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Abstract

This paper investigates the causal relationship between corruption and fixed capital investment in Russian regions. The panel data on corruption allow to control for unobserved heterogeneity with fixed effects estimation. We address the problem of endogeneity by introducing novel instrumental variables for corruption: the presence of free press and violations of journalists' rights. Our main result is the strong negative effect of corruption on aggregate investment in fixed capital. Disaggregating investment by ownership, we find that corruption decreases private investment, but not investment made by state-owned companies. The effect is larger for companies with foreign ownership. We also observe a strong negative relationship between regional import of capital goods and corruption.

Key words: Corruption, Investment, Russia, Freedom of Press, Import of Capital Goods

JEL classification: E22; K42; L26; P26

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1. Introduction

Corruption has long been recognized to be detrimental to economic growth.¹ It affects growth in different ways but, as recent studies show, its primary and by far the most important channel is domestic investment in physical capital (Pellegrini 2011, Hodge et al. 2011). As corruption creates uncertainty of investment outcomes (Mauro 1995; Wei 2000) and decreases the expected returns, the level of investment is expected to decline, which translates into forgone economic growth.

While the idea is straightforward and intuitive, empirical literature does not provide sufficient evidence on the topic. The negative relationship between corruption and investment was first empirically tested twenty years ago by Mauro (1995); his findings, however, were later contested by Shaw et al. (2011).² Using the data-set of Mauro (1995) they showed that the ethnolinguistic fractionalization is a weak instrument for corruption and is not sufficient to identify causal negative relationship between corruption and investment. Instead Shaw et al. (2011) employ data on legal origins and projected trade share as stronger instruments for corruption as had been suggested by Frankel and Romer (1999) and found no statistically significant effect of corruption on investment.³

The pioneering work by Mauro (1995) was followed by a number of cross-country studies that find a negative relationship between corruption and investment (Brunetti et al. 1998; Brunetti and Weder 1998; Campos et al. 1999; Mo 2001; Habib and Zurawicki 2001; Rock and Bonnett 2004; Méon and Sekkat 2005; Asiedu and Freeman 2009; Das and Parry 2011; Pellegrini 2011; Hodge et al. 2011) but do not manage to establish a causal relationship for several reasons. One of the main concerns in cross-country analyses, especially when they use cross-sectional data, is a potential unobserved heterogeneity bias. It is not possible to control for all conceivable dimensions that may affect investment such as legal system, social structure, traditions, culture, social norms, and institutions. The second issue is endogeneity in the form of potential reverse causality or omitted variables that might influence both corruption and investment. Standard approach to address endogeneity is to use instrumental variables (IV), but good instruments are hard to find as discussed in Treisman (2007: 225-226). Finally the perception-based measures of corruption employed by the previous studies might be biased themselves (Treisman 2007: 221). This bias can arise if corruption perceptions are influenced mainly by the quality of institutions rather than by corruption (Andvig 2005; Weber Abramo 2008) or by political competition and press freedom (Sharafutdinova 2010). Unsurprisingly, studies do not find strong correlation between perception-based data and experienced corruption (e.g. Donchev and Ujhelyi 2014, Gutmann et al. 2015).

Johnson et al. (2011) is the only study that attempts to overcome aforementioned difficulties. It analyzes the relationship between corruption and growth for the US, and uses data on convictions of public

1 For example, Myrdal 1989; Shleifer and Vishny 1993; Blackburn et al., 2006, Aidt 2009.

2 The influence of the article by Mauro (1995) is shown by the extremely high rate of citation: according to the online depository of economic papers (ideas.repec.org/top/top.item.nbcites.html), the paper by Mauro (1995) is among the 100 of most cited articles in economics.

3 Alternative instruments are legal origins and projected trade share as suggested by Frankel and Romer (1999).

officials instead of perception-based indices. Johnson et al. instrument for corruption using political variables that are expected to be uncorrelated with current economic outcomes: residency requirements for voting, restrictions on campaign financing, and adoption of state constitution. The authors find corruption to be negatively associated with growth and investment in the US, but their estimation strategy raises two main concerns about causality of the effect. First, their regression analysis is based on a small cross-section with only 50 observations, which leads to a potential unobserved heterogeneity bias. And, second, the IV approach is impaired by the weakness of the chosen instruments as the F-statistics are consistently below 10 in all estimations (Johnson et al. 2011: 387). It is also very possible that instruments such as the timing for adopting state constitution or restrictions on political-campaign financing can affect general institutional environment and, thus, can influence investment through channels other than corruption. In that case the assumption on the exclusion restriction would be violated.

Our paper attempts to close the gap in the existing literature in several ways. First, we study corruption within one specific country – Russia. Russia is a particular interesting case to study the costs of corruption: it is a former superpower and currently a 13th biggest economy in the world in terms of nominal GDP (World Bank estimation for 2015) and suffers severely from corruption, being ranked 131 out of 176 countries by Transparency International in 2016.⁴ While corruption is wide-spread in Russia, its regions are neither equally corrupt (Baranov et al. 2015), nor are they equally economically developed. They are, however, homogeneous in terms of official language, system of law, culture, history and traditions, which provides an ideal setting for econometric analysis. Moreover, very few empirical papers study the consequences of corruption in Russia and none of them with a focus on investment.⁵

Second, we employ a new measure of corruption based on actual incidents of bribe-taking by public officials as registered by the police authorities. Registered corruption by police is similar to the conviction-based corruption measure traditionally used in the empirical literature on corruption in USA (e.g. Goel and Rich 1989; Goel and Nelson 1998; Glaeser and Saks 2006; Johnson et al. 2011; Alt and Lassen 2014), but it is more appropriate for countries with highly corrupt environments, where conviction data is likely to be distorted by persistent corruption in the judiciary. This measure has been previously employed to study determinants of corruption in Russian regions by Schulze et al. (2016). The data are available for the period 2004-2013 allowing the use of a panel estimation with region and time fixed effects, thereby controlling for time-invariant unobserved heterogeneity.

Third, we propose new instruments to control for the endogeneity of corruption. Previous studies

4 Transparency International grades countries on the scale of 0 (most corrupt) to 100 (not corrupt); Russia's score is 29 (https://www.transparency.org/news/feature/corruption_perceptions_index_2016, accessed on 01.02.2017). Data on GDP estimation by World Bank is available at World Bank, World Indicators, <http://databank.worldbank.org/data/download/GDP.pdf> (accessed on 01.02.2017).

5 We find only three cited articles in the field: Safavian et al. (2001) use the data from a survey of micro-enterprises in one of Russian regions to show that corruption is similar to regressive tax and might discourage innovation and growth; Weill (2011) find evidence that higher corruption is associated with less bank-lending to private sector and individuals; finally, a more recent paper by Kuzmina et al. (2014) find that better governance quality attracts foreign direct investment in 40 Russian regions where their data on corruption was available.

have shown that a free press effectively reduced corruption, both across countries (Brunetti and Weder 2003) and across Russian regions (Schulze et al. 2016). According to Brunetti and Weder (2003), if a corrupt public official attempts to extort a bribe from a businessperson, the businessperson has just three options: to pay the bribe, to complain to a higher official or the law-authorities, or to reveal the bureaucrat's behavior to the local press. We argue that in an environment with higher officials or law-authorities that are corrupt themselves or unresponsive to complains, the ability of journalists to report corrupt behavior becomes the primary safeguard against opportunism of public officials. We identify two dimensions of the press freedom that determine the accountability effect of the press: the presence of a free press in the region and whether this free press is obstructed by the existing abuse of journalists' professional rights in a form of censorship or physical violence. Both instruments are good predictors of corruption levels at the regional level, but are unrelated to characteristics of local press such as its scope or average salary of journalists. Interestingly, press freedom has not been used to instrument for corruption previously.

Our results show that corruption decreases overall investment in Russian regions. The effect is significant for companies with private ownership but statistically insignificant for fully state-owned companies. Investment by foreign-owned companies is more sensitive to corruption as predicted by the literature (Habib and Zurawicki 2001). Our results are robust to the inclusion of various social-economic controls and the use of instrumental variables.

The paper is organized as follows. Section 2 explains our methodology and data. Section 3 presents the results of the ordinary least squares (OLS) estimation with fixed effects and the IV estimation. Section 4 provides robustness checks and section 5 concludes.

2. Data and estimation strategy

We study investment and corruption in Russian regions for the period 2004 to 2013. The time frame is determined by the availability of data on regional corruption, since no data records are accessible for the time before 2004, and by the political events following the annexation of Crimea by Russia in early 2014, which might have introduced distortions in the investment behavior as a result of Western sanctions, Russian counter-sanctions, and external political pressure (Doronina 2014).

The beginning of the period coincides with the end of the democratic transition, when Russia became a normal middle-income country with a market economy and a semi-democratic political regime (Schleifer and Treisman 2005). The whole period is characterized by a stable political situation as the actual power in the country was consolidated in hands of the second Russian president, Vladimir Putin, and his friends.⁶ Russia has suffered from widespread corruption: Transparency International (TI) has given Russia

⁶ Even when Putin had to step down from the presidency in 2008 as Russian constitution does not allow three consecutive terms, he became a prime minister and had his former colleague and good friend Dmitry Medvedev occupy the president's position for one term, allowing Putin to come back after elections in 2012.

consistently a score below 30 points out of 100 on their corruption perception index.⁷ Meanwhile the government has made no real effort to fight corruption during those years; even the introduction of the National Anti-Corruption plan in 2009 by the then president, Dmitry Medvedev, did not make any difference, as was later acknowledged by Medvedev himself in 2011.⁸ The growing corruption did not mobilize the population either.

For our analysis, we collected the data for 79 Russian regions, which account for 99% of total population.⁹ All regions have the same official language, taxation and law systems, and are similar in terms of traditions and culture, but strongly differ in the scope of investment: during the period examined, the region with highest investment (*Tyumen Oblast*) had on average almost 18 times as much investment per capita as the region with lowest investment (*Republic of Ingushetia*). The growth in investment over time is also very heterogeneous: while overall national investment per capita has doubled between 2004 and 2013, a region *Tuva Republic* has demonstrated a growth rate of over 670%, and the biggest decline over these 10 years was 32% in *Vologda Oblast*.

To analyze the effect of corruption on investment, we employ following estimation model:

$$Investment_{it} = \alpha + \beta Corruption_{it} + X_{it}\eta + \varsigma_i + \tau_t + \varepsilon_{it}, \quad (1)$$

where $i = 1, \dots, 79$ and $t = 2005, \dots, 2013$ index regions and years respectively, $Investment_{it}$ is a logarithm of total annual per capita investment in the region in constant rubles, $Corruption_{it}$ is a logarithm of registered cases of bribe-taking per 100,000 population plus one, lagged for one year; X_{it} is a vector of control variables; ς_i and τ_t are region and year fixed effects; and ε_{it} is an error term. We use fixed effects regression to control for time-invariant factors specific for each region (e.g. climate, geography, and political factors) and include time dummies to capture common time trend. Standard errors are clustered at the regional level to account for serial auto-correlation.

The data on fixed capital investment come from Federal State Statistics Service (FSSS). The annual data include officially documented capital expenditures aggregated on a regional level and adjusted for the “unobserved” economy.¹⁰ The data allow us to differentiate between investment made by organizations completely owned by state (INV_pub), investment made by private or partially private companies

7 Higher score for perceived corruption implies less corruption.

8 The full interview from 26.01.2011, where Dmitry Medvedev discusses the consequences of the anti-corruption campaign, is available at *Vedomosti* website at http://www.vedomosti.ru/newspaper/articles/2011/01/26/politicheskaya_konkurenciya_neobhodima_dmitrij_medvedev (in Russian, accessed on 02.02.2017).

9 In 2004 Russia consisted of 89 regions, but six small autonomous regions were officially merged with the neighboring larger regions in later years. The remaining three small autonomous regions are normally aggregated with their bigger neighbours for statistical purposes by the Russian Federal Statistic Service and we employ only the aggregate data on the extended regions. We exclude the region of Chechen Republic due to ongoing military conflict and a concern of data reliability (see Fuller 2013).

10 “Unobserved” economy includes shadow economy, illegal activities, and individual and household investment that are not reported to statistics authorities. The full official methodology is explained in the Decree by FSSS from 18 September 2014 №569 „On the approval of official statistical methodology to determine fixed capital investment at the regional level”, available online at http://www.consultant.ru/document/cons_doc_LAW_169551/ (accessed on 02.02.2017)

(INV_priv), and investment made by companies with full or partial (above 10%) foreign ownership (INV_for). Investment is divided by population to account for the size of the region.¹¹ We use imports of capital goods (IMPORT) as an additional dependent variable since this category can be related to investment activities in the same year. We assume that if corruption has a real effect on investment, import of capital goods will also be affected. There are several limitations regarding the data on imports of capital goods: first, it does not cover illegal imports, and, second, it does not guarantee that capital goods are installed within the region that officially imported them, - nevertheless we test this variable as a robustness check for our main hypothesis. The data on import of capital goods also come from FSSS.

Our measure of corruption (CORR) is the logarithm of a number of cases of bribe-taking by public officials as registered by the police annually plus one. The definition of bribery according to the Russian Criminal code (Article 290) is “the acceptance of money, securities, or other valuables by a public official (personally or through an intermediary) for his/her performance (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 authority or installs patronage”. This definition is in line with the common understanding of corruption as “a misuse of public office for private gain” (World Bank, 1997). Bribery itself does not exclude political corruption from our data, however we expect the majority of cases to refer to bureaucratic type of corruption which is more relevant for the decision to invest. Corruption variable is lagged one year to allow some time for its effect on investment to materialize.

Registered corruption is very similar to the conviction rate of corrupt officials often used by studies on corruption in the US (e.g. Johnson et al. 2011), however, it has several advantages as discussed in Schulze et al. (2016: 141-142). First, registration of crime as a first stage of criminal prosecution is not affected by any corruption that might occur during the investigation and legal process preceding conviction. Corruption could still affect the registration itself but to a lesser extent than conviction, and Schultze et al. (2016) argue that it would be relatively easier for the police to obstruct an on-going investigation than to refuse to register a crime, especially since this practice can be seriously punished if a person reporting corruption filed a complaint to a higher official. Second, the time of the registration is closer to the time of the actual corruption incident as any crime has to be registered within three days after its detection according to the law. Conviction, on the other hand, takes place after a longer period of investigation and legal proceedings and therefore enters the statistical records only after some time. Third, registered corruption reflects the number of actual incidents of bribe taking and not the number of people found guilty (as done in the case of convictions), and therefore reports the volume of the crime and not the criminals. That makes our measure a better proxy for the scope of regional corruption.

11 While most of the studies on corruption and investment use a ratio of investment to GDP, Lambsdorff (2005: 44) warns that GDP itself might be negatively influenced by corruption and therefore the Investment/GDP ratio underestimates the effect of corruption on investment.

Our econometric model includes control variables commonly used in the literature (Mauro 1995; Brunetti et al. 1998; Campos et al. 1999; Mo 2001; Meon and Sekkat 2005; Das and Parry 2011; Johnson et al. 2011): the logarithm of per capita income in the previous year (INC) is used as a measure for economic development, share of population with professional education in the previous year (EDU) as a proxy for human capital, and a logarithm of total population (POP) controls for the size of the region. We also include the regional consumer price index from the previous year (CPI) as a proxy for inflation, which is expected to be negatively associated with investment (Asiedu and Freeman 2009; Das and Parry 2011). Moreover, we control for oil and natural gas production (OIL) since several Russian regions benefit directly from extracting natural resources. The size of bureaucracy (GOV) is included since a bigger number of public officials in the executive branch of power might create bureaucratic competition and eventually improve conditions (e.g. reducing red tape) for investors as suggested by Drugov (2010). Finally, in order to show that investment is affected by corruption itself and that CORR does not just proxy the general level of crime, we introduce a crime rate of major and gravest crimes per population (CRIME) as an additional control. Crime data are produced by regional law-authorities and might capture the effort of the police to register more criminal offenses, which is a potential source of noise in our dependent variable. Table 1 provides a short description of data and summary statistics.

Table 1: Summary of main variables

Variable name	Description	Mean	St. Dev.
CORR	Number of registered incidents of bribe-taking by public officials per 100 000 population, logarithm lagged for one year	1.58	0.51
INV_total	Aggregate annual capital investment in the region, logarithm of thousand constant roubles per capita	10.10	0.66
INV_priv	Capital investment made by companies and entities with private ownership in constant roubles per capita, logarithm of thousand constant roubles per capita	9.79	0.76
INV_pub	Capital investment made by government-owned companies and public sector, logarithm of thousand constant roubles per capita	8.63	0.64
INV_for	Capital investment made by companies with foreign ownership (10% or more of capital belongs to foreign residents), logarithm of thousand constant roubles per capita	7.54	1.55
IMPORT	Import of machinery, equipment and electronic, logarithm of thousand constant roubles per capita	7.78	1.42
CRIME	Number of registered major and most serious criminal offenses (crimes penalized with imprisonment of 5 years or more) 100 000 population, logarithm lagged for one year	6.25	0.43
INC	Regional average monthly income per capita in constant roubles, logarithm lagged for one year	8.76	0.41
OIL	Oil and gas production in the region in constant thousand roubles per capita, lagged for one year	12.64	59.90
CPI	Consumer price index from the previous year	110.03	2.93
GOV	Number of governmental officials in executive branch of power per 10 000 of population by the end of the past year	112.55	50.56
EDU	Share of population with professional education in the previous year	68.89	7.19
POP	Average annual population in thousands, logarithm	7.13	0.90

3. Results

3.1 Fixed effects estimation

Table 2 presents the results from OLS estimation with region and time fixed effects. Higher corruption in the previous year is associated with lower per capita fixed capital investment in the region. The coefficient in column 1 suggests that one standard deviation increase in corruption is associated with a decrease of 5.5% of standard deviation of aggregate regional investment in fixed capital. The effect is statistically significant at the 10% confidence level.

Table 2: Effect of corruption on investment, OLS with fixed effects

Dep. Variable:	(1) INV_total	(2) INV_priv	(3) INV_pub	(4) INV_for	(5) IMPORT
CORR	-0.071* (-1.77)	-0.093** (-2.14)	-0.079 (-1.42)	-0.377*** (-2.76)	-0.152** (-2.40)
CRIME	0.06 (0.63)	0.09 (0.72)	0.18 (1.40)	0.51 (0.77)	0.01 (0.02)
INC	0.486*** (3.90)	0.559** (2.38)	0.559*** (3.03)	0.308 (0.38)	0.362 (0.72)
OIL	0.00011 (0.52)	0.00010 (0.35)	0.00001 (0.06)	0.00041 (0.66)	-0.00003 (-0.14)
CPI	0.001 (0.13)	-0.005 (-0.37)	0.0128* (1.72)	-0.0860** (-2.58)	-0.02 (-1.54)
GOV	0.0015 (0.62)	0.007*** (2.66)	-0.0006 (-0.23)	0.0287* (1.79)	-0.0120** (-2.17)
EDU	-0.0055** (-2.19)	-0.0108** (-2.02)	0.0011 (0.28)	-0.0110 (-0.73)	-0.0092 (-1.20)
POP	-0.413 (-0.47)	0.017 (0.02)	-0.186 (-0.16)	1.603 (0.32)	0.669 (0.27)
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	711	711	711	711	711
R2	0.66	0.60	0.37	0.24	0.45

Notes: t statistics in parentheses, * p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors clustered at the region level.

Everhart et al. (2009) emphasizes the importance to differentiate between public and private investment since both can be affected by corruption differently. Private investors are discouraged by corruption since it lowers the expected returns on private investment. Public investment is not directly driven by expected returns; it has strong connections to the government and might therefore be less targeted by corrupt officials. Previous studies find even a positive correlation between corruption and public investment (Keefer and Knack 2007; Balamoune-Lutz and Ndikumana 2008) and argue that public investment provides more opportunities for rent seeking and misappropriation of resources

We test the effect of corruption on capital investment by its ownership type: state-owned companies and companies with private ownership are analyzed separately (columns 2 and 3). The coefficient of CORR is negative for both types of investment, but it is significant only for investments made by privately owned companies and not for investment made by companies and organizations fully owned by

the state. The effect on INV_priv is bigger than for the overall investment: an increase in one standard deviation of corruption measure is associated with 6.2% of standard deviation decrease in private investment.

Investment in fixed capital made by companies with full or partial foreign ownership is negatively associated with corruption (column 4): an increase of one standard deviation in corruption is associated with a 12.4% of standard deviation decrease in this type of investment. The effect is much stronger for this type of investment as compared to aggregate investment and is statistically significant at the 1% level. This finding is similar to Habib and Zurawicki (2001), who find foreign direct investment to be more sensitive to corruption compared to domestic direct investment.

Column (5) finally reports the significant negative effect of corruption on imports of capital goods: a decrease in corruption of one standard deviation translates into 5.5% of standard deviation decrease in import of capital goods. The size of the effect is proportional to what we find for the aggregate investment in fixed capital. Since import of capital goods is closely related to investment activities in the region, the findings support our main hypothesis. Interestingly, the previous literature has never investigated the relationship between import of capital goods and corruption, even though the import of capital goods was as a determinant of a long-run economic growth for a long time (e.g. Lee 1995).

Table 2 shows that the effect of corruption is independent from the average level of crime in the region as coefficients of CRIME are positive but close to zero and statistically insignificant in all specifications. Alternative measures for criminal environment such as number of registered murders, thefts, robberies, or drug-dealing are likewise insignificant and do not affect our main results for corruption.¹²

Other significant determinants of investment are per capita income, education, size of bureaucracy, and consumer prices. Previous income per capita is positively associated with all types of investment and highly significant for INV_total, INV_priv and INV_pub (columns 1-3). The result for our measure of education being negatively associated with investment is surprising and contradicts the cross-country evidence (e.g. Campos et al. 1999; Meon and Sekkat 2005), but it is in line with Johnson et al. (2011), who find the same negative relationship for US American states. Our education measure may simply proxy shifts in the structure of the regional economy when, for example, the development of the service sector demands more skilled labor but at the same time requires much less physical investment than extracting or manufacturing sectors. Growth in consumer prices has a negative and significant relationship to the investment made by companies with foreign ownership as they are more sensitive to the value and the stability of the Russian currency. The size of the bureaucracy is positively correlated with private and foreign investment and we assume that it may be a result of the competition across public servants or reduction of the red-tape due to the availability of more labor in public service. Production of oil and gas is not associated with investment activities.

The basic OLS estimation demonstrates a strong negative relationship between corruption and

¹² Results are available upon request.

investment but does not assert its causation because of potential endogeneity of corruption. The endogeneity can arise from several sources, such as omitted variable bias or reverse causation, which are both likely for the case of corruption and investment as corruption does not occur exogenously and as both corruption and investment can be driven by some omitted factor, such as political cycles. Another problem would be a measurement bias since our corruption measure is not perfect. We address the issue of endogeneity by using instrumental variables, which are not correlated with investment but can be used to predict corruption. The following section discusses the instruments and presents estimation results.

3.2 Instrumental variables estimations

It is a challenge to find valid instruments for corruption that would not correlate with error term as discussed in Shaw et al. (2009) and Treisman (2007). While the literature on determinants of corruption has grown rapidly in recent years, commonly accepted instruments have not been established so far. Some previous cross-country studies employ instruments that are time-invariant characteristics and often derived from a distant past, such as colonial history and ethno-linguistic fractionalization (Mauro 1995) or length of exposure to democracy (Gupta et al. 2002). This solution is not optimal for our analysis since, on the one hand, it leaves out the time variation in our panel data set, and, on the other hand, historical data might also influence the current economic conditions through different channels and not exclusively through corruption as discussed in Aidt (2009). While many panel studies on the consequences of corruption employ lagged explanatory variables as instruments (e.g. Gupta 2001; Del Monte and Papagni 2001; Das and Parry 2011), we are reluctant to use this strategy because it fails to eliminate the endogeneity problem for reasons summarized in Reed (2015) and Bellemare et al. (2015).¹³ Instead we turn to a contemporary determinant of corruption that has been widely supported empirically.

Our suggested instrument for corruption is freedom of the local press. Previous literature has found persistent evidence that a free and independent press reduces corruption across countries (e.g. Brunetti and Weder 2003; Chowdhury 2004; Freille et al. 2007), and a recent study by Schulze et al. (2016) has produced similar findings for Russian regions. Following Schulze et al. (2016), we adopt the same data-set on freedom of press across Russian regions to construct our instrument. The data were provided by a non-governmental organization of journalists, Glasnost Defense Foundation (GDF), which conducted three surveys across 78 Russian regions in 2006, 2008, and 2010.¹⁴

The GDF ranking is similar to the Freedom House index of freedom of press used by cross-country studies as it is based on the opinions of local journalists and experts of mass media, but it is relatively more simple and straightforward. While the Freedom House index is assembled by weighting various aspects of

13 They find that the lagging dependent variables shifts the channel of the endogeneity bias and imposes an untestable assumption of „no dynamics among unobservables“

14 Surveys did not cover most autonomous sub-regions. Because our data-set does not include them separately, we use the aggregated regions and their values for freedom of press. The only region excluded from our initial sample is Chukotka Autonomous Okrug.

press freedom derived from a structured survey, GDF asks its experts only to evaluate regional press freedom in Russia across four categories: “free”, “relatively free (characteristics of free press are partially observable)”, “relatively unfree (characteristics of free press are barely observable)” and “unfree”. The categories are not strictly defined and the experts are only offered a set of guideline questions to make their evaluation, however, since all three surveys are produced by the same methodology and the same set of regional experts, we expect variations within a region to explain changes in the presence of a free press.¹⁵

As not a single region was ranked as „free“, our main concern was whether a „relatively free“ press is sufficiently strong to discourage public officials from corrupt practices. Yet, Schulze et al. (2016: 155) show that there is still less corruption when a region is classified as „relatively free“. To test the statistical power of the ranking from GDF surveys to predict corruption, we construct a variable (FREEPRESS) similar to Schulze et al. (2016): we set a value of one in a year when a region is considered as “relatively free” by experts and zero otherwise for the years 2006, 2008 and 2010; the values for 2007 and 2009 are linearly interpolated. Table 3, column 1 reports a regression of our corruption measure on relative freedom of press: freedom of press is associated with a decrease of 29.3% of the standard deviation in corruption, and the effect is significant at 10% level.

We assume that FREEPRESS signals the presence of local journalists who are potentially independent from the state and therefore able to investigate and report wrongdoings of public officials, but that it does not necessarily reflect how much journalists are motivated to do so. One particular aspect of the free press that is suggested by the methodology of Freedom House and that is directly linked to the motivation of journalists to carry out their job is whether their professional rights are violated. The violations of rights can be both physical violence or administrative pressure from the authorities. We assume that the presence of such violations will countervail the effect of free press on corruption. We use data from a joint project of International Federation of Journalists, Russian Union of Journalists, GDF and Center of Journalism in Extreme Situations. The data include incidents of actual physical violence against journalists or its threat, arrests and detentions by the police, censorship, expulsion, and murders.¹⁶ We construct a dummy (VIOLATED) that equals one if at least one violation is registered within a region in a current year.¹⁷ Column 2 in Table 3 demonstrates a strong positive relationship between corruption and the presence of violations: corruption is 16.8% of its standard deviation higher if at least one violation is

15 The list of guideline questions for the evaluation of the press freedom by experts of GDF is available in Appendix A. These questions are asked before the expert has to make a final decision on the ranking of the local press freedom, but the experts are not instructed on the weights for any question in particular and make the final evaluation based on their personal understanding of freedom.

16 The database that includes violation can be accessed at <http://mediaconflictsinrussia.org/> (accessed 03.02.2017). We did not include the data on the prosecutions of journalists by the court for several reasons: first, we consider the proceedings of the court to be within a legal framework of Russian law and, therefore, it is not a direct violation of the press freedom; second, a big share of the legal cases are initiated on the account of extremism and nationalistic publications, which are not relevant for the accountability argument. If we include the incidents of legal prosecutions of journalists, we find similar results as in our main IV estimation with slightly worse first stage statistics since prosecutions inflate the number of observations with violations present; results are available upon request.

17 Data on violations are available for the whole period under our investigation.

registered, which is more than a half of the effect of FREEPRESS alone. It seems that violations of press freedom clearly reduce the ability of the local press to provide accountability of public officials. We can also argue that violations are not relevant for the accountability in the regions, which have no free press in a first place. For this reason, we create an additional dummy variable VIOLATED*FREEPRESS, which is an interaction term of FREEPRESS and VIOLATED, and equals one if at least one violation of press freedom was registered in a region ranked as „relatively free“ by GDF experts and zero otherwise.¹⁸ Column 3 in Table 3 shows that the presence of violations hinder the accountability effect of free press by more than half and only in the regions where press is free – the simple presence of violations (VIOLATED) is no longer significant. Eventually, we use FREEPRESS and VIOLATED*FREEPRESS as our instruments for corruption with their effect presented in column 4, Table 3. We find that presence of violations is an important dimension of the ability of press to deter corruption, and it improves significantly the statistical power of our primary measure of press freedom.

Table 3: Effect of regional press freedom and violations against press on corruption, OLS with fixed effects					
Dep. Variable:	(1) CORR	(2) CORR	(3) CORR	(4) CORR	(5) CRIME
FREEPRESS	-0.141* (-1.89)	-0.139* (-1.89)	-0.295*** (-3.33)	-0.318*** (-4.01)	-0.04 (-1.24)
VIOLATED		0.081** (2.00)	0.032 (0.69)		
VIOLATED*FREEPRESS			0.184** (2.34)	0.210*** (3.17)	0.01 (0.54)
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	390	390	390	390	390
R2	0.07	0.08	0.10	0.10	0.77

Notes: t statistics in parentheses, * p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors are clustered at the region level.

To demonstrate that our instruments are not correlated with regional crime rates we run a placebo regression of CRIME on FREEPRESS and VIOLATION_FREE in column 5, and find no significant relationship.

Table 4 presents the results of the IV estimation with fixed effects and the same control variables as in our basic OLS setting (Table 2). It reports the P-values for the underidentification and overidentification tests and the Kleibergen and Paap (2006) weak identification F-statistic from the first stage of IV. The underidentification test yields zero P-values and thus confirms that our instruments are correlated with the endogenous regressor. The test on overidentifying restrictions does not reject the null hypothesis that both instruments are valid and correctly excluded from the estimation equation. F-statistic from the first stage is above 10 which indicates strong instruments according to Staiger and Stock (1997).

Results from IV are quantitatively similar to the OLS estimation: increasing corruption decreases total aggregate investment in fixed capital, and the effect is larger for investment made by companies with private and foreign ownership (columns 1-2, and 4), but there is no statistically significant effect for investment by companies with full state-ownership (column 3). Import of capital goods is also lower with

18 For the years 2007 and 2009, VIOLATED*FREEPRESS reports the presence of violations (can equal one or zero) only if the interpolated value of FREEPRESS is not zero.

Table 4: Effect of corruption on investment, IV estimation with fixed effects

	(1)	(2)	(3)	(4)	(5)
Dep. Variable:	INV_total	INV_priv	INV_pub	INV_for	IMPORT
CORR	-0.546** (-2.36)	-0.652** (-2.13)	-0.306 (-0.71)	-1.895** (-2.30)	-1.190* (-1.77)
CRIME	0.191 (0.97)	0.079 (0.28)	0.172 (0.50)	0.372 (0.45)	0.891 (1.51)
Controls	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	390	390	390	390	390
Underidentification test (p-value)	0.00	0.00	0.00	0.00	0.00
Overidentification test (p-value)	0.26	0.27	0.83	0.59	0.20
Hansen J-stat					
Kleibergen-Paap rk Wald F-Stat	11.28	11.28	11.28	11.28	11.28

respect to corruption levels. However, estimated coefficients are much larger than in basic OLS: now, one standard deviation increase in corruption reduces total investment by 44.4% of its standard deviation, private investment by 46.2%, investment of companies with foreign ownership by 69.4% and imports of capital goods by 41.8%.¹⁹ Additionally, we show that CRIME as a proxy for the crime in the region is not significant determinant of investment.

The findings suggest that corruption has a very strong influence on the level of investment in fixed capital in Russia. The magnitude is striking: if, in 2012, Russia had had a corruption level as low as in 2004, the national economy would have received additional 16% more investment in fixed capital in 2013. The missing investment amounts to 2.1 trillion rubles (66 billion dollars) in nominal values for 2013 or in about 4% of gross domestic product of the same year.²⁰

The IV estimation infers causal relationship between corruption and investment only if the instruments satisfy the assumption of exogeneity. We assume the heterogeneity of press freedom and violations against journalists to be mostly accidental and not driven by social or economic conditions for several reasons. First, several sources suggest that the regional press was overlooked by federal authorities who were continuously strengthening control over national mass media (Becker 2004). For this reason, the press developed regionally (Eismont 2007; Gehlbach 2010; Lipman 2010) and was mainly managed by local activists and enthusiasts (Lipman 2010: 158). Second, since the literature on the determinants of press freedom is scarce, we provide some empirical evidence to show that our measures of free press are not determined by any economic factors. We regress FREEPRESS and VIOLATED*FREEPRESS on regional unemployment (UNEMP), regional income (INC), education (EDU), average salary in regional tele- and radio-broadcasting (PRESS_salary) and number of employees in the sector of tele- and radio-broadcasting

19 The magnitudes are estimated using the standard deviations calculated for the IV sample: years 2007-2011 and 78 regions.

20 Numbers for overall investment in fixed capital and GDP are taken for calculation for the year 2013.

(PRESS_size) as a proxy for the size of regional press.²¹ Table 5 presents the results in column 1 for FREEPRESS and column 6 for VIOLATED*FREEPRESS. Economic conditions in the region do not predict the freedom of press or the presence of violations of journalists' rights. Interestingly, our proxies for the salary of journalists and the size of regional press are also not correlated with free press variables. This result implies that having a sizable press and well-paid journalists in the region does not guarantee a critical and independent view of the press on the local government. Additionally, we show that the past values of different types of investment are not correlated with current freedom of press and its violations. Columns 2-5 and 7-10 report the results of using one year lagged investment variables as regressors for FREEPRESS and VIOLATED*FREEPRESS as explanatory variables, and we conclude that past values of investment are not associated with freedom of press variables and that reverse causality might therefore not be an issue in our case.

Table 5: Potential determinants of press freedom, OLS with fixed effects

Dep. Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	FREEPRESS					VIOLATED*FREEPRESS				
UNEMP	-0.012 (-0.92)	-0.012 (-0.96)	-0.013 (-1.00)	-0.011 (-0.87)	-0.012 (-0.95)	-0.011 (-0.88)	-0.011 (-0.86)	-0.011 (-0.81)	-0.012 (-0.88)	-0.012 (-0.88)
INC	0.234 (0.82)	0.275 (0.92)	0.280 (0.94)	0.252 (0.87)	0.268 (0.92)	0.345 (0.99)	0.328 (0.90)	0.324 (0.90)	0.333 (0.93)	0.357 (0.99)
EDU	0.005 (1.04)	0.005 (1.02)	0.005 (1.12)	0.005 (1.03)	0.005 (1.13)	-0.002 (-0.31)	-0.001 (-0.31)	-0.002 (-0.35)	-0.002 (-0.31)	-0.001 (-0.26)
PRESS_salary	0.020 (0.20)	0.019 (0.19)	0.018 (0.18)	0.022 (0.22)	0.018 (0.18)	-0.038 (-0.35)	-0.038 (-0.35)	-0.037 (-0.34)	-0.040 (-0.37)	-0.039 (-0.36)
PRESS_size	0.001 (0.64)	0.001 (0.76)	0.001 (0.74)	0.001 (0.65)	0.001 (0.69)	0.003 (1.31)	0.003 (1.26)	0.003 (1.26)	0.003 (1.30)	0.003 (1.33)
INV_total		-0.058 (-0.56)					0.024 (0.21)			
INV_priv			-0.047 (-0.84)					0.021 (0.30)		
INV_pub				-0.028 (-0.38)					0.018 (0.24)	
INV_for					-0.013 (-0.86)					-0.005 (-0.26)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	390	390	390	390	390	390	390	390	390	390
R2	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

Notes: t statistics in parentheses, * p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors are clustered at the region level.

4. Robustness checks

One concern about the reliability of our results arises from the nature of the corruption measure,

21 Variables INC and EDU are described in Table 1; UNEMP is the regional unemployment rate in percentage in the same year as the dependent variables; PRESS_salary is a ratio of salary in the sector of tele- and radio-broadcasting to the average salary in the region in the current year; PRESS_size is the number of people employed in the sector of tele- and radio-broadcasting per 100 000 population in the current year. Logit or probit models as alternative estimation techniques to OLS yield similar results.

which was generated by police authorities and could be associated not only with corruption but also with regional characteristics of law-enforcement. Schulze et al. (2016) demonstrate a strong correlation between the number of registered cases of bribe taking and the resolution rate for major and most serious criminal offenses (crimes penalized with imprisonment of 5 years or more) as reported by the police. We include resolution rate (RESOLUTION) in the IV estimation in Table 6. Our main results remain unaffected by the proxy for police efficiency; RESOLUTION is no significant predictor for any investment variables, except for the import of capital goods, which is positively correlated with the resolution rate of crimes .

Table 6: Robustness check for the resolution rate of major criminal offenses, IV estimation with fixed effects

	(1)	(2)	(3)	(4)	(5)
Dep. Variable:	INV_total	INV_priv	INV_pub	INV_for	IMPORT
CORR	-0.538** (-2.33)	-0.643** (-2.07)	-0.300 (-0.70)	-1.920** (-2.25)	-1.231* (-1.88)
RESOLUTION	-0.002 (-0.71)	-0.003 (-0.79)	-0.003 (-0.65)	0.019 (1.47)	0.0184*** (3.08)
Controls	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	390	390	390	390	390
Kleibergen-Paap rk Wald F-Stat	10.986	10.986	10.986	10.986	10.986
Underidentification test (p-value)	0.002	0.002	0.002	0.002	0.002
Overidentification test (p-value)	0.262	0.280	0.835	0.542	0.193
Hansen J-stat					

Notes: t statistics in parentheses, * p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors are clustered at the region level.

5. Conclusion

The main finding of our paper is a strong causal effect of corruption on regional investment in fixed capital. The effect is robust to controlling for social-economic conditions and endogeneity of corruption by using freedom of press and violations of journalists' right as instrumental variables.

Our research is novel in several aspects. First, we employ a new data set on registered cases of bribe taking by public officials in order to create a better proxy for corruption as compared to conventional perception-based data. The data allow to run a panel regression model controlling for various factors and region-specific and time fixed effects. Second, we introduce new instruments for corruption that have not been used in the literature on corruption before. Freedom of press, as we show in our case, has an effect on investment by reducing corruption through improving the accountability of public officials and does not correlate with regional economic conditions, salary of journalists, or the extent of the local press. Third, we are able to differentiate between different ownership-types of investment. While previous studies show the effect of corruption mostly on the aggregate investment, our findings suggest that corruption mainly affects investment made by privately owned companies and not investment made by companies with full state-

ownership. The effect of corruption is particularly large for companies with foreign-ownership.

Finally, our study contributes to the literature on consequences of corruption in Russia. The country offers an extremely interesting environment for corruption research due to great heterogeneity in both regional corruption and social-economic conditions, and it has not been sufficiently studied previously. Our findings provide actual evidence on the reason behind an increasing under-investment in the country. We estimate that the increase in corruption during the period under investigation is responsible for the lack of 16% of national investment in fixed capital in 2013 and that the share of missing investment is likely to remain constant in the upcoming years if corruption maintains at the current level.

While the empirical evidence presented in this paper emphasizes the detrimental role of corruption for the economy in developing countries, we procure a policy implication for fighting corruption. We suggest that corruption can be reduced by sustaining freedom of press and allowing journalists to independently carry out their professional duty without the risk of being censored, oppressed, or physically harassed, and that, as a consequence, regions will see growth in fixed capital investment.

Appendix A.

Guideline questions suggested for the evaluation of press freedom by GDF to their experts (direct translation from Russian):

1. Have there been incidents of death of journalists? Attacks on the journalists? Injuring of the journals? Attacks on the editorial office (arson, property damage, unsanctioned raids, etc.)?
2. Did the attackers escaped the punishment?
3. Is there a direct censorship in press?
4. Have regional journalists been arrested or detained?
5. Have any journalists been sued for libel?
6. Have there been threats to journalists connected to their professional activities?
7. Is there an access to mass media for opposition?
8. Are there indications of unofficial control of journalists (stalking, wiretapping, etc.)?
9. Are there forbidden topics for mass media (army, religion, opposition, separatism, etc.)?
10. Have there been incidents of illegal lay offs of the journalists?
11. Have there been incidents of criminal proceedings against internet providers for the content of the websites?
12. Have there been incidents of blocking or closing the internet websites?
13. Are there restrictions for foreign investment in the media?
14. Are there difficulties to access public information (refusals, limited access, disinformation)?
15. Have the rights to conceal the source of information of journalists been violated?
16. Absence of TV channels that are independent from governmental, regional, district or municipal funding. (Yes/No)
17. Absence of print press that is independent from governmental, regional, district or municipal funding. (Yes/No)
18. Absence of radio channels that are independent from governmental, regional, district or municipal funding. (Yes/No)
19. Lack of alternative sources of broadcasting and distribution of that do not belong to the government. (Yes/No)
20. Lack of printing houses that are not owned by the state. (Yes/No)
21. The presence of monopoly for distribution of printed materials. (Yes/No)
22. Is there a self-censorship?
23. Are there any court proceedings against mass media for the defense of honor and dignity?
24. There are informal conflicts between mass media and controlling authorities, that occurred as a result of use of administrative resource. (Yes/No)
25. The existence of printed media that is printed outside of the region. (Yes/No)
26. The existence of convictions by the article 129 of Russian Criminal Code (defamation), especially, the ones which resulted in imprisonment. (Yes/No)
27. The presence of juridical claims against mass media aimed at their bankruptcy and termination of their activities. (Yes/No)
28. The evaluation by police authorities of the investigation of crimes against mass media and journalists. (Yes/No)
29. Self-perception of journalists – do they consider themselves free to write and report news the way they see them?

The text of the questionnaire is provided by GDF, and is available upon request.

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