THE VALUE RELEVANCE OF FIRMS' INTEGRAL ENVIRONMENTAL IMPACT: EVIDENCE FROM RUSSIA

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ABSTRACT

Purpose: The purpose of this paper is to investigate the value relevance of firms' integral environmental impact.
Design/methodology/approach: In this study we utilize data from 74 Russian listed firms for the years 2005-2007. For the proxy of environmental performance we use the integral environmental impact measure, which we construct on the basis of the data provided by the Russian Independent Ecological Rating Agency (NERA).
Findings: The results indicate that environmental performance measured as integral environmental impact is value relevant and is valued as an investment.
Originality/value: In our analysis, we extend the literature on the valuation properties of environmental performance introducing the measure of integral environmental impact. We also address the question of the legitimacy of environmental performance disclosure by examining differences between firms with different disclosure policies. Moreover, we contribute to the literature on the impact of ownership on environmental disclosure and performance by examining how foreign ownership affects environmental performance.
Keywords: value relevance, non-financial information, environmental performance, Russia.
Paper type: Research paper

1 Introduction

This paper investigates the value relevance of firms' integral environmental impact, *i.e.* our proxy for environmental performance, following a stream of non-financial information value relevance in accounting research. The heightened general public awareness of climate change, green gas accounting, sustainability issues and social responsibility has resulted in more attention being paid to companies' environmental initiatives and environmental reporting. The recent trend is that almost all big public companies voluntarily produce environmental reports either as a part of their financial reporting or as stand-alone reports. The issues disclosed in the environmental reporting can be classified into numerical and descriptive types and the meaning of such reports has been addressed by numerous accounting studies, for a review see Owen (2007).

A number of studies have addressed the issue of environmental performance value relevance (Hassel et al., 2005; Cormier and Mangan, 2007 etc). However, no consensus has been reached among researchers on the valuation properties of environmental performance. For instance, Freedman and Jaggi (1992) found no interrelation between environmental and financial performance in the pulp and paper industry, while Russo and Fouts (1997) found a positive association of environmental and financial performance. The basic question remains unanswered: is environmental performance treated as cost or as investment generating future cash flows? This question is crucial for investors making their investment and valuation decisions. Discrepancies in earlier research results regarding the valuation properties of environmental performance may be due to the different proxies of environmental performance used by researchers. For instance, some studies employing pollution levels as proxies for environmental performance, e.g. Cormier & Magnan (1997) and Hughes (2000), found that high pollution lowers firm value, while Murray and Gray (2006) found no relationship between share returns and environmental disclosure. Construction of environmental performance proxies from information provided in the corporate social responsibility reporting may be misleading, because due to the voluntary nature of these reports many companies do not disclose environmental performance information exhaustively (Frost, 2007; Adams and Frost, 2007) or use such reports for purposes of image creation and reputation risk management (Bebbington *et al*., 2008). Moreover, the involvement of a firm in environmental reporting initiatives does not automatically result in greater levels of accountability as the firm may select what information to disclose and may deliberately omit information on its environmental impacts that is material to key stakeholder groups (Adams and McNichols, 2006).

Studies using environmental impacts measures have been limited to either a single industry, e.g. pulp and paper (Freedman and Jaggi, 1992), mining (Magness, 2006) or a single environmental impact measure, e.g. air pollution (Hughes, 2000). However, in the course of its operations the firm influences the environment in many ways including water usage, air pollution, formation of waste *etc*. and not all these environmental implications are captured within current accounting systems (Deegan, 2008). To address the problem of climate change it is important to evaluate the environmental performance of the firm more holistically, including all possible environmental impacts. Thus, in our study for the proxy of environmental performance we use the integral environmental impact [1], which we construct based on the data provided by the Russian Independent Ecological Rating Agency (NERA). We use a unique measure of environmental performance directly addressing companies' integral environmental impacts, capturing the use of fresh

water, the volume of polluted sewage, the volume of emissions of pollutants, the emissions of air pollutants from vehicles, the volume of toxic waste and the total area of used and polluted land. The nature of the data allows us to compare the value relevance of environmental performance across companies and industries.

In this study we employ data from 74 Russian listed firms for the years 2005-2007. In our analysis, we extend the literature on the valuation properties of environmental performance (Jaggi and Freedman, 1992; Dowell *et al.,* 2000; Hassel *et al,*. 2005) by introducing the measure of integral environmental impact. We also address the question of the legitimacy of environmental performance disclosure by examining the differences between firms having different disclosure policies. Moreover, we contribute to the literature on the impact of ownership on environmental disclosure and performance (Magness, 2006; Cormier and Gordon, 2001; Cormier and Magnan, 2003) by examining how foreign ownership affects environmental performance. Finally, we examine the cross-industry valuation properties of environmental performance.

The results of the study indicate that environmental performance is valued positively in Russia, meaning that lower environmental impact is valued positively by investors, i.e. as investment. This finding has several implications: firstly, for the firm it pays to reduce its pollution levels and implement strategies for sustainable development, because ignoring environmental issues can result in future proprietary cost (Li *et al*., 1997) and massive future costs needed for liquidation actions due to environmental disasters can shatter the economic stability of the firm. It pays to take preventive measures to reduce environmental impacts, and by cutting down on the formation of waste and other pollutants, the firm is likely to manifest its strategic changes. Firms that disclose less than 50% of their environmental impacts have higher environmental impacts than firms disclosing their entire environmental impacts, demonstrating that such information is used for legitimacy purposes. Foreign owners in the firm are likely to have a positive effect on the environmental performance of the firm building on the stakeholder theory.

The remainder of this paper is organized as follows. Section 2 reviews the existing studies in the area of value relevance of non-financial information and environmental performance in particular. Section 3 describes the situation with regard to environmental performance and environmental performance in Russia. The methodological choices are described in Section 4. Section 5 presents the data and Section 6 considers the results. Section 7 concludes.

2 Value relevance of non-financial information

The potential of the incorporation of non-financial information into firm valuation was realized long ago in accounting research (Amir and Lev, 1995; Botosan, 1997). Non-financial information in the form of ratings can be viewed as an additional source of information containing impressionistic judgments on firm-specific management characteristics (Koch and Cebula, 1994). Furthermore, Junttila *et al.* (2005) find that non-financial information measured in terms of the analysts' perceptions has value relevance in a technology-oriented stock market.

2.1 Environmental non-financial information

In developed countries issues of corporate social responsibility have been emerging with the introduction of the social or environmental reports by firms serving as a means by which to communicate their ecological strategy to its stakeholders. The main feature of such corporate reporting practices is their voluntary nature, due to the fact that the corporate social responsibility market is not regulated, especially when compared to the financial reporting of a firm (Aras and Crowther, 2008). Currently there are two sets of global standards which provide guidelines for corporate social and environmental reporting: AA1000 and GRI. Why should corporate social responsibility or environmental performance matter for the valuation purposes? In the literature there are several theories on this. We propose to review the most influential ones and see how they are related to our study.

Stakeholder theory

Stakeholders are generally represented by investors, customers, employees, suppliers, governments etc. Throughout a firm's life-cycle stakeholders exert pressure on the firm and both exert influence and are influenced by the firm. Taking the further stance on stakeholder theory, Jones (1995) concludes that firms conducting business with stakeholders on the basis of trust have an incentive to demonstrate a sincere commitment to ethical behaviour. By demonstrating ethical behaviour, including environmental awareness, firms are more likely to achieve a competitive advantage and secure long-term relations with stakeholders. Therefore, applying stakehoder theory, we infer that a firm by introducing a strategy of minimizing environmental impacts is likely to initiate the stakeholder engagement process, for instance by means of GRI reporting and as outcome achieve a better understanding with its stakeholders. When the internal management actions are not observable, e.g. if the firm does not produce a GRI or any similar report, we conjecture that the firm's effort in environmental issues may be discernible through the measures of environmental impact levels of a given firm. Reduced environmental impact levels may indicate that management is concerned with environmental impacts and has been taking measures to manage the firm in a sustainable manner. Therefore, in this study we employ a measure of environmental impact constructed by using unique data from the Russian Independent Ecological Rating Agency (NERA).

Moreover, we are interested particularly in how certain stakeholders, namely foreign owners, affect the environmental performance of Russian firms. Cormier and Magnan (2003) find that foreign ownership has a positive effect on a firm's environmental reporting. Existing studies regarding the effect of foreign owners in

Russia document that they demand higher standards of corporate governance and stimulate the use of IFRS reports and corporate social responsibility reports. We believe that firms accessing external, foreign finance are more likely to be more accountable and concerned with environmental issues.

Legitimacy theory

Legitimacy theory deals with the notion of social contract and with the idea that managers will adopt strategies involving environmental disclosure to ensure that the organization is making an effort to comply with society expectations (Deegan *et al.,* 2002). Legitimacy theory is very much related to stakeholder theory, in other words they complement each other (Adams and Whelan, 2009). Consistent with legitimacy theory the functioning and management of an organization is based on the legitimizing strategies that would lead to achieving a balance between the organization's activities and what society expects of it. Therefore, any organization is likely to act within the boundaries and norms of the society in which it operates in order to maintain its legitimacy or right to operate

Regarding environmental performance the demonstrable consequences of legitimacy theory would suggest that in the case of environmental norms violations or negligent levels of pollution a company would face a legitimacy crisis. In order to regain its damaged legitimacy a company may increase its transparency by decreasing disclosure, for instance by means of environmental reporting (Deegan and Rankin, 1996). However, when dealing with the environmental performance disclosure provided by a company itself Deegan and Rankin (1997) indicate that there is always a danger of a biased picture since the format of disclosure is not regulated. This observation refers especially to the situation with the environmental reporting in Russia, where there is a lack of voluntary reporting initiatives, *per se,* accumulated with the high propensity to achieve low disclosure levels on environmental performance. Therefore, for the purposes of this study we rely on the environmental performance ratings assigned to firms by the Russian Independent Rating Agency (NERA). The registration and documentation of environmental impacts is compulsory in Russia, and the information is sent to the state statistical authority, but is not available to the general public. NERA issues requests to all major Russian firms to provide information on environmental impacts. The nature of the data provided by NERA allows us to empirically investigate legitimacy theory, because among the firms in the sample there are some firms which disclosed less than 50% of their environmental performance to NERA, and others for which the agency is able to provide reliable estimates. Therefore, by comparing two groups of firms, those with higher environmental transparency levels and those with lower transparency levels, we can see how their environmental impacts differ. We conjecture that firms with higher transparency would have lower environmental impact scores, as they would see it as a mean by which to demonstrate their legitimacy.

Proprietary costs

According to the model by Verrecchia (1983) firms withhold information to avoid incurring an exogenous proprietary cost. Li *et al.* (1997) claim that environmental liability information is proprietary because stakeholders can use it to impose costs on polluting companies. Government agencies would have the right to use this

information for investigations. Environmental liabilities encompass the notion of uncertainty due that the following reasons, first of all it is hard to judge according to the financial consequences of such liabilities, which may include emission control and cost of liquidation of contamination and pollution (Barth and McNichols, 1994; Milne, 1991; Hughes, 2000). Cormier and Magnan (2003) report that by incurring proprietary costs a firm enhances its reputation as a credible discloser. If firms become more pollution prone, they would be expected to have greater environmental liabilities. In the case of our data, why would it pay to have a lower integral environmental impact? By having lower environmental impact firms are likely to follow the strategy of minimizing future environmental liabilities, therefore, we might expect that the market would value high environmental performance. Hence, in the valuation context superior environmental performance should be valued as an investment increasing the value of the firm. For the purposes of our analysis, we are interested in whether there are cross-industry differences in the valuation of environmental performance.

2.2 Studies on value relevance of environmental performance

When dealing with environmental performance, one has to consider the choice of a proxy for it. A number of studies have used environmental rankings as a proxy for environmental performance. For instance, as a proxy of environmental performance, Ingram & Frazier (1980) and Freedman & Wasley (1990) used an environmental performance index devised by the Council on Economic Priorities (CEP), a non-profit organization specializing in the analysis of corporate social activities. Clarkson *et al.* (2004) confirms that environmental performance is the forward-looking measure that has the potential to augment the information in current accounting earnings and book value of equity.

Barth and McNichols (1994) and Hughes (2000) use non-financial pollution measures to show that they capture the exposure of high polluting firms to future environmental liabilities. Cormier et al. (2001) do not find a direct relationship between environmental reporting and stock market value for Canadian firms, however they observe a negative relation between environmental reporting and stock value for firms incurring fines and penalties and having pollution level in the excess of government standards. The stream of research investigating the relationship between stock prices and environmental disclosures has documented that environmental performance is important for stock market values, but the results are not very consistent across studies (Cormier *et al.,* 1993; Cormier and Magnan, 1997; Cormier *et al*., 2007; Barth and McNichols, 1994; Hassel *et al*., 2005).

We conjecture that the mixed results in the existing literature may be due to the fact that researchers first of all use different proxies for measuring environmental performance and, secondly, due to the fact that a country’s institutional environment is highly likely to affect the consistency of the results.

3 Environmental performance in Russia

In order to understand the situation with regard to environmental performance and corporate social responsibility in Russia, it is important to comprehend which forces have been forming the environmental performance landscape in Russia. According to the Independent Rating Agency (NERA), after the collapse of the Soviet Union many enterprises were left with obsolete equipment, whose modernization was very difficult. Business and government were short-sighted in treating environmental requirements as barriers and obstacles on the way to the economic growth.

In Russia the introduction of GRI and AA1000 principles has been very slow; only very few companies provide any sort of environmental and social reporting. Another distinguishing feature of the Russian business environment was that only few advanced companies have started to adopt IFRS or US GAAP accounting standards in the first decade of the 21st century and only listed firms have been required to report IFRS or US GAAP compliant financial statements starting from 2005, and even fewer have embarked on the process of adoption of world environmental reporting standards such as AAA1000 and GRI. In the Corporate register there are 22 Russian firms which have at least some sort of environmental reports, while only 13 firms adhere to GRI principles and 4 provide reports in accordance with AA1000. These figures serve to reveal the approach chosen and we are bound to rely on external measures of environmental performance, in our case the environmental impact rating by the Independent Rating Agency (NERA), enabling comparison of environmental impacts across firms and industries (please, see Appendix on the methodology on environmental impact rating calculation).

Kostin (2007) investigates the evolution of corporate responsibility situation in Russia, and the following features emerge: lack of transparency of Russian business, especially in Russian government-owned businesses and preference of Russian firms for charity work to CSR reporting. At the same time for Russian firms' involvement in corporate social responsibility can serve as an important tool for attracting foreign investment. Kuznetsov *et al*. (2009) report that some large Russian companies, mostly so-called *"blue chip"* firms operating in the Oil and Gas industry and other strategic industries and seeking international status are the quickest to implement strategies in the direction of greater transparency and environmental reporting. To investigate the effect of foreign ownership on environmental performance we collect data on foreign ownership in firms in order to see whether foreign owners create incentives for the companies to conduct their businesses with a view to reducing environmental impacts. By comparing firms with predominant foreign ownership (more than 20%) and firms with no foreign owners (or less than 20%) we are able to test the propositions of stakeholder theory more exactly if foreign owners' stakeholder pressures are visible through reduced levels of environmental impacts.

4 Methodology

We employ the accounting based valuation model by Ohlson (1995), in which the market value of equity is considered to be a function of book value of equity and accounting earnings (See Equation 1). According to Ohlson's (1995) model, the following three assumptions should be satisfied: the value of equity equals the present value of all future dividends, the accounting system satisfies a clean surplus relationship, and, third, a linear model frames the stochastic time-series behaviour of abnormal earnings.

$$MV_t = BV_t + \alpha_1 AE_t + \alpha_2 \psi_t \quad (1)$$

where MV_t is market value of equity at time t, BV_t equals book value of equity at the end of year t, AE_t equals abnormal earnings (difference between net income and opening book value of equity multiplied by the required rate of return), ψ_t represents other non-accounting relevant information. In our case, this will be the firm's environmental performance, which will serve as a proxy for other relevant non-accounting information. However, due to the practical constraints the use of Ohlson (1995) theoretical model is not feasible; therefore, as proposed by Collins et al. (1999), the following version of the valuation model is used (see Equation 2).

$$MV_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 NI_{it} + \alpha_3 EI_{it} + \varepsilon_{it} \quad (2)$$

where MV_{it} is the market value of firm i in year t, BV_{it} is closing book value of firm i, NI_{it} is the net income and ε_{it} is the regression error. All regressions account for White's (1980) standard errors. In the model (2) we extend the basic model by incorporating into it the environmental impact $EI_{it,}$ which serves as a proxy for other relevant information needed for firm valuation [2]. The coefficient β_3 on integral environmental impact does not have any predicted sign. The positive value of the estimate on α_3 would mean that lower environmental impact would be a source of competitive advantage and add financial value for investors (Dowell *et al.,* 2000). Moreover, the firms with lower environmental impacts are quite likely to be more transparent, which could serve as a capitalization factor for those firms. While the negative estimate on the coefficient $\alpha_{3,}$ would signify that environmental performance is valued negatively, because lower environmental performance requires costly investments that negatively affect earnings and, hence, market values (Jaggi and Freedman, 1992). In light of this discussion we can make no prediction on the sign of *EI*.

We start our investigation of the value relevance of accounting information stand alone by applying the basic version of Ohlson's (1995) model as in Equation 2, but we scale all variables by BV_{t-1} in order to control for size differences across firms (see Equation 3).

$$\frac{MV_t}{BV_{it-1}} = \alpha_0 + \alpha_1 \frac{1}{BV_{it-1}} + \alpha_2 \frac{NI_{it}}{BV_{it-1}} + \alpha_3 EI_{it} + \varepsilon_{it} \quad (3)$$

all variables as before, BV_{it-1} is closing book value of firm i in year t-1. The estimated intercept here α_0 is an estimate of the coefficient on BV_{it} in the original relation as in model (2) and is expected to be positive. Consistent with the theory and prior findings we expect the coefficient α_2 to be positive and it can be interpreted as a proxy for a firm's cost of equity capital (Kothari and Zimmerman, 1995). We also estimate the price model in order to investigate integral

environmental impact value relevance in different models. In price model we regress stock price on earnings and book value of equity per share.

We expand our model (2) by introducing industry and year specific dummy variables, and their interaction terms with the variable of interest IEI. However, we do not impose any restrictions on the sign of β_5, which moderates the effect of environmental impact on the particular industry. In the industry specific model (4) we are particularly interested in the value relevance of integral environmental impact on the Oil and Gas industry, due to the fact that the firms from the Oil and Gas industry are very likely to face high environmental liabilities if they do not have a rationalized environmental strategy. Thus they are among the firms which firm value is very likely to be affected by either good/poor environmental impact measure.

$$\frac{MV_t}{BV_{it-1}} = \alpha_0 + \alpha_1 \frac{1}{BV_{it-1}} + \alpha_2 \frac{NI_{it}}{BV_{it-1}} + \alpha_3 IEI_{it} + \sum_{s=1}^{6} \alpha_{s+3} IND_{it} + \sum_{s=1}^{3} \alpha_{s+9} YEAR_{it} + \sum_{s=1}^{6} \alpha_{s+12} IND_{it} \times IEI_{it} + \sum_{s=1}^{3} \alpha_{s+18} YEAR_{it} \times IEI_{it} + \varepsilon_{it} \quad 4)$$

In our research we are able to overcome the problem of obtaining a reliable source of environmental performance that is comparable across companies in the same industry and comparable across industries, e.g. Al-Tuwari *et al.* (2004), because our measure of integral environmental impact is normalized across industries.

5 Data

Data environment

The shares of all listed companies in Russia are traded either on the Moscow Interbank Currency Exchange (MICEX) or the Russian Trading System (RTS) stock exchanges. The MICEX was opened in 1997 and at that time had around 170 listed stocks. Due to the restructuring of the telecom sector in 2002, the number of stocks listed on the MICEX was reduced to approximately 130. Since then, these numbers have remained relatively stable. However, not all listed stocks are traded regularly. For instance, the number of stocks on another Russian stock exchange, (RTS) traded on any given day has been within the range 20 to 60 since 2000, with a slightly larger number of stocks traded on the MICEX (Goriaev and Zabotkin, 2006). The sample of the companies used in this study is composed of companies listed on the MICEX. The Russian stock market is characterized by a high proportion of Oil and Gas firms in its structure. Figure 1 presents graphs of the MICEX and MICEX O&G (Oil and Gas) indices [3]. As seen in Figure 1, fluctuations in the MICEX index are mirrored by MICEX O&G.

(Insert Figure 1 here)

Figure 2 presents the capitalization of MICEX and MICEX O&G indices. It can be seen that the Oil and Gas industry constitutes a large proportion of the capitalization of the most liquid Russian shares. The Russian stock market is largely dependent on the dynamics of oil and gas companies. Since the oil and gas industry is very prone to proprietary costs we are interested in its valuation of environmental performance. Moreover, we examine the cross-industry differences in environmental performances.

(Insert Figure 2 here)

Accounting data source

The accounting data is retrieved from the Thomson Worldscope database. We concentrate our research on the years 2005-2007, more precisely on the years for which there are environmental impact ratings available. We treat outliers by removing observations with studentized residuals exceeding an absolute value of 2. This yields 74 firms in the final sample and 152 firm-year observations.

Ownership data source

The ownership data is hand-picked for each firm in the sample from the Thomson ONE Banker - Ownership Module, containing information on the owners of a specific security and comparable ownership positions, including people and firms involved. The variable of interest is the percentage of foreign ownership in the firm, which is calculated as the percentage of total shares (outstanding) an investor holds of a company calculated by dividing the investor share position in the company by the most recent publicly available total shares outstanding of a company. Since the information is only available for the last year we kept this percentage unchanged for the years 2005-2007.

Measurement of integral environmental impact

Integral environmental impact is measured on the basis of the environmental impacts ratings provided by the Independent Ecological Rating Agency (NERA). NERA is the Russian independent agency which was founded in 2003 by the research centre and the Ministry of Economic Development of Russia-VNKZ "Sever" and the non-governmental organization "International Socio-ecological Union" (MSoES). NERA develops its activities towards creating a base for the comparison of environmental impacts by the largest Russian firms. It provides environmental impact ratings for the biggest Russian firms, including Gazprom, LukOil, RAO ESS. According to NERA, these environmental impact ratings provide a basis for monitoring firms' environmental activities and they exert a social influence towards decreasing dangerous impacts on the environment. Environmental impact ratings represent objective estimations of the effect of manufacturing in the various enterprises, the companies (and also branches and regions) on the surrounding environment. The system of ratings of ecological costs is intended for informing the public, the state and businesses.

The key principles of NERA ratings are: description of the real impact on the environment, availability of the measures, maximal universality and ease of comparison mechanisms. The environmental impact ratings include evaluation of the following categories: volumes of use of natural resources, pollution of waters and air, formation of waste, the areas of destruction of natural vegetation. All measurements are normalized by country averages for each category. In our research we use the NERA environmental impact ratings for the year 2005-2007. Starting from 2005 there are two types of ratings available; environmental impact ratings scaled by number of employees, which we shall refer to as *EPP* and environmental impact scaled by unit of production in natural and cost unit measurement, referred to as *EPM*. The environmental impact rating scaled by number of employees concerns environmental impact one *"human power"* produced in the company and can be viewed as analogous to exhaust produced by a car per one horse power of the engine. Another scaling denominator used by NERA is the unit of production in natural and cost unit measurement, such as revenues in millions of roubles and the production of main goods in natural measurement units.

In our research we use all three measures of environmental impact: environmental impact ratings scaled by number of employees *EPP* and environmental impact scaled by unit of production in natural and cost unit measurement *EPM*, and the integral environmental impact rating or *IEI* which is constructed for each firm and which is composed of the average of two types of ratings available for environmental impact scaled by the number of employees *EPP* and environmental impact scaled by unit of production in natural and cost unit measurement *EPM*. For the purposes of regression analysis results interpretation we convert *EPP* and *EPM* ratings into a percentage scale from 1 to 100 (see Equation 4).

$$EPP_{it}\% = (n_t - EPP_{it}) / n_t) \times 100\% \qquad (4)$$

where EPP_{it} is environmental impact ratings scaled by the number of employees for firm *i* in year *t, n* is the number of firms in year t for which ratings are available (in 2005 n=800, in 2006 n=2015, and in 2007 n=2975). Thus, IEI_{it} is also measured on a scale from 1 to 100, with 100 being the lowest integral environmental impact

(equaling highest environmental performance) and 1 being the highest environmental impact.

6 Results

Table 1 contains sample descriptive statistics on the variables used in the regression analysis and on the integral environmental impact index values across industries. From Panel A in Table 1 we observe market-to-book values of the firms, on average the market value of a firm is 2.57 times greater than its book value with a median value 2.09. Net income deflated by book value in year *t-1*, NI_{it}/BV_{it-1} has a mean value of 0.18 indicating a mean return on equity of 18%. The integral environmental impact has a mean value of 54.31 and a median value of 55.92, where 100 indicates the lowest environmental impact and 1 the highest. The mean value of foreign ownership in firms equals 8.75%. Panel B in Table 1 reports the values of IEI_{it} across industries. The lowest environmental impact is observed for Manufacturing (67.38) and Non-durables (67.32) industries, Oil and Gas industry exhibits low levels of environmental impact as well 59.73, while the most harmful for the environment appears to be Utilities with the lowest environmental performance (38.62).

(*insert Table 1 here)*

The correlations among the variables used in the regression are reported in Table 2. Both independent variables net income NI_{it}/BV_{it-1} and inverse of the book value $1/BV_{it-1}$ are exhibit a strong correlation with market value MV_{it}/BV_{it-1} of the firm and are statistically significant. It can be seen that the measures of environmental performance are positively correlated with independent variable market value MV_{it}/BV_{it-1} of the firm, correlation coefficients for EPP (0.17) and IEI (0.15) and are statistically significant, making them strong candidates for inclusion in a multivariate regression analysis.

(insert Table 2 here)

Panel A in Table 3 presents the results for difference in means analysis between different groups of firms that may have different incentives in environmental policies. First, in Panel A the results for the group that discloses more than 50% of its environmental impacts show that this group of firms has on average better environmental performance than a group of *opaque firms* that discloses less than 50% of its environmental impact related data. Compare, IEI_{it} (integral environmental impact) is on average 10% bigger for opaque firms than for the firms that prefer to disclose their environmental impacts, environmental impact scaled by unit of production in natural and cost unit measurement EPM_{it} is as much as 16% higher for opaque firms, the differences in means are significant at ($p<0.000$). These results support our conjecture that firms with higher environmental disclosure levels are more likely to have better environmental performance. Firms that have invested in environmental performance improvements, for instance, installing filters to prevent air pollution, equipment for more efficient use of water etc. are more likely to have reduced levels of environmental impacts, therefore they would have more incentive to legitimize their investments, or their internal strategy, by having higher levels of disclosure than other firms on average.

(insert Table 3 here)

Panel B in Table 3 presents results for analysis of differences in environmental performance among firms having more than 20% of foreign ownership and firms having less than 20% of foreign ownership, or no foreign ownership at all. Studies in Russia suggest that foreign owners have a positive impact on the adoption of the new practices, such as IFRS reporting (McGee and Preobragenskaya, 2003), and auditing by Big-4 firms (Krylova, 2000). Therefore, we should expect that foreign ownership is likely to create incentives for firms to be more involved in corporate social responsibility and thus to have superior environmental performance. Moreover, firms with foreign ownership may have more funds allocated to environmental performance improvements, such as the renewal of obsolete equipment. The analysis of environmental performance among these two groups of firms shows that firms with foreign ownership of more than 20% have on average better environmental performance, compare 54.55 and 47.89 for the reference group, the differences in means are significant at ($p<0.000$). The differences in disclosure levels between these two groups are striking; the results show that firms having more than 20% of foreign ownership are twice less likely to be opaque than the reference group, meaning that the firms with foreign owners are more transparent in disclosing environmental impacts to the stakeholders. These results contribute to the stakeholder theory e.g. Magness (2006) by demonstrating that foreign owners are likely to influence the reductions of environmental impacts.

We continue our analysis by investigating the value relevance of environmental performance. Table 4 reports the results of the regression analysis. Model (1) corresponds to simple earnings regression and has $Adj.R^2$ of 10.5% and the coefficient for net income is significant and equals 3.23 ($p<0.000$). The intercept term here represents the coefficient on the book value and is also positive and statistically significant, α_0 equals 1.99 ($p<0.000$). These results suggest that earnings and book value of equity are value relevant on the Russian market. By adding different measures of environmental performance such as environmental impact scaled by the number of employees (EPP_{it}), environmental impact scaled by unit of production in natural and cost unit measurement (EPM_{it}) and integral environmental impact (IEI_{it}) into the model, we observe whether the environmental non-financial information has any value relevance in Russia market. In Model (2) in Table 4 we incorporate EPP_{it} into the regression, resulting in $Adj.R^2$ of 12.8%, therefore we observe a 2.3% increase in the overall value relevance due to the inclusion of EPP_{it}. The coefficient estimate on net income remains positive and significant, the same holds for the intercept term and the coefficient for EPP_{it} is significant and positive at 0.012 ($p=0.030$). In Model (4) the coefficient estimate on *IEI* is also positive 0.012 and significant at the 5% level, $Adj.R^2$ equals 12.7%. These results indicate that IEI_{it} as well as its components EPP_{it} and EPM_{it} have a positive valuation on the Russian market. Thus, superior environmental performance is associated with positive future values. This means that lower environmental impacts are valued by investors as value generating non-financial information. In Table 5 we also report the results of price regressions that confirm the results from the previous analysis; environmental impact is value relevant for stock prices.

(insert Table 4 here)

(insert Table 5 here)

The Model (5) in Table 6 represents the results of estimating a simple Ohlson's model with the inclusion of a dummy variable $FOREIGN_{it}$ taking a value of one if a firm has more than 20% of foreign owners, and otherwise zero. The results demonstrate that foreign ownership has a positive valuation 0.918 with a 10% significance level. Finally, we estimate cross-industry regression model of value relevance of integral environmental impact, by including industry and year dummy variables. The results indicate that earnings and book value of equity are value relevant; both coefficient estimates are positive and significant. The coefficient on the interaction variable of IEI_{it} and $NONDUR_{it}$ showing the moderating effect of integral environmental impact on the non-durables industry, is positive (0.10) and statistically significant ($p<0.000$). This signifies that in the non-durables industry lower levels of environmental impact are valued positively. The coefficient on the interaction variable of IEI_{it} and OG_{it}, standing for moderating effect of integral environmental impact on the Oil and Gas industry is positive (0.06) and statistically significant ($p=0.019$). This result can be interpreted in the following way: lower environmental impact (or higher environmental performance) has positive valuation properties for the Oil and Gas industry. Lower environmental impact is likely to be a consequence of investment in greener technologies and adherence to the environmental strategy of a firm. Due to the fact that the environmental liabilities in the Oil and Gas industry could be vast, for instance compensation for oil spillovers, it pays to invest in technologies that would ensure lower environmental impact. Therefore, the market recognizes the need for lower environmental impact for the Oil and Gas industry in Russia.

7 Conclusions

This study addresses the question of value relevance of environmental performance using a proxy of integral environmental impact together with other value relevant accounting information from financial statements. The results indicate that environmental performance information has incremental value relevance. Since the sample size is rather small and the time period covers three years, the results should be treated with caution.

The results of the study show that investors value lower environmental impacts positively. This result indicates that superior environmental performance achieved by lower environmental impact is valued as an investment in Russia and has a positive impact on expected market values. Lower environmental impacts are likely to be a result of firms' investments in equipment modernization. Moreover, lower environmental impacts are likely to manifest that a firm is unlikely to incur major costs for environmental compensation in the future.

Our study is one of the first to address the question of the cross-industry value relevance of environmental performance. In Russia the market recognizes the need for lower environmental impact for the Oil and Gas industry. Moreover, we document that foreign ownership has a positive effect on environmental performance and firms with foreign owners are more likely to have higher transparency levels and lower environmental impacts.

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Fig 1. Development of MICEX and MICEX O&G indices from 1997-2008

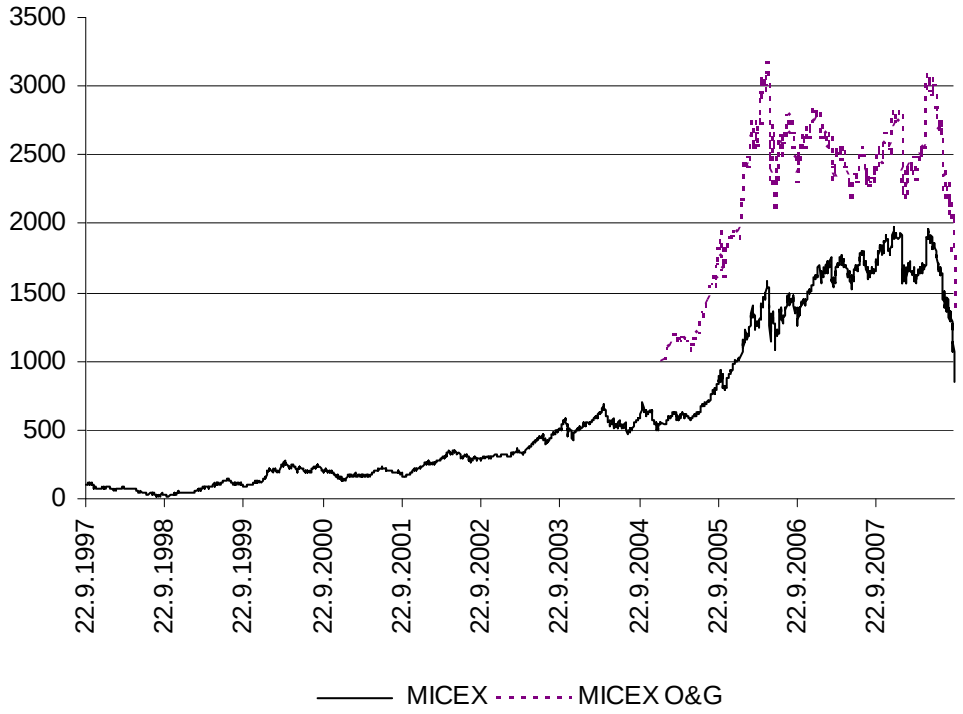

Fig2. Market capitalization of MICEX and MICEX O&G indices from 2002-2008

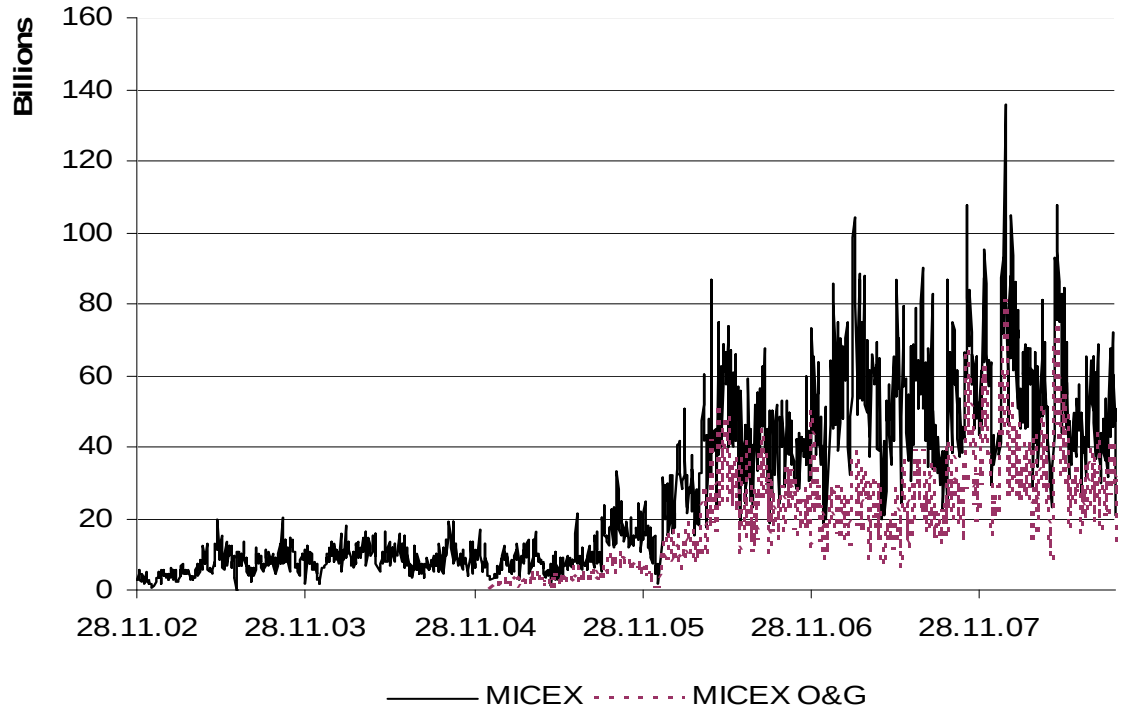

Table 1 Descriptive statistics

	Mean	*Median*	*Std. deviation*	*N*
Panel A. Main variables				
MV_{it}/BV_{it-1}	2.574	2.093	2.091	152
NI_{it}/BV_{it-1}	0.179	0.145	0.210	152
$1/BV_{it-1}$	0.001	0.000	0.002	152
P_{it}	399.157	46.199	967.369	141
NIS_{it}	35.071	2.576	89.995	141
BIS_{it}	162.241	24.240	339.818	141
EPP_{it}	59.172	64.063	30.048	152
EPM_{it}	49.467	45.927	31.797	152
IEI_{it}	54.319	55.922	28.860	152
$FOREIGN_{it}$	8.755	0.805	19.700	152
$OPACITY_{it}$	0.493	0.000	0.502	152
Panel B. Industry breakdown of *IEI*				
Manufacturing	67.386	84.327	30.876	36
Non-durables	67.326	74.938	21.164	11
Utilities	38.626	33.341	28.345	52
Oil&Gas	59.731	68.313	20.078	29
Trade	48.427	54.783	18.847	10
Other	61.788	62.645	27.275	14
Total				152

Notes:
Sample consists of 74 Russian listed firms from Worldscope for the time period 2005-2007, where MV_{it} is the market value of firm *i*, BV_{it-1} is closing book value of firm, NI_{it} is the net income, P_{it} is share price at the end of the year, NIS_{it} is end-year earnings per share, BIS_{it} is end-year book value of equity per share, EPP_{it} is the environmental impact ratings scaled by the number of employees for the firm i in year t, EPM_{it} is environmental impact scaled by unit of production in natural and cost unit measurement IEI_{it} is the integral environmental impact, $FOREIGN_{it}$ is the is the percentage of foreign ownership in the firm, $OPACITY_{it}$ is a dummy variable taking a value of 1 if the firm discloses less than 50% of its environmental performance. Industry classification is based on the French 10-group industry classification. The following four digits SIC codes are assigned to each group:
Manufacturing: 2800-2829, 2840-2899, 3000-3099, 3200-3569, 3717-3749
Non-durables (including Food, Tobacco, Textiles, Apparel): 0100-0999, 2000-2399
Utilities: 4900-4949
Oil&Gas: 1200-1399, 2900-2999
Trade: 5000-5999
Other (including Mines, Transport): 1000-1221, 4400-4790

Table 2 Pairwise correlations among variables used in regressions

	MV_{it}/BV_{it-1}	NI_{it}/BV_{it-1}	$1/BV_{it-1}$	EPP_{it}	EPM_{it}	IEI_{it}	$FOREIGN_{it}$	$OPACITY_i$
MV_{it}/BV_{it-1}	1.000	0.326	0.155	0.169	0.118	0.153	0.265	-0.097
		(<0.000)	(0.057)	(0.038)	(0.147)	(0.060)	(0.001)	(0.233)
NI_{it}/BV_{it-1}	-	1.000	0.168	0.060	-0.072	-0.008	0.154	-0.061
			(0.038)	(0.460)	(0.377)	(0.919)	(0.058)	(0.458)
$1/BV_{it-1}$	-	-	1.000	-0.145	-0.039	-0.097	-0.075	-0.067
				(0.074)	(0.631)	(0.233)	(0.360)	(0.415)
EPP_{it}	-	-	-	1.000	0.742	0.929	0.100	-0.097
					(<0.000)	(<0.000)	(0.219)	(0.235)
EPM_{it}	-	-	-	-	1.000	0.937	0.065	-0.269
						(<0.000)	(0.430)	(0.001)
IEI_{it}	-	-	-	-	-	1.000	0.089	-0.199
							(0.282)	(0.014)
$FOREIGN_{it}$	-	-	-	-	-	-	1.000	0.058
								(0.481)
$OPACITY_{it}$	-	-	-	-	-	-	-	1.000

p-Values (two-tailed) are reported in parentheses.
Notes: See Table 1 for variables description

Table 3 Differences in firms' environmental performance: opaque firms and firms with foreign ownership

Panel A			
Variables	Firms disclosing less than 50% of environmental impacts	Firms disclosing more than 50% of environmental impacts	T-test for difference in means
EPP_{it}	49.61	54.97	16.92 (0.000)
EPM_{it}	34.62	50.17	13.08 (0.000)
IEI_{it}	42.64	52.95	16.42 (0.000)
MV_{it}/BV_{it-1}	1.89	2.30	9.92 (0.000)
NI_{it}/BV_{it-1}	0.12	0.14	7.35 (0.000)
N	75	77	
Panel B			
Variables	Firms without foreign ownership or with foreign ownership less than 20%	Firms with foreign ownership of more than 20%	T-test for difference in means
EPP_{it}	52.07	59.07	21.32 (0.000)
EPM_{it}	41.07	48.56	16.99 (0.000)
IEI_{it}	47.89	54.55	20.53 (0.000)
$OPACITY_{it}$	0.41	0.23	11.36 (0.000)
MV_{it}/BV_{it-1}	2.07	2.36	14.13 (0.000)
NI_{it}/BV_{it}	0.14	0.13	9.68 (0.000)
N	130	22	

Notes: See Table 1 for a description of variables

Table 4 Regression analysis of value relevance of accounting information and environmental impact with market-to-book ratio as dependent variable

	(1)	(2)	(3)	(4)
α_0	**1.999**	**1.267**	**1.456**	**1.287**
	(0.000)	**(0.001)**	**(0.000)**	**(0.003)**
$1/BV_{it-1}$	**87.804**	**110.926**	**91.271**	**101.857**
	(0.010)	**(0.001)**	**(0.006)**	**(0.002)**
NI_{it}/BV_{it-1}	**3.233**	**3.079**	**3.346**	**3.229**
	(0.002)	**(0.002)**	**(0.001)**	**(0.001)**
EPP_{it}	-	**0.012**	-	-
		(0.065)		
EPM_{it}	-	-	**0.010**	-
			(0.085)	
IEI_{it}	-	-	-	**0.012**
				(0.063)
Adj. R^2	10.5%	12.8%	12.0%	12.7%
N	152	152	152	152

Notes: See Table 1 for a description of variables

* p-values are reported in the parentheses corresponding to White's (1980) heteroscedasticity-consistent standard-errors

Table 5 Regression analysis of value relevance of accounting information and environmental impact with stock price as dependent variable

	(1)	(2)	(3)	(4)
α_0	30.852	-95.141	-95.173	-115.831
	(0.254)	(0.114)	(0.167)	(0.101)
BVS	0.664	0.722	0.722	0.731
	(0.253)	(0.202)	(0.207)	(0.197)
NIS	**7.428**	**7.183**	**7.623**	**7.181**
	(0.007)	**(0.007)**	**(0.006)**	**(0.006)**
EPP_{it}	-	**2.129**	-	-
		(0.045)		
EPM_{it}	-	-	**2.484**	-
			(0.048)	
IEI_{it}	-	-	-	**2.667**
				(0.034)
Adj. R^2	83.7%	84.0%	84.3%	84.2%
N	141	141	141	141

Notes: See Table 1 for a description of variables
* p-values are reported in the parentheses corresponding to White's (1980) heteroscedasticity-consistent standard-errors

Table 6 Sensitivity analysis: value relevance of foreign ownership and cross-industry value relevance of environmental performance.

	(5)	(6)
α_0	2.111	**6.212**
	(0.371)	**(0.102)**
$1/BV_{it-1}$	73.805	**91.591**
	(0.106)	**(0.042)**
NI_{it}/BV_{it-1}	**3.097**	**2.546**
	(0.006)	**(0.018)**
IEI_{it}	-	-0.018
		(0.166)
$FOREIGN_{it}$	**0.918**	-
	(0.081)	
$LSALES_{it}$	-0.038	-0.184
	(0.705)	(0.185)
$Y2006_{it}$	**0.752**	**1.049**
	(0.030)	**(0.000)**
$Y2007_{it}$	**1.020**	**1.105**
	(0.006)	**(0.003)**
$O\&G_{it}$	-	**-2.462**
		(0.059)
$NONDUR_{it}$	-	**-3.952**
		(0.001)
$MANUF_{it}$	-	-1.542
		(0.229)
$ELECTR_{it}$	-	-0.185
		(0.860)
$TRADE_{it}$	-	0.099
		(0.919)
$IEI_{it}*O\&G_{it}$	-	**0.059**
		(0.019)
$IEI_{it}*NONDUR_{it}$	-	**0.099**
		(0.000)
$IEI_{it}*MANUF_{it}$	-	**0.038**
		(0.032)
$IEI_{it}*ELECTR_{it}$	-	-0.008
		(0.554)
$IEI_{it}*TRADE_{it}$	-	0.098
		(0.912)
Adj. R^2	15.2%	32.2%
N	152	152

Notes

*see Table 1 for industry classifications

MV_{it} is the market value of firm *i*, BV_{it-1} is the closing book value of firm, NI_{it} is the net income, is the integral environmental impact, IEI_{it} is the integral environmental impact, $LSALES_{it}$ is the natural logarithm of sales, $O\&G_{it}$ is a dummy variable taking a value of 1, if industry equals Oil&Gas and zero otherwise, $NONDUR_{it}$ is a dummy variable taking a value of 1, if industry equals Non-durables and zero otherwise, $MANUF_{it}$ is a dummy variable taking a value of 1, if industry equals Manufacturing and zero, otherwise, $UTILITIES_{it}$ is a dummy variable taking a value of 1, if industry equals Utilities and zero otherwise, $TRADE_{it}$ is a dummy variable taking a value of 1, if industry

equals Trade and zero, otherwise, $Y2006_{it}$ is a dummy variable taking a value of 1 if year equals 2006, otherwise zero, $Y2007_{it}$ is a dummy variable taking a value of 1, if year equals 2007, otherwise zero, $FOREIGN_{it}$ is a dummy variable taking a value of 1 if foreign ownership is larger than 20%, otherwise zero, $LSALES_{it}$ is the natural logarithm of sales.

APPENDIX

For comparison of ecological aspects of activity of the enterprises operating in different industries NERA uses observable indicators characterizing firms' effect on the environment. All these indicators can be expressed numerically, thus the same feature set can be applied to all firms (in different industries and technologies). The technological level of any firm and dynamics of its efficiency can be characterized by the following indicators:

1. Volume of water extraction or use of fresh water from natural sources in thousands of cubic meters
2. Volume of polluted sewage dumped in thousands of cubic meters
3. Volume of emission of polluting substances into the atmosphere from stationary sources
4. General running of motor vehicles – in thousands of kilometers (or an estimation of emissions from mobile sources)
5. Volume of toxic waste formed (I-IV types of danger) in thousands of tons
6. Total area occupied by buildings, roads, dumps, and also area occupied by flooded water basins in thousands of hectares

The majority of these indicators are a part of statistical reporting officially collected in the country on water use (the form №2-TP (water)), air pollution (the form №2-TP (air)), formation of waste (the form №2-TP (toxic waste)), use of lands (the form №22-2). The emissions of pollution from vehicles are estimated using the data on the size of motor transport fleet and its mileage.

NERA sends a form to the investigated firms asking them to provide the above mentioned indicators. After that the following four steps are applied to form ratings for the firms that provided the requested data:

Step 1 For each indicator (water consumption, polluted drains, emissions from stationary sources, motor transport exhausts, formation of waste and land transformation) the total volume of influence of all firms is divided by number of people occupied in the Russian economy.

Step 2 For each firm on which there are data on influences on the environment and number of workers available, six indicators of influence are similarly defined per person occupied in the firm.

Step 3 Each of the six values received in step 2 (average influence of one worker of the firm) is divided by the corresponding average value for one occupied in the economy of Russia, as received in step 1. The result is expressed as a percentage.

Step 4 The received values are summed and divided by six. The arithmetic mean is an integrated indicator of ecological impacts in the firm as a percentage of the Russian average norm. The value of an indicator of impacts above the average Russian norm (for example 200%) corresponds to average excess of volume of ecological impacts in 6 indicators (in this example - in 2). The value of an indicator below the average corresponds to lower than on the average levels of ecological impacts across Russia.

To estimate the influence on an environment for a firm on which there is no disclosed data the following algorithm of the approximated estimation is used. Note that only step 2 differs from the above described procedure.

Step 2a Geographical location and industry to which the firm belongs is defined.

Step 2b Based on the state statistical data the total ecological impacts in the given region of all firms of the given industry is calculated excluding those firms on which there is no data available on ecological impacts and no data on total number of workers in the firm.

Step 2c The value of environmental impacts obtained at step 2b is normalized by the average number of workers in the industry of interest. The value obtained indicates an average level of influence of one worker in the firm that has not disclosed its ecological impacts. As only large firms are evaluated, the approximation error is quite low. After this it is possible to move to step 3.

NOTES

[1] Environmental performance and environmental impact are used to describe the same phenomenon from different angles, and thus have different interpretations. High environmental performance equals to low environmental impact. Higher environmental performance may be achieved, for instance, by investing in greener technologies and reducing pollution, so the integral environmental impact is reduced.

[2] We use three available measures of environmental impact available: environmental impact ratings scaled by number of employees (EPP) and environmental impact scaled by unit of production in natural and cost unit measurement (EPM), and the integral environmental impact rating or IEI, which is constructed for each firm and which is composed from the average of two types of ratings of available environmental impact scaled by the number of employees EPP and environmental impact scaled by unit of production in natural and cost unit measurement EPM.

[3] MICEX Index is a capital-weighted price index of the 30 major and most liquid Russian stocks traded on the MICEX Stock Exchange (initial value of the index is 100 points), which covers nearly 80% of the market capitalization of the Russian equity market. The MICEX O&G index is a real-time market capitalization-weighted sector index that comprises stocks which are classified into a relevant sector depending on the company's primary source of revenue, i.e. Oil and Gas.