Corruption, Multinational firms and Innovation in Russia

Abstract

This paper examines the impact of institutions and multinational enterprises (MNEs) on innovation in Russia between 1998 and 2011. The results indicate the existence of a strong relationship between corruption, FDI and innovation. These results are consistent with the provocative argument that under certain institutional conditions corruption can be a "greasing wheel" of innovation and exercise a positive impact.

Keywords: Russia; Innovation, Corruption; FDI

1. Introduction

Innovation, continues improvement, and change are the three cornerstones of competitiveness enabling the long-term survival of firms locally and globally (Porter, 1990)[1]. International diffusion of technology from foreign-owned firms (MNEs) is argued to be one of the key drivers of growth in post-transition economies because of the spillovers that occur when local firms benefit from the superior knowledge of product, process technology or markets brought about by MNEs "without incurring a cost that exhausts the whole gain from the improvement" (Blomstrom et al, 2000).

The large body of literature has examined the spillover effects from MNEs (Holland and Pain, 1998; Zsuzsa, 2003; Javorcik, 2004; Girma and Görg, 2005) and the role of institutions in fostering spillovers and innovation (Barrel and Pain, 1999; Rodrik, 2000; Jalilian et al., 2007). Corruption (defined as the misuse of public office for private gains as in some cases public office can provide private benefits to politicians (Rose-Ackerman, 1999; Jain, 2001; Aidt, 2003) is the most frequently used measure of institutional quality due to its principally damaging economic effect (Aidt, 2003; Jain, 2001).

The quality of institutions matters for attracting FDI and fostering innovation because institutions are the key determinants of corrupt practices (Rose-Ackerman, 1999). Corruption can "sand the economic wheel" as investments in innovation may incur higher costs leading

[1] We take a broad view of innovation and consider innovation as a process involving generation, adoption, implementation and incorporation of new ideas and practices within organizations (Van de Van et al., 1989).

to greater inefficiencies and lower profitability for firms (Schleifer and Vishny, 1993; Mauro, 1995; Rose-Ackerman, 1999; Acemoglu and Verdier, 2001). Corruption may also help removing rigid obstacles to investment and foster innovation and growth, i.e. "grease the economic wheel" (Leff, 1964; Bailey, 1966).

Across the globe, there is a high reliance on inward foreign direct investment (FDI) as an explicit means to improved competitiveness. This applies to post-transition economies alike where FDI may provide a vital source of capital and technology fuelling economic growth (Kugler, 2006). For example, MNEs are able to exploit their proprietary advantage (e.g. knowledge) generated at home (Vernon, 1966; Dunning and Lundan, 2008) and innovations based on resources in the heterogeneous host country environments in which they operate (Dunning, 1998).

Nevertheless, there does not appear to be much of cumulative benefits of technology spillovers emanating from MNEs (Sjöholm, 1998; Aitken and Harrison, 1999; Yudaeva et al., 2003; Damijan et al., 2003) and the literature is inconclusive at best. This is of great concern. Although the role of FDI in fostering innovation from the developed economies has received great attention from international business scholars (see, for example, Caves, 1996; Driffield, 2011), the recent surge in FDI from emerging countries demands new research focus.

Transparency International Corruption Perception index shows that emerging markets have higher level of corruption compare to the developed countries (see Table, 1). But the literature is unclear on what impact that exposure to corruption at home has on MNCs activities within the host.

Habib and Zurawicki (2002), for example, argue that whilst generally considered as an obstacle, dealing with corruption at home may provide a learning experience preparing firms to handle corruption abroad. MNEs from emerging markets (EMNEs) differ fundamentally from MNEs from developed countries (DMNEs) in ownership advantages, internationalization motives, and home environmental characteristics (Buckley et al., 2007). However, it is unclear how such differences influence EMNEs behaviour and shape their internationalisation outcomes.

The paper seeks to examine the effect of institutions on innovation outcome in Russia. The case of Russia is of particular interest given its evolving institutions, an increasing importance of FDI for the economy and its widespread corruption. The aim of this study is to contribute some further evidence to the debate on the role of institutions in shaping innovation in transition economies. We focus on EMNEs as well as DMNEs as the literature has pointed

out that DMNEs can take advantage of their experience of dealing with corruption at home to obtain advantage in markets with similar characteristics (Habib and Zurawicki, 2002).

The paper is structured as follows. In the next section, we review the literature on the relationship between corruption, FDI and innovation. Section three describes data and present the empirical model used in the analysis. Section four discusses the main findings. Section five concludes and discusses future areas of research.

2. Corruption and innovation

The literature offers two views on the impact of corruption on innovation. Common wisdom views corruption as an obstacle to growth, which "sand the economic wheel" (Mauro, 1995; Schleifer and Vishny, 1993; Acemoglu and Verdier, 2001; Rose-Ackerman, 1999; Murphy et al. 1993; Schleifer and Vishny, 1993). Under corruption, investments in innovation may incur higher transactional costs, lower profitability and lead to greater inefficiencies (Acemoglu and Verdier, 2001).

Indeed, the rent-seekers are likely to target the innovation sector, which requires more public goods than established industries (Ehrlich and Lui, 1999). Mankiw and Whinston (1986) and Rose-Ackerman (1999) argue that paying the highest bribes allows firms to enter markets even though these firms may compromise on the quality of their products. As a result, the entry of rent-seeking firms may hinder innovation in both the established firms and start-ups.

Furthermore, corruption creates obstacles to doing business by undermining property rights protection, impeding innovation and the transfer of technology (Fosu et al., 2006). Regional bureaucrats (by using their offices) create a private market for public goods (e.g. protection of property rights) to which only a limited number of firms can have access through side payments (Hellman et al, 2003; Levin and Satarov, 2000).

Schleifer and Vishny (1993) argue that corrupt firms often report having advanced technologies even when this is not the case. Thus, the amount of innovative activity in corrupt environments might seem larger. Bureaucrats may also reject promising projects and delay innovation until a threshold level of bribe is reached which could be extracted often waiting until the maximum offer is made (Qian and Xu, 1998). Regulations can also create rigidities, slowing down the innovation process, because once bureaucrats realise they can take advantage of regulation they produce more regulation.

Following this line of research, empirical studies examined the impact of corruption on innovation (Veracierto, 2008; Starosta de Waldemar, 2011). Some found that corruption has a negative effect on product innovation (Starosta de Waldemar, 2011), whilst small increases in the penalties to corruption or the effectiveness of detection may result in large increases in the amount of product innovation (Veracierto, 2008).

Mahagaonkar (2008), however, provides some contrasting evidence of the impact of corruption on innovation activity. While corruption is shown to discourage product, process, and organisational innovation, it is found to facilitate marketing innovation due to varying degree of impact of corruption on the type of innovative activity and the degree of involvement of public property in a given innovative activity.

The second view of corruption is that it helps removing rigid obstacles to investment and economic activity and "grease the economic wheel" hedging against political risks (Leff, 1964; Bailey, 1966). In that capacity, it can allocate investment to the most efficient firms given that they are able to pay the highest bribes. Corruption can improve time efficiency allowing firms to move in front of bureaucratic lines (Leff, 1964; Bailey, 1966).

Empirical evidence confirms a positive impact of corruption on growth (Bardhan, 1997; Anokhin and Schulze, 2009; Heckelman and Powell, 2010). In some (e.g. incremental innovation) cases corruption may enable firms to overcome bureaucratic barriers (Bardhan, 1997) and reduce the inefficiency in public administration (Heckelman and Powell, 2010). By encouraging rent-seeking behaviour, official can allow firms to win the innovation race. Thus, corruption may act as an incentive for bureaucrats to help fasten the innovation process. Therefore, in governance systems that do not allow much scope for innovation, corruption might facilitate entrepreneurial activities (Heckelman and Powell, 2010).

In a longitudinal cross-national study, Anokhin and Schulze (2009) confirm the positive relationship between corruption and innovation. Using patents and realised innovation as proxies for the level of innovative activity, the study finds a curvilinear relationship between innovation, FDI and corruption. Whilst the relationship between corruption and patents is found to be positive and concave, the relationship between corruption, FDI and realised innovation is positive but convex. The level of patent activity and domestic innovation are greater when FDI is low than when it is high due to the possibility of corrupt nations attracting FDI only from other corrupt nations, which can result in lower rates of domestic innovation.

3. Corruption, Institutions and FDI/MNEs

Investors are attracted to locations with the capacity to adapt and apply external knowledge; to those with the necessary endowments and capabilities for knowledge diffusion (Fagerberg, 1994; Cantwell and Iammarino, 2003). To sustain economic growth, countries and/or regions must generate higher returns from fostering knowledge creation. Inward FDI can stimulate innovation through a number of channels.

For example, the presence of foreign firms in a region can put demands on local firms to adopt more efficient technologies and production methods (Girma and Wakelin, 2001). Such *competition effect* may lead to technological advancements in local firms *crowding out* less efficient businesses (Aitken and Harrison, 1999). Another positive effect of FDI on innovation is through *labour mobility* (Meyer, 2004). When local workers become familiar with foreign technology, they are likely to move on to set up their own businesses, using knowledge accumulated during previous engagement with foreign firms.

Local firms may also improve their efficiency though forward (from buyer to supplier) and backward linkages (from supplier to buyer) (Smarzynska, 2004). Forward spillovers result from adopting higher standards required by foreign companies, whilst backward spillovers result from providing training or technical assistance.

Notwithstanding the vast number of empirical studies that have examined such spillovers from FDI, very few statements or stylised facts are universally valid. In many cases there is conflicting evidence suggesting that the occurrence of spillovers depends on a complex interplay of both subsidiary- and region-specific factors (Caves, 1974; Blomstrom and Persson, 1983; Bertschek, 1995; Blomstrom and Sjoholm, 1999; Aitken and Harrison, 1999; Konings, 2001; Damijan et al., 2003; Iammarino et. al 2008).

It appears that conditions in the host country and in particular, the quality of institutions, can be crucial for whether positive spillovers from FDI are generated (Rose-Ackerman, 1999; Barrel and Pain 1999). While good governance raises productivity prospects for foreign investors, the low quality of institutions increase costs for MNEs (Wei, 2000). Poor government efficiency, policy reversals, graft, or weak enforcement of property rights increase uncertainty and, therefore, sunk costs for foreign firms, determining investment decisions by MNEs (Acemoglu et al., 2002; Wei, 2000).

To date, the empirical research examining the relationship between institutions and FDI has focused on cross-country variation in volume of FDI and on the extent to which the

latter is affected by the level of corruption of the host country. More often, these studies find a negative relationship in this context (Wei, 2000; Habib and Zurawicki, 2002; Lambsdorf, 2003; Voyer and Beamish, 2004). This is in line with a "grabbing hand" argument as bureaucrats in host countries tend to extract high rents from foreign investors (Tanzi and Davoodi, 2000) and the latter increases the cost of doing business in a country (Mauro, 1995; Jun & Singh, 1996) discouraging MNEs from investing.

Corruption, however, has also been considered a "helping hand" for MNEs (Tanzi and Davoodi, 2000). It can speed up the business processes in overcoming bureaucratic issues and enhance efficiency (Leff, 1964; Lui, 2001), and help companies gain favourable treatment regarding public funded projects (Tanzi and Davoodi, 2000). Habib and Zurawicki (2002), for example, conclude that in general MNEs tend to avoid corruption because "it is considered wrong and it can create operational inefficiencies".

They argue that "to handle corruption makes FDI challenging for companies from less corrupt countries and can result in a negative FDI decision. Alternatively, exposure to corruption at home provides a learning experience preparing the individual companies to handle them abroad. Hence, acquiring skills in managing corruption helps develop a certain competitive advantage." (Habib and Zurawicki, 2002: 295).

4. Data and variables

Data

All estimations in this paper are based on the data collected from the *Rosstat (Federal State Statics Bureau of the Russian Federation).* Monetary variables were deflated by the *CPI Index* provided by *Rosstat*. We use a number of MNEs from both developed economies and emerging markets. Due to data availability, we focus on two sub-samples of FDI location choice of firms from four emerging markets (EMNE) (i.e. Belorussia, Kazakhstan, Ukraine and China) and four developed markets (DMNE) (i.e. Germany, UK, USA and Finland). These foreign investors have equal to or more than 10% share in the capital of a particular firm registered in Russia.

Between 1998 and 2011, there were on average 8,573 foreign-owned firms (2,958 MNEs from emerging economies and 5,615 MNEs from developed markets). Our sample accounts for around 53% of the total number of MNEs operating in Russia between 1998 and 2011 as reported by *Rosstat*. The data set specifies the type of investors as either individuals

or companies. A brief look at a breakdown of MNEs across 81 regions (for which the data are available) shows that on average the inward FDI flow has mainly been concentrated in Moscow city and Moscow region (with 1,094 EMNEs and 1,631 DMNEs) and Leningrad region and St Petersburg city (with 182 EMNEs and 849 DMNEs). Belgorod region had 127 EMNEs and Bryansk - 122, whilst Kaliningrad has attracted 111 DMNEs. In contrast, the smallest number of EMNEs is located in Tuva, Kabardino-Cherkssia, Khakassia and Yamalo-Nenetsk with 1 firm respectively. Kalmykia, Khakassia and Altay are the regions with the lowest number of DMNEs.

Variables

The choice of control variables was motivated by the related empirical research and the availability of data. In our regression analysis we follow the literature on determinants of innovation to control for the key innovation once. While our focus is on the impact of corruption and foreign investment on innovation, we also control for other 'traditional' factors that have been found to be important in the literature.

Dependent variable

A number of proxies have often been used to measure the amount of innovation in a country with the level of R&D expenditure and patent statistics as the most common measures. Data on both R&D and patents, however, can suffer from a number of problems when used as a proxy for the level of innovation. For example, R&D is argued to be an input to innovation outputs rather than a measure of innovation occurring in a country (Frost, 2000). Because data on R&D rely merely on the linear, technology-driven view of innovation, it may establish no necessary link to any tangible innovation output (Mansfield, 1984).

An alternative proxy for innovation is patents. Patents are considered as a clear output indicator but may not result in commercialization (Love and Roper, 1999). Firms sometimes protect their innovations with alternative methods, notably industrial secrecy. Not all inventions are technically patentable. This is the case of software, which is generally legally protected by copyright. Furthermore, firms have a different propensity to patent in their domestic market and in foreign countries, which largely depends on their expectations for exploiting their inventions commercially. In each national patent office, there are many more applications from domestic inventors than from foreigners.

We argue that patents are not a measure of innovation *per se* but rather of the outputs and outcomes of successful historical innovation. The definition of innovation adopted in this paper is rather broad to encompass minor product improvements and adaptations as well as

more technologically driven product changes (see Audretsch, 1995 for a discussion). Therefore, our selected measure of innovation is a direct output-based measure of the extent of innovation, which we see as the output of the 'innovation production function' (i.e. the number of new, adapted and improved products). We use the total count for invention patents, (i.e. a set of exclusive rights granted to an inventor, and utility models, i.e. intellectual property right to protect inventions).

Key Independent variables

To rule out plausible alternative explanations that might influence the likelihood of innovation in regions, we control for several local-level characteristics.

Institutions

Economic performance and innovation are largely determined by the type and quality of supporting market institutions with national governments being the key in making their environments favourable for innovation through sound fiscal and monetary policies, solid legal and regulatory structures (North, 2005) which is the key component of any innovation system. Different proxies have been used to measure the quality of institutions in the context of transition economies.

Popov (2001) and Kim and Kang (2009) use the number of reported crimes. Crimes can in fact be interlinked with corruption (Buscalia & vanDijk, 2003; van Dijk, 2007), because corruption tends to be an integral part of organised crime's *modus operandi*. Zahra et al. (2005), for example, note that corruption includes terms such as corporate wrongdoing, management fraud, and illegal corporate behaviour.

In this paper we use the data on economic crimes (ECCR) which is *the number of economic crimes per capita* as reported by *Rosstat.* Examples of *economic crimes* include embezzlement, insider trading, the padding of one's expenses, paying a bribe to get a contract, altering a financial document, and individuals receiving money or being promoted for altering a financial document. Using this type of data gives us some obvious advantage. More specifically, as government corruption varies across Russia's regions, we can test its impact on innovation output.

In modern criminology, economic crimes are defined as crimes committed in the area that infringes on the interests of economic agents, as well as order management of the economy. In reality, however, legal and illegal activities often overlap and shade into each other as different forms of economic crime and criminal behaviour spread when organised criminals invest their proceeds into the legal economy (Council of Europe, 2005).

Lame (2002: 11) argues that 'the economic crime ranks amongst the most costly of all criminal activities, with dear consequences for societies'. Economic crimes undermine good governance in both the public and private sectors[2]. Market for economic crimes involves corruption in its various forms including fraud, kickbacks, conflicts of interests, and trading in influence. Thus, it may be more realistic to assume that corruption is indeed a major tool facilitating economic crime.

We use two alternative proxies for institutions in this paper. Both are ranking variables representing elements in evaluation of the investment environment in Russian regions published by *Expert*. These are an index of institutional potential (INST) and an index of political risk (POLIT) and both are representing the nature and quality of the institutional and political environment within Russia. They rank all regions in Russia on a scale from 1 (high) to 83 (low) potential/risk.

FDI/MNEs

To account for the fact that MNEs can generate intra-regional spillovers through diffusion of new technologies (Girma, 2003), we use the stock of the number of foreign multinationals in a region (MNEST). Although it has been acknowledged that FDI stocks can be 'a noisy' measure of the amount of value-adding MNE affiliate activity (Dunning and Lundan, 2007; Beugelsdijk et al. 2010), the aggregate stock of FDI has been frequently used in the country-level studies as a measure of the total amount of value-adding activity performed by MNEs.

Traditional determinants: R&D Expenditures

Traditional determinants: Labour Quality

In our analysis we also control for the educational level across Russian regions (LABQ). The growing literature on innovation focuses the ability of firms to acquire, master and adapt imported technology to benefit from FDI spillovers (Girma and Görg, 2005; Lall and Urata, 2003; Mancusi, 2008; Griscuolo and Narula, 2003). Innovation, as a knowledge intensive activity, is expected to be related to human capital in multiple ways. Black and Lynch (1996), for example, propose that investment in human capital through on-the-job training and education are the driving force behind increases in productivity and competitiveness at the organisational level. Cannon (2000) argues that human capital raises

[2] Source: www.europol.europa.eu

overall productivity as the human input to economic activity in terms of physical and intellectual effort increases.

The level of technology used by MNEs, however, may also depend on local technological capabilities (Wang and Blömstrom, 1992). If domestic technological capabilities are low, the level of technology transferred will also remain low. Local firms can increase their level of technological capabilities by continuously investing in R&D (Griscuolo and Narula, 2003). LABQ is *a number of graduates with technical qualifications as well as with university degree per capita*.

4. Regression analysis

Methodology

A number of issues that our data have made the use of ordinary-least squares (OLS) methods inappropriate. First, the data were likely to be heterogeneous in the variance in the disturbance terms across different cross-sectional units (region-year), presenting the heteroscedasticity issue that causes problems with OLS methods. Second, our dependent variable was a non-negative count measure, thus violating the OLS assumption of a normally distributed dependent variable. To deal with these concerns, we used a panel data methodology designed to account for unobserved heterogeneity (frequently a source of autocorrelation and heteroscedasticity).

Our approach, therefore, involved modelling fixed effects. As we had a non-negative count measure as our dependent variable, our analytical choices were Poisson regression and negative binominal regression. As our dependent variable was over-dispersed, the Poisson assumption that the conditional mean of the outcome was equal to the conditional variance was violated. Consequently, negative binominal was an improvement over Poisson (Greene, 2008). We applied a test presented in Greene (2008) that directly compares negative binominal and Poisson regressions to our data, the test indicated significant improvement over Poisson for our study. Therefore, we run and report the results from negative binominal regressions in Tables 6 and 7.

Further, because of the panel data format, we also needed to account for unobserved heterogeneity in our cross-sectional units (region-year). So we included dummy variable for each year to control for unobserved temporal heterogeneity, and random intercepts for regions. Summary statistics for our major regression variables is presented in Table 4. In Table 5, we present correlation between variables. We estimate the following model:

$$PATr,t = \gamma Xr,t\text{-}3' + \varepsilon r,t\text{-}3$$

where $PAT_{r,t}$ is the number of patent applications in a region r at time t (r = 1, ..., 83 and t = 1997, ..., 2011). Xr,t-3' is a vector of variables affecting innovation. Our two explanatory variables of interest are corruption and MNCs; these are included in Xr,t-3'.

When relating knowledge input to innovative output a time lag has to be assumed (for the reason that R&D is a lengthy process requiring time for attaining a patentable result). Since patenting of innovation can be decided long time before a patent is filed which may happen at t-3, FDI and other endogenous explanatory variables if lagged one year only may turn out to be correlated with the measures of innovation. Therefore, it is more rational to use these variables lagged at least three times to account for the possible endogeneity. This means that the innovation output in a given year is reflected in the patents filed and new technologies granted and created three years in the future. We allow a time lag of three years with all variables to minimise endogeneity problems. This means that the innovation output in a given year is mirrored in the patents filed created three years in the future.

Since all the years (from 1997 to 2011) are used in our regression, we also use the clustering by region. Our estimation procedure for the innovation production function is governed largely by the nature of the dependent variable. For the number of patent applications linear exponential models such as Poisson are appropriate (Hausman et al., 1984; Cameron and Trivedi, 1986). We conduct the Cameron and Trivedi (1990) test for over-dispersion that indicated that the Poisson model was invalid. We therefore use a negative binomial model.

Since the aim of this article is to empirically disentangle the impact of the level of corruption in the host country on the volume of innovation output, the investigation will employ a panel data analysis. With panel data use, the sample size is much larger than would be the case if just pure time-series or cross-sectional data were employed, and so more degrees of freedom and more efficiency results in an increase in the reliability of the estimates of the regression coefficients (Baltagi 2005: 5).

To decide between fixed or random effects we run a Hausman test where the null hypothesis is that the preferred model is random effects (REs) vs. the alternative the fixed effects (Fes) (Green, 2008). The corresponding p-values of the test are reported at the bottom of Table 6. As Hausman test supports the use of FEs, the FE regressions are run. We added time-specific effects into all our models.

Table 6 presents our main results. To our model we also added an alternative measure of institutions, i.e. institutional potential (INST). As we want to check (in case of a positive association between corruption and innovation in Russia) if corruption can act as a hedge against political risks, so we added *POLIT* which is the index of political risks.

Therefore, Model 1 is our basic model with MNEs that includes main innovation determinants plus corruption. Model 4 is our basic model with DMNEs that includes main innovation determinants plus corruption. Model 7 is our basic model with EMNEs that includes main innovation determinants plus corruption.

Model 2 reports the results after adding an index of institutional potential index into Model 1 with MNEs. Model 5 reports the results after adding an index of institutional potential into Model 4 with DMNEs. Model 8 reports the results after adding an index of institutional potential into Model 7 with DMNEs. Model 3 reports the results after adding political risk index into Model 2 with MNEs. Model 6 reports the results after adding political risk index into Model 5 with DMNEs. Model 9 reports the results after adding political risk index into Model 8 with DMNEs.

The overall all models are statistically significant. The evaluation of the models is undertaken by applying the Ramsey RESET test. The results show that we could not reject the null hypothesis of the test suggesting no evidence of misspecification of functional forms. The corresponding p-values of the test are reported at the bottom of Table 6. Our results seem robust to different specifications. The signs of the coefficients do not change and the magnitudes are very similar.

RESULTS

The Effect of Corruption

As can be seen from Table 6, the coefficient of corruption is significant and positive for all specifications. This result confirms the previous work that has found a positive association between corruption in the host country and innovation (Bardhan, 1997; Heckelman and Powell, 2010; Anokhin and Schulze, 2009). This result is robust because once we control for the institutional potential as well as political risk in the host region, the positive effect does not disappear.

The finding of a positive impact of corruption measured by the number of economic crimes per capita is interesting, it should not however be interpreted as evidence that the corruption does not reduce the amount of innovation it produces. Rather, one should view the

result as an indication of the importance of the quality of institutions. In other words, as we discussed above, corruption is an illegal activity and so the willingness to engage in corrupt activities depends on the penalty imposed and on the probability of being caught (Becker 1968). Therefore, if a country has good-quality institutions, it may still be able to innovate despite its level of corruption.

The Effect of the Control Variables

All the control variables have the expected effects and are significant at the 1% level. The results are consistent with the existing literature. The host country's R&D stock is positive and highly significant at the 1% level. The stock of MNEs, which is a proxy for knowledge spillovers, is also positively and statistically significant at the 1% level. This finding is consistent with the hypothesis that innovation can be facilitated by MNE affiliate's superior knowledge of product, process technology or markets (Blomstrom et al, 2000).

The effect of the human capital is also positive and statistically significant at the 1% level, so innovation is enhanced within a region country with high levels of skilled labour. The results show strong support for the existence of the expected negative relationship between innovation and political risk (Schleifer and Vishny, 1994). This variable is statistically significant at the 1 % level in all models. Corruption can discourage investors, because doing business in corrupt envirnments amplifies risk and uncertainties (Schleifer and Vishny, 1994; Getz and Volkema, 2001). However, acting as a hedge against political risks, corruption can boost the scope and scale of investment (Leff, 1964).

Sensitivity Analysis

Therefore, we find that corruption has a positive effect on innovation in that it is "greasing the wheels of government". This might be because Russia has a rigid bureaucracy. However, the willingness to engage in corrupt activities depends on the penalty imposed and on the probability of being caught. If a region has well-functioning institutions, the probability of getting caught is very high and government officials may find it difficult to engage in corrupt activities. Thus, our robustness analysis is concerned with the interaction terms that occur between institutions and corruption.

We use two terms: one that occurs between intuitional potential and corruption (*ECCRIME*INST*) and the other one that occurs between legislative risk and corruption (*ECCRIME*POLIT*). Essentially, we are just testing whether the effect of corruption is

significantly different in regions with a high level of institutional quality. We would expect these interaction terms to have negative effects on innovation if corruption deters innovators.

If the coefficient of *ECCRIME*INST* is negative and significant, then it is interpreted that corruption negatively affects innovation via the interaction with the institutional potential. If the coefficient of *ECCRIME*POLIT* is negative and significant, then it is interpreted that corruption negatively affects innovation via the interaction with the legislative risk. The results of those regressions are reported in Table 7.

Columns (1) and (2) show that there is indeed evidence that the effect of corruption on innovation depends on the quality of institutions. In particular, column (1) shows that the interaction term *ECCRIME*INST* is negatively related to innovation. The effects of both corruption and institutional potential are however positive and significant at the 5 % level, and their magnitudes are rather large. Column (2) shows that the interaction term *ECCRIME*POLIT* is positively related to innovation, and its effect as well as the effect of corruption is significant at the 5 % level. Although the effect of corruption is positive, the effect of legislative risk has a negative association with innovation output (in both cases with significance at the 5 % level).

Discussion

Our most important findings can be summarised as follows. First, our results support some earlier research that innovation can be facilitated by R&D, human capital and FDI stock (Cohen and Klepper, 1992; Black and Lynch 1996; Cannon 2000; Girma and Görg, 2005). Second, our finding that the number of economic crimes in a region is positively associated with innovation outcome supports the view of "the grease of the economic wheel" (Leff, 1964; Bailey, 1966). In the context of Russia, it may help remove rigid obstacles to investment and foster innovation by reducing the inefficiency in public administration (Bardhan, 1997; Heckelman and Powell, 2010). Such result challenge the view that transitional period has been completed in Russia accompanied by increasing formalisation of rules and filling the gaps in the legislative and regulatory basis (Radaev, 2000). More economic crimes associated with more innovation may at first sight seem as an oxymoron, but it may actually imply that the more economic crimes are reported the greater the chance that these will be effectively addressed, hence enhancing the belief of likely innovators that corruption can be effectively tackled. In other words the bigger the number of economic crimes recorded, the bigger the possibility that the authorities will do something about this,

the bigger the boost to the confidence of companies to invest in the regional economies. This is in line with the negative relation between legislative risk and innovation: if economic crimes are not recorded but are prevailing, or if they are recorded but not effectively tackled companies will be alienated from the poor institutional response reducing their efforts.

The stock of R&D and FDI capital, and quality of human capital are all important factors in determining innovation outcome across Russia. The coefficients of these variables are positive and strongly significant at the 5% and above level. The magnitude of coefficients of R&D stock and human capital is higher than of that of FDI stock. In that, we find a convincing evidence of a positive effect of both tangible and intangible capital on innovation in Russia. This result is in line with the previous studies (Feldman et al., 2002; Cohen and Klepper, 1992; Black and Lynch 1996; Cannon 2000).

When looking at the results for the institutional variables, i.e. economic crimes, it is interesting that it has a positive sign (and this result is statistically significant at 5% and above level), indicating that innovation output in Russia is higher in regions with a higher rate of economic crimes. The explanation of this result is the following. Any corrupt deal runs a risk to be detected and punished, thus the expected bribe revenue for a corrupt official (so-called "facilitation payment") should be higher if a larger bribe or payment is expected to be offered by firms.

As larger innovation projects (e.g. by MNEs) are probably expected to have the higher probability of a larger bribe or payment being offered by firms-innovators, a corrupt regional government would prefer a larger innovation project to a smaller one. Therefore, firms that are capable of offering higher payments may be those with better access to finance or funding (these are likely to be MNEs and not the indigenous exporters).

Given that MNEs require possible access to permits, licenses to new technologies quickly, they will require passing through the tangled bureaucratic system by paying facilitation fees. What is more, corruption can mitigate barriers to the growth of firms and innovation, blocking vandalism and organised crime. These results are consistent with theory grounded in political economy and with previous theorising based "sand the wheels" argument, which states that corruption misallocates resources and distorts investment priorities (Baumol, 1990). It is consistent with the argument that in environments with high political risk, corruption can act as a shield against political risk (Kesternicha and Schnitzerb, 2010).

5. Conclusion

The paper empirically analysed the impact of corruption and FDI on innovation in Russia. We argue that in a geographically large federative country such as Russia it is important to consider the factors affecting innovation output at sub-national level. In particular, we focus on distribution of patent statistics among Russian regions. The main purpose of this paper was to test the link between corruption and innovation within the environment that have attracted FDI from both emerging markets as well as the developed markets. We examined the significance of traditional determinants of innovation (e.g. R&D stock, human capital and FDI as well as institutions).

We have tried to challenge the idea of corruption to "grease the economic wheal", however, our study has provided some evidence of corruption to be a "helping hand" to innovation (Leff, 1966). We have disaggregated a sample of multinational companies into firms that have come from less corrupt environments (developed markets MNEs) and more corrupt markets (emerging markets MNEs). This provided an opportunity to test whether the impact on innovation of both types of firms was different. Our results are consistent with the argument that in high risk political environments, corruption can act as a hedge against political risks, boosting the scope and scale of foreign investment (Leff, 1964).

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APPENDIX

Table 1 Number of MNEs from developed (DMMNEs) and emerging markets (EMMNEs) in Russia (1998-2010)

		1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
EMMNEs:	*Belorussia*	242	292	350	371	400	465	649	720	844	1212	1496	848	797
	Kazakhstan	131	131	149	125	113	136	190	227	318	402	441	447	447
	Ukraine	448	395	416	377	443	612	734	839	956	1169	1032	1104	1135
	China	733	914	1051	1177	1418	1577	1935	1403	1457	1577	1352	1045	1210
Total:		1554	1732	1966	2050	2374	2790	3508	3189	3575	4360	4321	3444	3589
DMMNEs:	*Germany*	662	698	756	767	799	860	974	1332	1434	1454	1505	1597	1478
	UK	713	637	966	1263	1500	1500	1493	910	1000	910	908	884	808
	USA	1350	1437	1394	1403	1356	1408	1411	1208	1186	1067	969	872	822
	Finland	492	594	612	608	569	639	626	547	610	565	563	542	468
Total:		3374	3494	3871	4165	4333	4535	4682	6040	6758	7246	7860	8440	8201
Russia Total		**4928**	**5226**	**5837**	**6215**	**6707**	**7325**	**8190**	**9229**	**10333**	**11606**	**12181**	**11884**	**11790**

Table 2 The accumulated annual number of MNEs in Russia by the year of registration (1998 to 2010)

	EMMNEs				*DMMNEs*			
Year	*Belorussia*	*Kazakhstan*	*China*	*Ukraine*	*Germany*	*UK*	*USA*	*Finland*
1998	242	131	733	448	662	713	1350	492
1999	534	262	1647	843	1360	1350	2787	1086
2000	884	411	2698	1259	2116	2316	4181	1698
2001	1255	536	3875	1636	2883	3579	5584	2306
2002	1655	649	5293	2079	3682	5079	6940	2875
2003	2120	785	6870	2691	4542	5989	8148	3422
2004	2769	975	8805	3425	5516	7489	9556	4061
2005	3489	1202	10208	4264	6848	8982	10967	4687
2006	4333	1520	11665	5220	8282	9982	12153	5297
2007	5545	1922	13242	6390	9736	10892	13220	5862
2008	7041	2363	14594	7422	11241	11800	14189	6425
2009	7889	2810	15639	8526	12838	12684	15061	6967
2010	8686	3257	16849	9661	14316	13492	15883	7435

Table 3 Transparency International Corruption Perception Indices of countries in the sample (1995-2010)

	Home Country	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
DMMNEs	*Finland*	9.1	9	9.5	9.6	9.8	10	9.9	9.7	9.7	9.7	9.6	9.6	9.4	9	8.9	9.4
	Germany	8.1	8.3	8.2	7.9	8	7.6	7.4	7.3	7.7	8.2	8.2	8	7.8	7.9	8	8
	UK	8.6	8.4	8.2	8.7	8.6	8.7	8.3	8.7	8.7	8.6	8.6	8.6	8.4	7.7	7.7	7.8
	USA	7.8	7.8	7.6	7.5	7.5	7.8	7.6	7.7	7.5	7.5	7.6	7.3	7.2	7.3	7.5	7.1
EMMNEs	*Belorussia*				3.9	3.4	4.1	4.5	4.8	4.2	3.3	2.6	2.1	2.1	2	2.4	2.4
	China	2.3	2.4	2.9	3.5	3.4	3.1	3.5	3.5	3.4	3.4	3.2	3.3	3.5	3.6	3.6	3.6
	Kazakhstan					2.3	3	2.7	2.3	2.4	2.2	2.6	2.6	2.1	2.2	2.7	2.7
	Ukraine				2.8	2.6	1.5	2.1	2.4	2.3	2.2	2.6	2.8	2.7	2.5	2.2	2.3

Source: Transparency International 2011

Table 4 Description of variables

Variable	*Description and source*
PAT	Total Number of Patent applications
RDST	Stock of R&D expenditures
MNEST	Overall stock of the number of foreign MNES
DMNEST	Developed countries' MNEs stock
EMNEST	Emerging Economies' MNEs stock
LABQ	Number of people with technical qualification plus university degree award
ECCR	Number of economic crimes per 100, 000
INST	Index of Institutional Potential
POLIT	Index of Political Risk

Table 4 Descriptive statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
PAT	1245	381.0	1020.2	0	13180
RDST	1397	44653.7	222436.7	0.7	3812621
MNEST	1135	602.0	2731.4	0	35952
DMNEST	1135	49.2	197.9	0	1922
EMNEST	1135	36.5	129.2	0	1577
LABQ	1351	0.0	0.0	0.0	0.1
ECCR	1245	2995.0	3053.4	23	25506
INST	1410	42.6	24.0	1	83
POLIT	916	45.6	25.4	1	83

Table 5 Correlation between main variables

	PAT	*RDST*	*MNEST*	*DMNEST*	*EMNE*	*LABQ*	*ECCR*	*INST*	*POLIT*
PAT	1								
RDST	0.6974	1							
MNEST	0.5091	0.6849	1						
DMNE	0.5314	0.5385	**0.8469**	1					
EMNE	0.5237	0.7133	**0.9546**	0.7563	1				
LABQ	0.1501	0.178	-0.1336	-0.2301	-0.0618	1			
ECCR	0.7832	0.6152	0.4399	0.4906	0.4567	0.0814	1		
INST	-0.6395	-0.4313	-0.2481	-0.2735	-0.2252	-0.0921	-0.6871	1	
POLIT	-0.018	0.0534	0.0104	0.0121	0.0016	-0.0322	0.0103	0.0508	1

Table 6 Fixed Effect Regressions: Innovation and Corruption; dependent variable - number of patents filed.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
RDST	0.089**	0.091**	0.081*	0.086**	0.088**	0.066***	0.135**	0.136**	0.143**
	(0.032)	(0.031)	(0.035)	(0.033)	(0.032)	(0.036)	(0.030)	(0.030)	(0.034)
MNEs	0.275**	0.283**	0.320**						
	(0.033)	(0.034)	(0.037)						
DMNEs				0.298**	0.305**	0.359**			
				(0.037)	(0.037)	(0.042)			
EMNEs							0.054***	0.057***	0.069*
							(0.029)	(0.029)	(0.032)
LABQ	0.160*	0.158*	0.213**	0.180**	0.179**	0.238**	0.106	0.106	0.154*
	(0.068)	(0.067)	(0.070)	(0.066)	(0.066)	(0.068)	(0.072)	(0.072)	(0.075)
ECCR	0.090*	0.105**	0.106*	0.091*	0.106**	0.107*	0.124**	0.127**	0.137**
	(0.037)	(0.038)	(0.043)	(0.037)	(0.037)	(0.043)	(0.039)	(0.039)	(0.046)
INST		0.080*	0.084*		0.077*	0.081*		0.017	0.023
		(0.036)	(0.038)		(0.036)	(0.038)		(0.037)	(0.040)
POLIT			-0.044*			-0.042*			-0.045*
			(0.018)			(0.018)			(0.018)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Const	1.373**	0.939***	0.309	1.558**	1.143*	0.570	0.992***	0.887	1.444*
	(0.505)	(0.539)	(0.617)	(0.503)	(0.536)	(0.618)	(0.520)	(0.567)	(0.634)
N	821	821	736	800	800	716	792	792	706
Wald	73.23***	77.06***	168.54***	151.36***	155.38***	178.91***	52.22***	52.27***	59.12***
Hausman	452.39***	195.95***	177.89***	536.98***	255.07***	186.45***	569.56***	629.33***	143.21***

*Note: Robust Jackrife standard errors in parentheses; *** p<.10, * p<.05, ** p<.01.*
All models are estimated with a constant and the full control variables.

Table 7: Sensitivity Analysis: Innovation and Corruption

	(10)	(11)	(12)	(13)	(14)	(15)
INST	0.067**		0.079**		0.013**	
	(0.060)		(0.060)		(0.063)	
POLIT		-0.026***		-0.028***		-0.021***
		(0.015)		(0.015)		(0.016)
ECCR	0.098***	0.008**	0.011***	0.005**	0.096***	0.038**
	(0.058)	(0.041)	(0.057)	(0.041)	(0.061)	(0.042)
*ECCR*INST*	-0.001**		-0.001**		-0.001**	
	(0.000)		(0.000)		(0.000)	
*ECCR*POLIT*		0.001**		0.001**		0.001**
		(0.000)		(0.000)		(0.000)
N obs	822	732	801	712	793	702
N groups	77	77	77	77	77	77

*Note: Robust Jackrife standard errors in parentheses; *** p<.10, * p<.05, ** p<.01. All models are estimated with a constant and the full control variables.*