Region; Khanty-Mansi Autonomous District and *Yamalo-Nenets* Autonomous District belong to Tyumen Region). In 2004 there were 89 regions; yet 6 small autonomous districts (okrug) were merged in the period under study with the neighboring larger jurisdictions in 2005 (1), 2007 (3) and 2008 (2). Because these districts are very small, often below 100,000 population, and mergers were planned in 2004 already, the FSSS did not provide separate data for the soon to be merged districts. Thus we use the current delineation of regions.

[6] For this reason, Glaeser and Saks (2006) use FBI data rather than data from the local or state police.

authorities or installs patronage. It is in line with the conventional definition of corruption as "a misuse of public office for private gain" (World Bank, 1997). Bribery necessarily implies the public official to be involved as a recipient of a bribe.

Our primary corruption measure CORR differs from the conviction rate used by Glaeser and Saks (2006) and others in three important aspects. First, conviction is a product of completed juridical proceedings while registering a crime is only the first stage of criminal prosecution. In an environment in which the juridical system may be corrupted as well, conviction rates may be distorted much more than primary criminal statistics, such as the incidence rate we use — court proceedings may be politicized or corrupted. While the registration decision may be in principle corrupted as well, we argue that this is much less of an issue as police officers face the risk of being accused and prosecuted if the reporting person complains to a higher official. It is much easier to protract and effectively sabotage the investigation in exchange for a bribe due to non-transparent and complicated investigation procedures than not to register a crime, which is an offense that is easy to prove.[7] Second, convictions refer to the number of convicted individuals independent of the number of cases, each incident on the other hand corresponds to one detected criminal act. The number of incidents arguably portrays the corruption landscape better as it measures the frequency of corruption.[8] Third, the time span required to register an incident is much shorter than to complete criminal proceedings with a conviction: the criminal procedure legislation requires corruption incidents to be registered within three days from the moment of detection or notification. This allows a much better timely fit of the corruption measure as endogenous variable with the explanatory variables, notably relative salary levels, which change over time. Incidents data are more responsive to changes in actual corruption levels than conviction rates.

For these reasons, we think that the incident rate fits better for a panel data analysis. Nevertheless, we use conviction rates as a secondary corruption measure in Section 4 to investigate whether our results are affected by the choice of the corruption measure. We obtained both data sets from the Ministry of the Interior, yet only for the period 2004-2007.[9] Figure 1 depicts the distribution of incidents (pooled sample).[10]

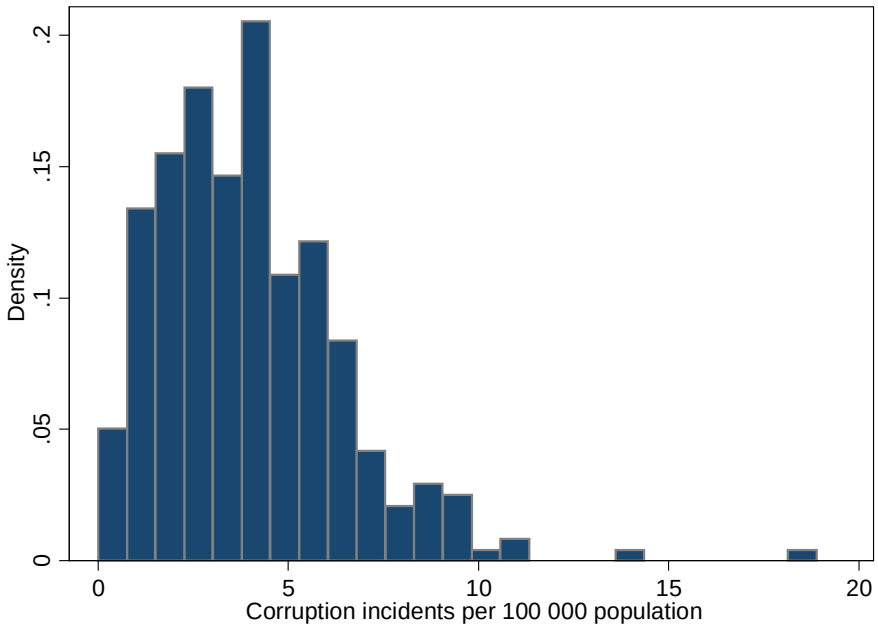
[7] Before 2003, the police was paid bonuses solely on the basis of the resolution rate, which might have created an incentive not to register crimes. This practice was discontinued after Ministry of the Interior had initiated a police reform introducing a different motivational mechanism (MDV press service, 2002).

[8] Moreover, conviction data are often quite noisy (Alt and Lassen 2013), not the least because one case can lead to more convictions making the data "lumpy".

[9] While no reason was given why newer data were not made available to us, we surmise that police officials did not want to be held accountable for any findings that referred to the recent past.

[10] Descriptive statistics for all data used are given in Table 1. Details on data construction are given in the Appendix.

Figure 1: Distribution of corruption incidents per region-year



2.2 Relative Salary

Russia's bureaucracy has three tiers – federal, regional, and municipal – with the wages of the federal level being centrally set. The law on the civil service states as one of its principles that remuneration should be comparable across all levels of civil services. The Code also establishes a system of additional payments for the length of service and special payments (e.g. for work in the northern region) and requires an annual salary increase according to the inflation rate. Yet, there is no clear guidance for the salary size, neither at the federal nor at the regional level. Decisions on salary levels are centrally made and have to be approved by the Ministry of Finance.

After the economic recovery following the crisis in 1998, Russia witnessed significant raises in salaries in nearly all industries of the private sector, while the public sector was lagging behind. After the presidential election in 2004, it was decided to increase the civil service salaries starting from January 1, 2005. Although it was not officially announced to be a special anti-corruption measure, fighting corruption was the most commonly named reason for this salary raise according to a sociological survey (Petrova 2004).

Our relative salary variable (RELSAL) is constructed as a ratio of the average monthly salary payments of a public official in the region[11] to the average monthly salary payments in a comparable sector, lagged for one period. The data on public officials cover civil servants with executive and legislative functions at federal, regional, and local levels. These functions include taxation, budget execution, budget and taxation supervision, custom services, inventory and estate management, socio-

[11] It includes all paid salaries, various monetary and non-monetary compensations for labor, bonuses, vacation pay, *etc*.

economic planning, and governance. The numerator of the ratio reflects the actual legal earnings of the potential bribe-takers.

The denominator of the salary variable reflects the opportunity costs of being a civil servant (or the remuneration level that a civil servant may deem adequate) and thus indicates the temptation to accept bribes. While per capita GDP and average per capita income have been frequently used as a comparison (Treisman 2000; Pellegrini and Gerlagh 2008; Goel and Nelson 1998; Karahan et al. 2006), they are extremely aggregate measures and can be misleading as they do not portray the remuneration of the group of people civil servants compare their income to. Moreover, the GDP per capita strongly depends on the sector composition of the regional economy and therefore differences in relative wages constructed with regional GDP per capita as denominator may not reflect differences in opportunity costs but rather differences in the sectoral composition of the regions. Civil servants may compare themselves to occupations in the private sector that require comparable skills. As a solution, Van Rijckeghem and Weder (2001) propose wages in the manufacturing sector, but they admit that their measure does not meet the same level of skill content as of the government employees.[12]

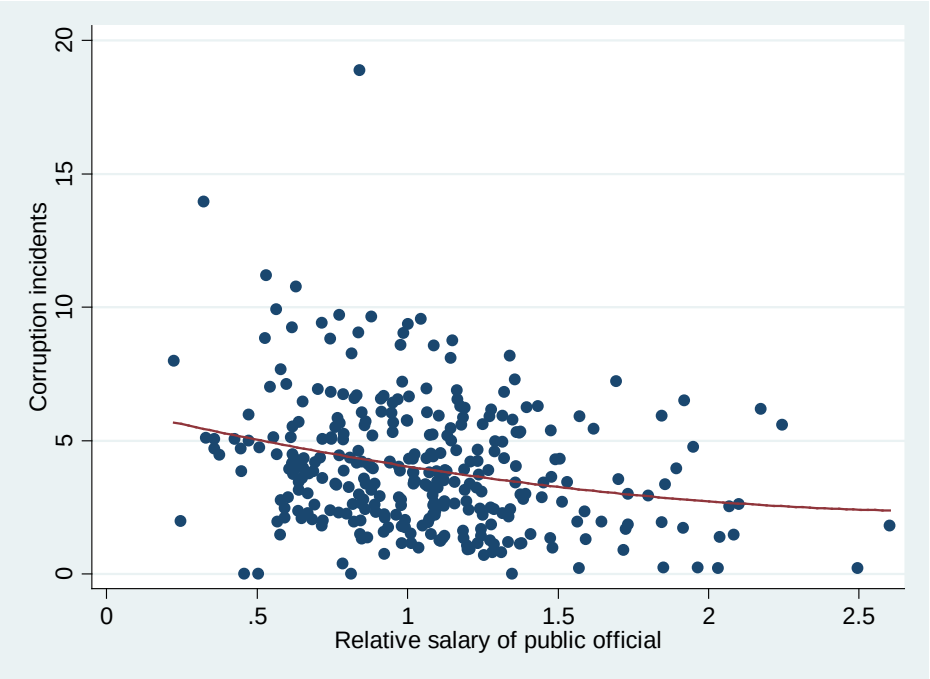
We argue that a natural alternative wage for public officials is the salary level in business counseling. Skill requirements and level of responsibilities are comparable so that counseling may be a realistic alternative for public officials. Goel and Rich (1989) use a similar strategy by comparing public officials pay to that of the middle-grade accountants (as a measure of average salary of white collar professionals in the private sector), assuming that middle-grade accountants may have similar skill sets as the relevant public officials. While we consider their measure to be preferable to the average manufacturing wages or GDP per capita, we think that in the Russian context, business counseling is more appropriate because the job requirements and responsibilities are more comparable to those of public officials, who make decisions on a regular basis, especially if they are able to extort bribes. According to the Russian Federal State Statistics Service (FSSS), the section "business counseling" incorporates financial management counseling, the development of accounting and controlling systems, human resources and marketing counseling, consulting organizational planning, assessing of tangible and intangible property, public relations services, leading projects (management and supervision of resource allocation, quality control and reporting), services for solving industrial disputes, and other services for business operations. Therefore, business counseling resembles executive and legislative functions of a government since both sectors provide services to the same commercial entities in a region. Indeed, public salaries are within the same range as salaries in counseling: on average RELSAL ratio amounts to 1.06.

RELSAL is lagged one period. Our data are annual averages, implying that this year's relative salary is the average public officials' salary divided by the average salary in business counseling, both averaged over all occupations within that group and the entire year, part of which is in the future at the time when the official decides whether to engage in corrupt activities. Contemporaneous relative salary is thus unobservable; past relative salaries, in contrast, are well known. Moreover, some corrupt activities may take time to arrange and/or to reveal so that the decision to engage in corrupt activities may have been taken in the year before the incident was registered.

[12] In cross-country studies data availability often leaves little choice in selecting a comparable remuneration, which casts some doubt on the explanatory power of such studies.

Figure 2 shows the relationship between relative salary and corruption incidents. The scatterplot suggests a negative nonlinear relationship between these variables. It also shows a substantial variation in relative salary levels ranging from 0.22 to 2.60.

Figure 2: Corruption incidents and relative salary levels



2.3 Other Determinants of Corruption

The primary concern with the criminal data on bribery is to control for the *effectiveness of law-enforcement*. More effective law enforcement may deter corrupt activities (Becker and Stigler 1974), thereby reducing actual corruption levels. At the same time, more effective law enforcement may detect a larger share of the existing corruption, leading *ceteris paribus* to higher registered incidents of corruption.[13] While the deterrence effect may take some time to materialize, the second effect may be faster. In order to capture both opposing effects, we introduce several measures of law-enforcement. The first two measures pertain to the Ministry of the Interior of Russian Federation (*Ministerstvo Vnutrennikh Del, MVD*). The resolution rate of major criminal offences (SOLVE) reflects the efficiency of the agency to solve the registered crimes. Yet, it is conceivable that the resolution rate is high because the share of registered crimes in total crimes is low. The available resources normalized by population serve as an additional proxy for the ability of the agency to fight crime. We use data on budgetary expenditures on law-enforcement and security per capita (ENFORCE). Lastly, we use the number of court employees per 100,000 population (JUDGE). Judicial employment is a proxy for effective prosecution in court and does not directly relate to our dependent variable but to our alternative dependent variable, the number of convictions per 100,000 population. Nevertheless, a well endowed juridical system may indicate a higher probability of being convicted once the crime is registered and thus may create a significant deterrence effect.

[13] People may be more inclined to report corruption if they are convinced that the police will be effective in building a case against the perpetrators.

The size and frequency of corrupt acts is likely to depend on available *economic rents*. Larger public budgets, especially public procurement of non-standard equipment, will increase opportunities for corruption (Shleifer and Vishny 1993). We use per capita real budget expenditures, excluding expenditures for law-enforcement, juridical system, and total wage fund of employees in the governmental sector (EXPEN) as a proxy for rents to be acquired through corrupt behavior (for instance misappropriation of funds in exchange for kickbacks).

Natural resource rents often create a corrupt environment (Leite and Weidmann 1999, Kronenberg 2004, Bhattacharyya and Hodler 2010 and Van der Ploeg 2011). Firms in the extractive industries operate in non-competitive market environments with high entry barriers and intensive regulations; as they are not footloose, they cannot escape government extortion. Given the regulatory environment and the high resource rents and thus high (potential) profits, bureaucrats and firm executives may face strong temptations to engage in corruption. In cross-country studies, the share of fuel and mineral exports in the total exports have been used as a proxy for abundance in natural resources (Ades and di Tella 1999, Treisman 2000, Pelligrini and Gerlagh 2008), which is not suitable for within-country estimations. We use the share of natural resource tax revenues in the total revenue of the region (%). It indicates the importance of the extractive industry for the regional economy and the size of the rents. We also control for the *socio-economic profile* of the regions. We include *average income,* which has frequently been used in corruption studies and found to be negatively correlated with corruption levels (e.g., Meier and Holbrook 1992; Goel and Nelson 1998; Adsera et al. 2003, Glaeser and Saks 2006, Alt and Lassen 2013) and use the logarithm of income per capita in constant rubles. We also include *income inequality*, which has been found to be a strong determinant of corruption, e.g. Gyimah-Brempong (2002) for Africa, You and Khagram (2005) for a cross-section of countries, Glaeser and Saks (2006) for the U.S., and Dong and Torgler (2010) for China. *Education*, as a vertical check on government (Knack et al., 2003), should be negatively associated with corruption levels as it empowers people to resist corruption demands (Glaeser and Saks 2006, Alt and Lassen 2013). We include the percentage of the economically active population with college, university, or higher education (EDU). Data on education are composed on the bases of quarterly representative surveys by FSSS.[14]

Opportunity costs of corruption are measured by our variable of interest, the relative salary of public officials, the probability of detection (captured by the law enforcement variables described above), and the ease to find a different occupation once the public official has been convicted and fired.[15] We measure the latter influence by the long-term unemployment rate (of the previous period) as it captures the structural properties of the labor market better than the actual business cycle (which

[14] Income per capita, education, and inequality may be affected by corruption as well, so that these variables may be endogenous. Gundlach and Paldam (2009) find that long-run causality runs from high income to low corruption and not conversely. Still, we cannot exclude the possibility of endogenous regressors, which would make their point estimates less reliable, especially in pooled OLS regressions. In fixed effects regressions using annual data, this is much less of an issue as the time for feedback effects is comparatively short. As the estimates for our variable of interest are very similar in pooled OLS and FE regressions and also the omission of these variables (income per capita, inequality, education) from the regression model did not change the estimates of our variable of interest in any significant way, we believe that this is not a major issue in our context. Except for the paper by Glaeser and Saks (2006), no other paper using conviction rates has instrumented for these variables.

[15] Cf. Van Rijckeghem and Weder (2001). Of course, ideally we like to include the unemployment rate for individuals with a comparable skill set, but these data are unavailable.

may not be decisive for the decision to engage in corruption as conviction may fall in a different cycle). We use the percentage of unemployed population that seeks jobs for 12 months or more (UNEMP12).

Larger *Government size* may be conducive for bribery. Bigger governments may imply a larger role of the state in the economy and therefore provide more possibilities for bribe-taking and larger returns to bribe-giving (Glaeser and Saks 2006). It may also be true that states with larger numbers of public officials have more potential bribe-takers. We measure government size by the share of government employment in total employment (GOV).

Media have been found in other contexts to curb corruption effectively (Brunetti and Weder 2003, Chowdhury 2004) through monitoring, information transmission and exposure of corrupt officials. However, this requires a certain degree of press freedom, and it is not clear to what extent this requirement is met in the Russian Federation. To control for such a possible effect, we include the coverage of *regional* television channels (TV) as a share of total population. Regional TV stations may be more inclined to report on local corruption cases than the national media.[16]

As standard controls we include *population* in order to capture scale effects (in addition to the normalization of the endogenous variable by population) and *year fixed effects* which may capture common time trends such as changing priorities in law enforcement.

Data are summarized in the following Table 1.

Table 1. Variable description and summary statistics

Variable Name	Variable Description	Descriptive Statistics		Data Source
		Mean	Standard Deviation	
CORR	Number of registered incidents of bribe-acceptance as defined by Criminal Code, Article 290, normalized by 100,000 of population.	4.00	2.44	[1]
CONV	Number of convicted persons for bribe-acceptance as defined by Criminal Code, Article 290, normalized by 100,000 of population.	1.55	0.77	[1]
CONVmjr	Number of convicted persons for major crime of bribe-acceptance as defined by Criminal Code, Article 290, normalized by 100,000 of population.	2.10	1.09	[1]
RELSAL	A ratio of paid average monthly salary (including compensations and bonuses) of a public official to paid per capita monthly salary (including compensations and bonuses) in business counseling sector, lagged for 1 year	1.06	0.39	[2]
SOLVE	Annual resolution rate (%) for major and gravest crime offences (defined as a crime falling within a sentence of over 5 years).	55.11	10.85	[1]
ENFOR	Per capita budgetary expenditures for law-enforcement and security (including public prosecution bodies, police department, internal security troops, organs of justice, penitentiary service, drug control service, federal security service) in 1000 constant rubles	0.50	0.30	[3]

[16] Another good proxy for media presence is local newspaper circulation as used by Ferraz and Finan (2011); however, these data are unavailable for Russian regions. Ideally, we would like to incorporate the degree of press freedom in a region in our measure since free media are more effective in monitoring corruption, but data limitations preclude that.

JUDGE	Average annual number of judicial employees (excluding magistrate and technical staff) per 10,000 population	10.37	5.94	[2]
EXPEN	Per capita total expenditures by state and local governments (excluding law-enforcement, judicial power and salaries of government employees), in 1000 constant rubles	17.56	22.12	[3]
OIL	Tax revenue from oil-extracting industry as a share of total budget revenue (%)	0.96	3.40	[3]
INC	Logarithm of average monthly per capita income in constant rubles	8.54	0.41	[2]
GINI	Measure of gross income inequality, Gini coefficient (gross-income), [0,1]	0.38	0.37	[2]
EDU	Percentage of economically active population with professional (college or higher) education (annual estimates)	68.59	6.37	[2]
POP	Average annual constant population (thousands), lagged for 1 year	1793.94	1615.40	[2]
TEL	Density of fixed landline telephones per 100 of population, 1 year lagged	26.83	7.80	[2]
UNEMP12	Share of unemployed population (estimated according to the methodology of International Labour Organization) who is in search for job for period over 12 months to economically active population (%), lagged for 1 year	3.92	3.36	[2]
GOV	Governmental employment as a share of total employment (%, average annual data)	8.81	2.93	[2]
TV	Broadcasting coverage of regional TV channels, percentage of population covered (%)	88.92	13.09	[2]

Data sources:

[1] Ministry of the Interior (http://www.mvd.ru/)

[2] Federal State Statistics Service (http://www.gks.ru/)

[3] Ministry of Finance (http://roskazna.ru/)

3. Results

We first run an OLS regression on the pooled sample with robust standard errors clustered at the regional level including a full set of time dummies. Dependent variable is the number of bribery incidents per 100,000 population registered by the police. Results are reported in Table 2. Our preferred specification is (4), in accordance with the Akaike and the Schwarz information criteria.

Corruption declines significantly as the relative salary of public officials rises; the relationship, however, is strongly non-linear: the decline of corruption incidents diminishes with rising relative salaries and corruption starts rising beyond a relative salary of 1.57, which is the case for roughly nine percent of the observations. The effectiveness of the judicial system is measured by three variables: the annual resolution rate of severe criminal offenses, the resources for law enforcement as measure by per capita expenditure for law enforcement, and the number of juridical staff per 10,000 people. In principle, these variables could have a negative effect on reported bribery cases as they deter individuals from engaging in corruption or a positive effect as a higher share of corruption acts get reported. The net effect is an empirical issue.[17] We find a small positive effect of the clearance ratio (SOLVE) on reported corruption incidents, which, however, is not significant at the usual levels. Better resource endowment of the law enforcement agencies reduces the reported

[17] These variables measure different things: resource endowment (ENFORCE) and clearance ratio (SOLVE) are only weakly correlated (ρ=0.08), which is an interesting finding in itself. Resource endowment of law enforcement and staffing levels of the judiciary (JUDGE) are correlated with ρ=0.60.

corruption incidents significantly. The number of judicial staff per 10,000 population does not exert any significant effect, which is not surprising given that the staff is not responsible for registering the crime with the police.

Natural resource rents as measured by the size of the oil rents increase corruption significantly. This is in line with findings of Bhattacharyya and Hodler (2010), who find that natural resource rents increase corruption in countries with poor institutions (but not in countries with good institutions, cf. van der Ploeg 2011). The non-staff government expenditure as a proxy for the size of available resources to be acquired through corruption has no effect on reported corruption incidents in the pooled sample. The same holds for the size of the public sector as measured by the share of government employment in total employment. Income and education have the expected sign as they have been found to reduce corruption (Glaeser and Saks 2006), but estimates do not reach usual significance levels. Income inequality and population are insignificant. Long-term unemployment significantly reduces corruption. As bureaucrats are removed from their positions when convicted of corruption, the level of long-term unemployment influences the chances of obtaining alternative employment and thus co-determines the opportunity costs of corruption. There is only sparse evidence on the functioning of political accountability mechanisms in the pooled OLS framework. The coverage of local TV has no effect on registered corruption, which may be due to the fact that media is heavily controlled by the government. Chowdhury (2004) and Brunetti and Weder (2003) show that press freedom significantly reduces corruption, not the existence of press as such.

Table 2: Pooled OLS estimates on reported corruption incidents per 100,000 population

	(1) Corruption incidents	(2) Corruption incidents	(3) Corruption incidents	(4) Corruption incidents
RELSAL	-1.726***	-4.023**	-4.936**	-4.947**
	(-3.44)	(-2.19)	(-2.38)	(-2.42)
RELSAL^2		0.927	1.593**	1.574**
		(1.34)	(2.13)	(2.10)
SOLVE	0.0136	0.0142	0.0253	0.0262
	(0.69)	(0.73)	(1.45)	(1.52)
ENFORCE	-2.322***	-2.455***	-2.877**	-2.808***
	(-2.86)	(-2.81)	(-2.61)	(-2.71)
JUDGE	-0.0108	-0.0124	0.0436	
	(-0.34)	(-0.37)	(0.79)	
OIL			0.135***	0.127***
			(2.72)	(2.87)
EXPEN			-0.00397	0.00238
			(-0.28)	(0.21)
INC			-1.119	-1.082
			(-1.35)	(-1.28)
EDU			-0.0305	-0.0341
			(-0.94)	(-1.18)

GOV			-0.0353	
			(-0.40)	
GINI			2.918	2.594
			(0.34)	(0.30)
POP			0.00000745	-0.0000252
			(0.05)	(-0.21)
UNEMP12			-0.293***	-0.304***
			(-4.43)	(-5.93)
TV			0.0122	0.0131
			(1.09)	(1.17)
Constant	5.767***	7.084***	16.69**	16.76**
	(5.84)	(5.70)	(2.64)	(2.60)
Year FE	Yes	Yes	Yes	Yes
Observations	316	316	316	316
R^2	0.164	0.172	0.301	0.299
AIC	1417.7	1416.6	1381.1	1378.1
BIC	1447.7	1450.4	1448.7	1438.2

t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, robust standard errors clustered at the region level

Pooled OLS regressions potentially encounter the problem of unobserved heterogeneity and thus may suffer from an omitted variable bias. Confounding – unobservable - variables which may be correlated with the relative salary (or other controls) may include general attitude towards the state, culture, ethical norms, the inclination to report crimes to the police etc. These variables may affect the number of reported corruption incidents, and they are largely time invariant. We therefore run fixed effects regressions and analyze the determinants of the within variation of corruption. Their estimates are not biased through the omission of time-invariant variables. Results of the FE regression with robust standard errors clustered at the regional level and a full set of year dummies are reported in Table 3.

Table 3: Fixed effects estimates on reported corruption incidents per 100,000 population

	(1) Corruption incidents	(2) Corruption incidents	(3) Corruption incidents	(4) Corruption incidents
RELSAL	-0.185	-4.199***	-5.015***	-5.161***
	(-0.56)	(-3.47)	(-3.77)	(-3.85)
RELSAL^2		1.532***	1.841***	1.895***
		(3.87)	(4.06)	(4.16)
SOLVE	0.0420**	0.0469***	0.0460**	0.0468**
	(2.33)	(2.72)	(2.42)	(2.46)
ENFORCE	-0.404	-0.425	-0.582	-1.062
	(-0.22)	(-0.24)	(-0.33)	(-0.63)

JUDGE	-0.202**	-0.173**	-0.140	
	(-2.43)	(-2.26)	(-1.60)	
OIL			0.246***	0.246***
			(3.13)	(3.05)
EXPEN			0.0208***	0.0241***
			(3.77)	(4.50)
INC			1.363	1.396
			(0.80)	(0.79)
EDU			-0.0554***	-0.0533***
			(-2.69)	(-2.66)
GOV			0.0630	
			(0.41)	
GINI			37.24**	38.53**
			(2.31)	(2.38)
POP			0.0155**	0.0149**
			(2.25)	(2.18)
UNEMP12			-0.212**	-0.212**
			(-2.44)	(-2.44)
TV			-0.0197***	-0.0205***
			(-2.83)	(-2.94)
Constant	3.350*	5.194***	-42.63**	-42.99**
	(1.88)	(2.79)	(-2.09)	(-2.11)
Year FE	Yes	Yes	Yes	Yes
Observations	316	316	316	316
R^2	0.119	0.155	0.234	0.229
AIC	1079.1	1067.9	1055.2	1053.2
BIC	1105.4	1098.0	1119.0	1109.5

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, robust standard errors clustered at the region level

Our favorite specification is model (4); it is the best model of AIC and second best of BIC. Again, the relative salary level exerts a strongly negative and significant effect on the level of corruption, which is sub-linear — the turning point is now reached at a relative salary level of 1.38. A higher clearance ratio points towards a more effective law enforcement and thus to more corruption incidents registered. The resource endowment of the law enforcement agencies deters corruption – registered corruption incidents decline.

The availability of rents in the region, created by natural resources or large government expenditures, significantly increases corruption incidents. This is in line with findings in the literature. Income is insignificant; higher education levels decrease corruption. Corruption incidents increase with income inequality and convexly with population. High long-term unemployment functions – again – as effective a deterrent to corruption. In the fixed effects setup, increases in the local TV

coverage significantly reduce corruption pointing towards a disciplining effect of the media – an effect that we could not identify in the pooled sample, possibly due to unobserved heterogeneity.

4. Robustness Checks

4.1 Conviction rates as endogenous variable

We carried out a number of robustness checks, the most important is reported below. The literature that uses law enforcement data has almost exclusively relied on conviction rates.[18] Evidence exists for the U.S. (Goel and Rich 1989, Goel and Nelson 1998, Glaeser and Saks 2006, Karahan et al. 2006, Alt and Lassen 2013), for Argentina (Di Tella and Schargrodsky 2003), and for China (Dong and Torgler 2012). While the juridical system in the U.S. may be regarded as unbiased and fair on average, and thus conviction rates may reflect reality quite well, it is not clear whether this applies to political systems in which the juridical system may be open to corruption and political influence. If the juridical system is receptive to corruption and/or political influence, conviction rates may portray actual levels of corruption less well than registration of corruption incidents. We have argued that non-registration of reported corruption cases may be very risky to police officers as this may be easily proved, and as the police officers may be charged with obstruction of justice if complaints are filed. Effective obstruction of the investigation, however, is relatively riskless due to non-transparent investigation procedures. Incidents are a preferred measure also because the time lag between corruption act and registration is much shorter (registration is required within three days of notification) and thus in a panel with annual data time-variant controls may be more accurate. Lastly, convictions data are noisier than incidents data. They report the number of convicted people implying that one court case may result in a number of convictions, which may make the data lumpy (Alt and Lassen 2013). A potential drawback of incidents data may be that some of the registered corruption incidents may be unfounded, which might make the data imprecise.

To see whether the two measures of corruption portray the same picture, we run our preferred specification, i.e. model 4 in Table 3, for two conviction rates as alternative endogenous variables.[19] CONVICTION RATE – ALL measures all convictions of bribery regardless the severity of the offense, CONVICTION RATE MAJOR CRIMES measures the rate of conviction for corruption crimes with five years or more of imprisonment.[20] Results of the fixed effects regression with robust standard errors clustered at the regional level are reported in Table 4.

Table 4: Conviction rates as measure of corruption (Fixed Effects Estimation with clustered SE)

	(1) Corruption incidents	(2) Conviction Rate - All	(3) Conviction Rate of Major Crimes
RELSAL	-5.161***	-1.825**	-1.130*
	(-3.85)	(-2.01)	(-1.81)
RELSAL^2	1.895***	0.764**	0.521**
	(4.16)	(2.22)	(2.37)

[18] Monte and Papagni (2007) and Dong and Torgler (2012) are exceptions.

[19] We also use a specification that included JUDGE, the number of judicial staff, which turns out to be insignificant.

[20] We obtained data for all convictions only for the years 2006 and 2007.

SOLVE	0.0468**	0.0129	0.0173
	(2.46)	(0.61)	(1.62)
ENFORCE	-1.062	-0.616	-2.389*
	(-0.63)	(-0.54)	(-1.88)
OIL	0.246***	-0.0450	-0.0931***
	(3.05)	(-0.95)	(-3.26)
EXPEN	0.0241***	0.0272*	0.00159
	(4.50)	(1.87)	(0.49)
INC	1.396	-3.633**	-1.128
	(0.79)	(-2.01)	(-1.39)
EDU	-0.0533***	0.00979	0.0114
	(-2.66)	(0.54)	(0.55)
GINI	38.53**	5.452	9.620
	(2.38)	(0.44)	(1.00)
POP	0.0149**	-0.00299	0.00450
	(2.18)	(-0.34)	(1.30)
UNEMP12	-0.212**	0.0576	0.0177
	(-2.44)	(0.59)	(0.34)
TV	-0.0205***	0.0122	-0.000535
	(-2.94)	(1.04)	(-0.09)
Constant	-42.99**	34.56	-0.565
	(-2.11)	(1.47)	(-0.06)
Year FE	Yes	Yes	Yes
Observations	316	158	316
R^2	0.229	0.141	0.168

t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, robust standard errors clustered at the region level

For our variable of interest, the same picture emerges. Relative salaries have a significant negative effect on corruption; this effect is again sublinear, with the turning point being at somewhat lower relative salary levels than in the case of registered corruption incidents. The control variables display roughly similar features, although the significance levels differ. In particular, education, unemployment, and TV coverage are no longer significant. A notable change is the influence of oil rents, which lowers conviction rates for severe corruption cases. This is in stark contrast to the findings in the literature and our previous findings and may point towards a more biased juridical system in those areas. Overall, the results of the baseline regressions are mostly corroborated.[21]

[21] We also ran regressions with the size of the juridical staff (JUDGE) as additional variable, which did not turn out significant in any of the specifications.

4.2 Alternative salary concepts

In order to test how robust our results are with respect to the relative salary measure that we use, we employ a number of alternative concepts that have been used in the literature. Goel and Nelson (1998) and Karahan et al. (2006) use per capita income, Dong and Torgler (2010) use average salary in economy, and Van Rijckeghem and Weder (2001) focus on the average salary in the manufacturing sector for the reason of comparability across countries. We expect these alternative measures to perform less well because they do not represent the adequate reference remuneration as the skill sets are very different. In addition, we construct a measure of the salary for white collar workers. Details of the wage concepts are found in the appendix. Results are reported in Table 5. We use our baseline specification (Table 3, model 4), which is repeated in column 1 and replace our preferred measure of relative salary with alternative relative salary concepts.

Table 5: Alternative Relative Salary concepts (Fixed Effects Estimation with clustered SE)

Relative salary concept	(1) Baseline: business counseling	(2) Average income	(3) Average salary	(4) Average manufacturing wage	(5) Average white collar wage
RELSAL	-5.161***	-1.144	-8.640	-2.581	-6.599*
	(-3.85)	(-0.91)	(-1.13)	(-1.57)	(-1.86)
RELSAL^2	1.895***	0.412**	3.306	0.911***	2.880**
	(4.16)	(2.21)	(1.35)	(2.78)	(2.52)
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	316	316	316	316	316
R^2	0.229	0.192	0.189	0.197	0.196
AIC	1053.2	1067.8	1069.2	1065.9	1066.6
BIC	1109.5	1124.1	1125.6	1122.3	1122.9

t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, robust standard errors clustered at the region level.

The signs of the coefficients again suggest a U-shape relationship between corruption incidents and relative salary with comparable turning points; however, for the broadly defined wage categories (average income, average salary, and average manufacturing wage) not all the coefficients reach usual significance levels. The more narrowly defined and more suitable concept of white collar workers' salary performs much better and turns out significant. According to AIC and BIC, however, our preferred specification outperforms alternative relative salary measures. Overall, these results show that our findings are not limited to the specific relative salary concept that we use but that results are more pronounced if we use a reference wage that requires a comparable skill set.

4.3 Placebo – Test

In this section, we investigate whether a low relative salary is indicative for a crime-ridden environment in general rather than portraying a situation that is specifically conducive for corruption. If relative salaries were negatively correlated with crime levels in general, our results would not explain the occurrence of corruption as such, but corruption as endogenous variable

would only be indicative for a crime-intensive environment overall. Such a situation could occur for instance if low relative salaries – including those of the law enforcement community – would erode motivation and zeal of the police force to fight crime.

In order to test for such a possibility, we run our baseline specification with different endogenous variables capturing important aspects of the overall crime environment. We use the number of all crimes (except corruption), the number of economic crimes, and the number of murders, all per 100,000 population. Results of the fixed effects regression are reported in Table 6.

Table 6: Placebo fixed effects regression with clustered SE at the regional level

	(1) Corruption incidents	(2) All crimes minus bribery	(3) Economic crimes	(4) Murders
RELSAL	-5.161***	-156.2	22.18	-0.119
	(-3.85)	(-1.00)	(0.61)	(-0.05)
RELSAL^2	1.895***	35.32	-5.905	0.263
	(4.16)	(0.51)	(-0.47)	(0.26)
SOLVE	0.0468**	-13.12***	0.365	0.0553
	(2.46)	(-3.18)	(0.74)	(1.43)
ENFORCE	-1.062	988.7***	-5.256	-2.143
	(-0.63)	(2.91)	(-0.14)	(-0.60)
OIL	0.246***	-25.94*	3.580***	-0.00151
	(3.05)	(-1.88)	(2.87)	(-0.02)
EXPEN	0.0241***	-1.343	0.0957	0.00486
	(4.50)	(-1.28)	(0.68)	(0.33)
INC	1.396	-285.5	3.630	4.502
	(0.79)	(-0.92)	(0.08)	(1.20)
EDU	-0.0533***	-2.571	0.0723	-0.0771
	(-2.66)	(-0.54)	(0.19)	(-1.30)
GINI	38.53**	1384.3	-114.7	29.27
	(2.38)	(0.58)	(-0.18)	(0.71)
POP	0.0149**	-2.734**	-0.545**	0.0385**
	(2.18)	(-2.37)	(-2.20)	(2.08)
UNEMP12	-0.212**	-5.384	-0.136	-0.263
	(-2.44)	(-0.46)	(-0.08)	(-1.31)
TV	-0.0205***	1.103	-0.0487	-0.0442*
	(-2.94)	(0.72)	(-0.23)	(-1.76)
Constant	-42.99**	9448.0***	1115.2	-87.08*
	(-2.11)	(2.86)	(1.62)	(-1.93)
Year FE	Yes	Yes	Yes	Yes

Observations	316	316	316	316
R^2	0.229	0.688	0.368	0.531

t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

It turns out that all crime variables are uncorrelated with relative salary levels but not for corruption. We find similar results for pooled OLS regressions, which are available upon request. Thus we can exclude that our previous results are only indicative for an overall crime environment but conclude that low relative salaries of public officials are specifically conducive for corruption in the public sector.

4.4 Corruption experiences

We consider the law enforcement data the best measure of corruption. Yet, if the legal system were systematically biased (especially if this bias were regionally different), corruption convictions and, to a lesser extent, registered corruption incidents would give a biased picture. In that case, corruption experiences of the population would be a better measure. In order to analyze whether data on corruption experiences portray a different picture, we analyze the available survey data on corruption experiences on a regional level. As there are only two surveys (2002 and 2010), we employ a difference-in-difference approach and relate the change in corruption to the change in relative salaries and in control variables.

In 2002, Transparency International (TI) and the Information for Democracy Foundation (INDEM) surveyed 5,666 citizens and 1,838 representatives of small and medium enterprises in 40 regions.[22] Those regions are home of 73 percent of the population and are generally representative of the Russian federation; however, they exclude the non-ethnic Russian regions of North Caucasus (Chechnya, Dagestan, and Ingushetia). The survey asked for corruption perceptions as well as for experiences of corruption. As we are skeptical about the accuracy of corruption perceptions (see Section 2.1 above), we use the survey on corruption experiences on everyday corruption.[23] The survey calculated the amount of everyday corruption payments as a share of regional GDP, which is used as the measure of corruption in the region.

The second survey was conducted in 2010 by the Ministry of Economic Development of the Russian Federation and the Fund of Social Opinion on the order of the President of the Russian Federation dated March 14, 2010 (#Order-670).[24] It utilized the same methodology as the 2002 TI and INDEM survey and covered 70 regions (with a population share of 94.5 % of the total Russian population and a sample size of 17,500). This allows analyzing the dynamics of everyday corruption in the 40 regions covered by both surveys. We use the following protocol: First, the 2002 value of everyday corruption as a share of regional GDP is subtracted from the 2010 value. Second, this regional difference is subtracted from the difference for the whole country during this period. The changes in everyday

[22] Cf. http://www.transparency.org.ru/docman/drugie-issledovaniia/regional-corruption-indexes-2002/download (accessed 22. February 2013).

[23] The 2002 survey also asked businessmen for corruption experiences, but since the 2010 survey did not do that, we focus on petty corruption only.

[24] The survey is available online http://www.economy.gov.ru/minec/activity/sections/anticorruptpolicy/doc20110614_027 (accessed 24. February 2013)

corruption are subsequently regressed on the changes in relative salaries and relative salaries squared as well as a set of controls.[25] This approach allows us to address the issue of omitted variable bias stemming from unobserved – time-invariant – heterogeneity to obtain robust results. Data description and descriptive statistics are found in the appendix.

Table 7 provides the results. Model 1 contains the full set of regions. The estimates do not yield statistically significant results, which can be explained by the existence of outliers (and the small number of observations). Dininio and Orttung (2005: 518), who analyzed corruption in the same 40 regions in 2002, suggest excluding the republics of Baskortostan and Tatarstan (model 2). These regions have small amounts of reported corruption even though experience and the neighboring regions suggest that corruption is very strong. As the regions are among the most authoritarian regions in Russia, this counterintuitive corruption value is suspected to be the result of people being reluctant to discuss corruption in these regions. Model 3 additionally excludes Primorskii Krai which is dominated by criminal elements resulting in a similar effect on underreporting corruption in the region (Dininio and Orttung 2005: 518-9). Finally, in model 4, the remaining two republics in our sample (Udmurtskaya Republic and Republic of Karelia) are excluded.

Table 7. Corruption determinants regressed on measured corruption experience (OLS regression of first differences with robust SE)

First differences 2010-2002	(1)	(2)	(3)	(4)
	corr	corr	corr	corr
RELSAL	-1.834	-2.270**	-2.355**	-3.359***
	(-1.67)	(-2.19)	(-2.29)	(-3.59)
RELSALSQ	0.645	0.812*	0.854**	1.265***
	(1.52)	(2.04)	(2.17)	(3.81)
ENFORCE	0.168	0.247	0.112	0.687
	(0.21)	(0.32)	(0.14)	(0.92)
EXPEN	-0.0559	-0.116**	-0.138**	-0.173***
	(-0.97)	(-2.29)	(-2.57)	(-3.39)
OIL	-0.437	0.261	0.951	3.514
	(-0.11)	(0.07)	(0.25)	(0.84)
INC	-0.458	-0.931	-1.145	-2.281**
	(-0.53)	(-1.00)	(-1.17)	(-2.51)
GINI	3.973	7.567	7.968	13.12***
	(0.81)	(1.62)	(1.71)	(2.92)
EDU	-0.0188	-0.0541	-0.0365	-0.119*
	(-0.27)	(-0.74)	(-0.51)	(-1.81)
POP	0.000151	0.000796	0.000873	0.00145**
	(0.24)	(1.38)	(1.46)	(2.69)
UNEMP	-0.105**	-0.130**	-0.156***	-0.183***

[25] Controls are not exactly the same as in the previous sections as not all data are available.

	(-2.16)	(-2.76)	(-2.97)	(-3.87)
URB	17.60**	12.57	13.83*	21.53***
	(2.60)	(1.64)	(1.80)	(3.43)
Observations	40	38	37	35
R^2	0.357	0.432	0.440	0.571
AIC	61.36	51.58	50.37	40.76

t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Once we exclude outliers, we find that petty corruption decreases with relative salaries of public officials and picks up again after a turning point of the same order of magnitude as before. This corroborates our earlier findings. Controls behave similarly: education, income, and unemployment reduce corruption, inequality increases it. Due to the small number of observations, variables do not reach usual significance levels in all specifications. Law enforcement and oil rents have no significant effects. The latter is not surprising, given that the survey focuses on petty corruption. Due to the small number of observations, our results are illustrative and supportive of our previous results but may not be convincing by themselves.[26]

4.5 Additional Robustness checks

Ethnic fragmentation has been shown to deteriorate economic policy, increase favoritism, and reduce growth performance (Easterly and Levine 1997, Alesina et al. 2003, Alesina and Ferrara 2005, Franck and Rainer 2009). Olken (2006) finds that corruption is larger in ethnically divided than in ethnically homogenous Indonesian villages. This corroborates earlier findings of cross-country studies based on corruption perceptions (Mauro 1995, La Porta et al. 1999). We use three different measures to study the influence of ethnic heterogeneity on the corruption level: the share of ethnic Russians in the population, the index of ethnic fragmentation in a region, and the index of ethnic polarization. Since these variables have very little variation over time, we run a pooled OLS and a between effects panel model. In neither specification reaches any of these variables usual significance levels.

In one specification, we exclude the *Caucasian* regions as corruption levels and the institutional quality may arguably be very different (cf. Dobler 2011: 3; 22). In other specifications, we exclude *independent republics* from our data set or inserted a dummy controlling for them. We also control for income and wealth through a variable measuring *telephone density* in the population. In all cases, results do not change in any significant way.

5. Concluding remarks

The main finding of the paper is a strong causal non-linear relationship between the relative salary of public officials and the number of corruption incidents as registered by the police or as convicted by the courts. Salary raises reduce corruption at low and medium relative salary levels with diminishing returns up to a turning point after which corruption rises again. This non-linear relationship has been detected employing pooled OLS as well as robust FE estimations in a panel data set at the regional

[26] For a more favorable view on the explanatory power of the data set, see Dininio and Orttung (2005)

level in Russia. Our empirical result corroborates the theoretical prediction by Besley and McLaren (1993) about the effect of salary raise on corruption when second-order corruption among officials' supervisors is present. It is in accordance with the notion of a non-monotonous relationship between wages and effort in labor economics.

Results for our control variables are plausible and support earlier findings and theoretical predictions. Natural resources and the size of the non-staff government budget increase corruption levels — corruption rises with the rents that are up for grabs. Corruption is lower in better educated regions and in those with lower inequality. Increasing coverage of local TV stations reduces corruption levels. These results suggest that transparency may enhance accountability, at least to some extent. More effective law enforcement and higher long-term unemployment rates increase the expected costs of corruption and thus reduce corruption levels.

Our main finding of a negative relationship between corruption and relative salary levels that turns into a positive one at high relative salary levels was suggested by the theoretical literature, but it has not been shown empirically so far. We are able to show that this relationship is very robust with respect to the corruption measure used – incidents, convictions, and bribe experiences – and to the relative salary concept used. Previous cross-country studies yielded inconclusive results once they controlled for unobserved heterogeneity through country fixed effects. The majority of the within-country studies show a negative relationship between relative salary levels and corruption, which is what we would have found if we had not included a non-linear term as well. One study shows a positive relationship — our results suggest this may be due to the high relative salary level of the public officials investigated. Apart from providing evidence for a particularly interesting country, our paper thus supports the notion that the salary-corruption nexus may be more complicated than a simple negative relationship would suggest.

Our results have important implications for policy formation. While raising public officials' salaries may be an integral part of an anti-corruption reform, it is no silver bullet. Salary adjustments may not only be costly in monetary terms, they need to be carefully designed with the proper reference salary identified to avoid increasing corruption when the goal is the opposite.

6. Appendix

Relative salary measures

The first three alternative relative salary variables are constructed by dividing the average salary of public officials by regional average per capita monthly income, by average monthly salary in the region, and by average monthly salary in the manufacturing sector in the region for the corresponding year. All data are provided directly by Federal State Statistics Service (FSSS).

The "white-collar" salary is assembled from the following data:

1. The FSSS report (Statistical Newsletter, 2005) on the composition of the civil service according to the grade provides regional information on proportions of employees (executive branch) with the following grades for the end of the year 2005: a) top administrators (19% on average), b) assistant administrators (0.4% on average), c) specialists (67.1% on average), and d) supporting specialists (13.18% on average).

2. The FSSS report (Statistical Newsletter, 2006) supplies data on average monthly salaries for the following categories of employees in the regional private sector in October 2005: a) top managers and heads of structural departments, b) high-level specialists, c) middle-level specialists, d) employees with supportive functions: serving, keeping records and paper work, e) workers in housing sectors, trade, and similar sectors, f) qualified workers in construction, transport, mining, manufacturing, g) qualified workers in mechanics and machinery operators, and h) unqualified workers.

3. The average monthly salary in the region is provided by the FSSS database.

We take average monthly salaries of top managers, high-level specialists, and employees with supportive functions as they are reported for the private sector of the region in October 2005, weight them by the composition of grades in the regional civil service reported for the same year, and divide the figure by the average monthly salary in the region for October 2005. Thereby, we obtain a scale coefficient for "white-collar" workers that match the composition of grades in the civil service with corresponding salary levels in the private sector. We further multiply the average monthly salary in each region by this coefficient for each year.

Data for corruption experiences

In this appendix, we provide explanations and descriptive statistics for the variables used in Section 4.4 Corruption experiences).

Table A. Variable description and summary statistics

Variable Name	Variable Description	Descriptive Statistics		Data Source
		Mean	Standard Deviation	
CORR	Change in the share of petty corruption in regional GDP (%) minus change in the share of petty corruption in national GDP for the whole country between 2010 and 2002.	0.012	0.487	[1]
RELSAL	Change in the ratio of average monthly salary paid (including compensations and bonuses) of a public official to paid per capita monthly salary (including compensations and bonuses) in business counseling sector between 2009 and 2002.	-0.312	0.431	[2]
ENFORCE	Change in per capita budgetary expenditures for law enforcement and security (excluding fire-fighting department, department for emergencies and natural disasters and department for migration policies), in 1000 constant rubles, between 2010 and 2002	0.225	0.113	[3]
EXPEN	Change in per capita total expenditures by state and local governments (excluding national defense, law-enforcement, judicial powers), 1000 constant rubles 2010 – 2002	5.837	2.116	[3]
OIL	Change in regional shares of tax-revenue from oil-extracting industry (regional tax for oil and associated gas condensate) to total regional budget revenue (%) between 2009 and 2002	-0.009	0.021	[3]
INC	Change in logarithm of average monthly real income per capita in constant rubles between 2009 and 2001	0.994	0.153	[2]
GINI	Change in income inequality, as measured by the Gini coefficient (gross-income), [0,1], between 2009 and 2001.	0.041	0.028	[2]
EDU	Change in share (%) of adult population (over 15 years old) with professional (college or higher) education as reported by National Censuses of 2010 and 2002.	4.614	1.535	[2]
POP	Change in population (in thousands) between 2010 and 2002	-24.000	222.955	[2]
UNEMP	Change in unemployment rate (%), constructed according to the methodology of International Labour Organization, between 2009 and 2001	-0.365	1.644	[2]
URB	Difference in urbanization rate as reported by National Censuses of 2010 and 2002	0.001	0.015	[2]
	Data sources:			
	[1] Office of Internal Affairs			
	[2] Federal State Statistics Service			
	[3] Ministry of Finance			

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