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FIRM SPECIFIC CHARACTERISTICS AND REINSURANCE – EVIDENCE FROM CROATIAN INSURANCE COMPANIES

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Abstract

Reinsurance is the most important method of insurance companies' actuarial risk management. Insurance companies' internal factors of the reinsurance demand in the Republic of Croatia are examined in this paper. Random effects panel model was estimated by using the data about internal characteristics of 19 insurers in the period between 2006 and 2011. The results of empirical analysis show that important factors of the insurance companies' decisions regarding the purchase of reinsurance are leverage, size, return on investment, ownership structure, as well as a share of non-life insurance in total insurance business. Underwriting result and asset volatility do not show statistically significant effect on reinsurance demand in the Croatian insurance market.

Keywords: reinsurance, insurance companies, insurers' internal characteristics

1. INTRODUCTION

By underwriting risks, insurance companies expose themselves to risk. The main risk for insurance companies is variation of actual loss from those predicted. Namely, the insurers are characterized by inversion of production process in a way that they sell insurance products and determine premiums before knowing actual losses. Although there are various methods of insurance companies' underwriting risk management, from coinsurance and pools to alternative risk transfer (insurance securitization, insurance derivatives, contingent financing), reinsurance is mostly used. According to Webb et al. (2002) there are six functions which reinsurance provides to insurance companies: stabilization of loss experience, large-line capacity, financing (surplus relief), catastrophe protection, underwriting assistance and withdrawal from territory or class of business. There are several types of reinsurance contracts, quota share and surplus share as categories of pro rata reinsurance, and per risk, per occurrence as well as aggregate excess as types of excess of loss reinsurance.

Since reinsurance reduces variability of insurance company's cash flow as well as its financial leverage, the decision on buying reinsurance belongs to both risk management and capital management decision making (Garven and Lamm Tennant, 2003). As efficiency of risk management of insurance company depends on operational and financial characteristics of the company, the reinsurance decision should also vary according to the same factors (Adams, 1995). Indeed, based on theoretical considerations as well as empirical studies, all of which are based on developed insurance markets, the main factors that determine reinsurance demand are leverage, size, result of underwriting activities, investment returns, and ownership structure. There is a question if the same determinants are influential in undeveloped insurance markets, as Croatian insurance market is.

The Croatian market is characterized by low insurance penetration of 0.73 percent of GDP for life and 1.77 percent of GDP for non-life business in 2011. Insurance density was 80 EUR for life business and 221 EUR for non-life in 2011 (Swiss Re, 2012). The insurance industry is dominated by non-life insurance with 73.4 percent share in total insurance premium. There were 27 insurance companies operated in the market in 2011, 10 of which are engaged entirely in non-life business, 10 are composite and 7 provide life insurance exclusively. There is only 1 company that offers reinsurance (Croatian financial services supervisory agency, 2012). Most of the reinsurance is bought abroad. As compared to the world average, insurance companies in Croatia cede more insurance premiums to reinsurance market. Precisely, 14.25 percent of insurance premiums collected by the Croatian insurance companies in non-life business are transferred to reinsurance while the world average is 9 percent. In the life business 4.05 percent of the total life insurance premiums are ceded to reinsurers in Croatia in comparison to 2 percent average for the world (Croatian financial services supervisory agency, 2012; International Association of Insurance Supervisors, 2012).

Considering the existing empirical research that is entirely based on developed countries, along with the lack of the reinsurance demand analysis in emerging markets, as well as the characteristics of insurance market in Croatia, the main aim of this research is to determine internal factors that influence insurance companies' demand for reinsurance in Croatia.

According to the authors' best knowledge this is the first paper that analyses factors of insurance companies' decision making on reinsurance purchase in Croatia and in emerging markets in general, thus contributing to the literature tackling the reinsurance demand in the specific insurance and economic environment.

The paper is organized as it follows. The next section provides literature review. The data and methodology are described in Section 3. Section 4 presents and discusses results. Section 5 concludes the paper.

2. LITERATURE REVIEW

Mayers and Smith (1990) research determinants that influence the decision of insurance companies on reinsurance purchase. The sample consists of 1.276 non-life insurers with different ownership structure in 1981 from A. M. Best database. Reinsurance demand is measured by ratio of reinsurance ceded to total insurance premium. The results of cross-sectional regression show that the ownership structure has statistically significant influence on the demand for reinsurance, indicating that firms with more concentrated ownership have greater demand for reinsurance while those organized as stock companies buy fewer reinsurance in comparison to mutual insurers and Loyd's. Group insurers and subsidiaries demand more reinsurance. Size, credit standing, line-of-business concentration and geographic concentration have negative influence on reinsurance demand. The line of business's concentration is negatively related to reinsurance purchase.

Adams (1995) observes reinsurance decisions of life insurers in New Zealand in 1988 - 1993 period. The model predicts the impact of organizational form, firm size, product range and leverage. Dependent variable is ratio of annual reinsurance premiums ceded to total annual premium income. It is predicted that reinsurance demand is higher for mutual companies than for stock companies. In addition, for firm size, natural log of total market value of assets is used, implying that smaller insurers have higher reinsurance demand. Product range is measured by a Herfindahl concentration index (calculated using six major lines of products) and it is expected that reinsurance will be higher in more specialized companies. Last hypothesis is that the leverage (ratio of the annual actuarial value of the life fund to the market value of total assets) has positive effect on reinsurance demand. The results of the research show that all independent variables are statistically significant but only firm size and leverage have expected sign.

Mutual companies have lower reinsurance demand than stock companies and multiproduct companies have higher reinsurance demand than specialized companies.

Using data on insurance companies in the period 1996 – 1999, Powell and Sommer (2002) examine the demand for reinsurance on U.S. insurance market. This study distinguishes internal and external reinsurance. Empirical results for the simultaneous equations regression indicate that insurers with more total assets cede less reinsurance, and highly levered insurers cede more reinsurance. The coefficient of geographic concentration is significantly negative only in external reinsurance. Line of business concentration and the ratio of tax-exempt investment income to total investment income are positively related to demand for internal reinsurance. The ratio of insurer's assets to the sum of group's assets is significantly negative with internal reinsurance equation. This research shows that internal reinsurance is significantly negative in external reinsurance equation but external reinsurance is not significant in internal reinsurance equation.

Garven and Tennant (2003) investigate the factors that determine demand for reinsurance in the U.S. by applying the panel data analysis on the 1980-1987 database. In accordance with earlier research, they test four hypotheses. They try to prove that demand for reinsurance will be greater for insurers that have higher leverage and lower correlation between the firm's investment returns and claims costs. Also, insurers that write "longer-tail" lines of insurance and insurers that concentrate their investments in tax-favoured assets should have higher demand for reinsurance. The results of regression estimation confirm most of the model predictions. Demand for reinsurance is positively related to leverage, asset volatility, and length of tail (claim delay) and negatively related to the correlation between investment returns and claims costs. The tax shield effect is not empirically confirmed in this study.

Factors which might influence reinsurance decision of Australian insurers are examined by Carneiro and Sherris (2005). They test theoretical hypotheses with OLS model with Panel Corrected Standard Errors (PCSEs) and estimate the impact of leverage, size, taxes, return on investment and company structure on demand for reinsurance. Using a panel-data set (1996-2001) which provides 543 observations, they find that only leverage has a significant positive influence on the demand for reinsurance in Australia. This confirms the importance of the amount of capital on the insurers' liabilities for the reinsurance decisions process. However, company size, taxes, investment return and company structure are not statistically significant in their research.

Reissaus and Wambach (2005) test reinsurance demand on German insurance market. They observe the reinsurance decisions on the sample of 139 insurers in the period from 1994 to 2003. In their model, independent variables are divided in two groups. First group named Risk allocation tests the influence of risk spreading (size, ownership structure), bankruptcy avoidance (technical

leverage), solvability regulation (solvency ratio according to local regulatory requirements), tax optimization (convexity of tax function) and underinvestment avoidance (growth). Second group, Risk management service, tests the impact of monitoring (efficiency gain), signalling (quality of claims liability management) and reinsurance accounting (relation to balance sheet items with a similar impact on annual accounts). This research confirms the significant negative influence of size and ownership structure. Size is measured as ratio of accounted assets total related to the sample mean of accounted assets total and for ownership structure a dummy variable is used. Technical leverage as one of the most important variables in every study is also confirmed in this research. Insurers with high technical leverage cede more reinsurance. This research finds the significant negative influence of solvability regulation. This is measured with two proxies, first is dummy for the solvency ratio gross (significant positive) and second is solvency ratio gross itself (significant negative). Convexity of tax function (absolute value of the normal loss probability) and reinsurance accounting (ratio of equalization reserve according to German GAAP and case reserves gross) are also significantly negative. The growth (of accounted investments) and efficiency gain (ratio of insurer's technical result before tax to gross premiums written) are positive and significant.

Kader and Adams (2007) evaluate the effects of the underwriting risk, solvency risk and expected taxes on demand for reinsurance in the United Kingdom life insurers market. Panel data includes 635 insurers/year observations for the period between 1992 and 2004. Dependent variable in their research is ratio of the amount of reinsurance premiums ceded in year t minus the amount of reinsurance premiums ceded in year $t-1$ and gross insurance premiums in year t minus 1 including reinsurance assumed. They predict that insurers with higher underwriting risk need more reinsurance coverage to mitigate solvency risk. Solvency risk is estimated through free asset ratio (reverse leverage) and insurers that have more free assets will cede less reinsurance. They observed relationship between reinsurance decision and before-planning tax convexity and predicted negative relation. Tax convexity is measured as the excess of the marginal tax rate over the effective tax rate in that year. Also, it is predicted that the relationship between level of reinsurance and before-planning marginal tax rates (MTR) is negative. This study confirms that insurers with higher underwriting risk use more reinsurance and that higher level of leverage increases the demand for reinsurance. Also, it is confirmed that low marginal tax rates cause more reinsurance demand. Additionally, tax convexity is not significant in the reinsurance decision process.

Using 1990 – 2004 panel data Wang, Chang, Lai and Tzeng (2008) analyse the demand for reinsurance in U.S. insurance market using sample of 36 demutualized insurers. They try to prove that demand for reinsurance by converting insurers will be reduced after conversion. To measure the demand for reinsurance, researchers used the changes in reinsurance ratios. The data are analysed with a two-stage selection regression model. The results of the research

show that there is decrease in the demand for reinsurance of the non-affiliated reinsurers by converting insurers after conversion and increase in the demand for reinsurance of the affiliated reinsurers. The relationship between return on assets variable and demutualized dummy has expected negative sign. The same is true for the coefficient of the interaction of leverage and demutualized dummy variable which is positive and significant, but only for reinsurance from non-affiliated reinsurers. Otherwise, coefficient is negative. Also, business-concentration is significant positive to the demand for reinsurance from non-affiliated reinsurers after conversion. Firm size is significantly negative.

Reinsurance demand on the medical malpractice insurance market in the U.S. is analysed by Lei and Schmit (2008). They used data for 131 reinsurers specializing in medical malpractice and 268 insurers in the period from 1995 to 2001. To get the dependent variable, they measure the relative amount of reinsurance purchased by primary insurers. It is predicted that leverage, loss volatility, tax, group and industry liquidity have positive influence on the dependent variable, while size, loss development, return on equity, industry price and industry loss development have negative influence on the demand for reinsurance. Four independent variables have ambiguous influence: specialization, geographic Herfindahl, physician-directed (PD) and non-PD-stock. The main hypothesis is that there will be the difference between the demand for reinsurance by the PD medical malpractice insurers and non-PD-directed medical malpractice insurers. The data are analysed by applying the two regression models. The results of the regression models show that all independent variables are statistically significant with the expected sign, except the loss volatility and the three reinsurance industry variables. Furthermore, non-PD insurers buy more reinsurance than PD medical malpractice insurers.

3. DATA AND METHODOLOGY

Based on the literature reviewed regarding the determinants of insurance companies' decision making on reinsurance purchase, we selected a set of firm specific characteristics that might impose a significant effect on reinsurance demand in Croatia. The number of insurance companies, the time period and choice of variables are determined by data availability.

The empirical analysis is based on the sample that consisted of 19 insurance companies that were active in the Croatian insurance market in the period from 2006 to 2011. The sample is representative since the share of premiums of the analysed companies in total insurance premiums was higher than 90 percent in each of the analysed years. In order to get more observations we use annual panel data. Since some of the data on variables for some companies and years are missing, our sample is unbalanced. The total number of observation is 90.

The data are extracted from annual reports of insurance companies collected by Financial Agency (2013). Part of the data is based on the official statistics of Croatian financial services supervisory agency (2007-2012). Data on ownership structure are obtained from annual reports of Croatian Insurance Bureau (2007-2012).

Dependent variable is measured by the ratio of reinsurance expense to total premium revenue. We investigate influence of seven insurers' specific factors as potential determinants of reinsurance demand.

According to the previous empirical studies, leverage is one of the most important determinants of reinsurance demand. Leverage reflects the degree to which the insurers use debt as its financing source. The insurance companies' liabilities are dominantly consisted of insurance reserves which represent insurance companies' liabilities to policyholders. Higher leverage implies higher risk of insolvency. Thus, insurance companies with higher leverage have less own funds to absorb financial and operational losses that result from unexpected events and demand reinsurance more compared to the companies with lower level of leverage. Leverage ratio is approximated by ratio of total liabilities to total assets.

Insurance company size could reflect its strength and ability to reduce the expected bankruptcy costs. Large company size means large number of units exposed to risk, which reduces the deviation of actual losses from those expected. Larger insurance companies are able to exploit economies of scale and increase efficiency in both underwriting activities and loss adjustment, which result in smaller demand for reinsurance. The same insurance companies employ specialised staff that are more effective in realization of the risk underwriting and risk management functions, resulting in lesser need for reinsurance (Adams, 1995). On the contrary, smaller insurers have fewer resources to realize these functions efficiently. Moreover, insurance company size may be an indicator of diversification opportunities whose increasing should lower insurer risk. Consequently, we expect negative relationship between insurance company size and reinsurance demand. Natural logarithm of insurance company assets was applied as a measure of size.

The underwriting result variable is measured by the loss ratio. The ratio is calculated as a share of the sum of claims, changes in claim provision and changes in other technical provisions (including changes in life assurance technical provisions where the policyholder bears the investment risk) in insurance premium earned (Croatian financial services supervisory agency, 2012). Higher loss ratio indicates poorer underwriting activities. The ratio higher than 100 shows that the insurer is not able to cover the losses by insurance premium. It could be the result of inadequate assessment of risk and insurance premium, as well as in the short-run: catastrophic losses, inflation and change in the regulation (Webb et al. 2002). Additionally, in order to achieve higher market share and to improve performance in the short term, insurance companies may

alleviate level of risk underwriting standards. These actions may result in the problem of adverse selection and in an increase of risk. Based on the above mentioned, the positive direction of the nexus between underwriting results and reinsurance demand is expected.

Beside risk underwriting, the important insurance companies' activity is investment. Return on investment activities may compensate negative results of risk underwriting activities that may be produced by unexpected catastrophic losses. Thus, insurers with higher level of investment return will demand less reinsurance. The investment return is measured as the ratio of income from investments reduced by investment expenses to the amount of investment (Croatian financial services supervisory agency, 2012).

In the existing empirical research the ownership structure is mainly referred to stock and mutual insurance companies. Despite the fact that mutual insurers are allowed by the law, all companies that operate in the Croatian insurance market are stock companies. However, in the Croatian market, as in the markets of other (post)transition countries, important characteristic of ownership is increasing foreign participation in the capital of insurance companies. Thus, we adapt the variable to the emerging market circumstances and test if the companies' reinsurance demand may be influenced by domestic/foreign ownership. The expected sign of the variable is ambiguous. Precisely, foreign owners are mainly those from large European insurance companies and they are able to provide the insurers with additional capital more easily in comparison to domestic owners, resulting in lower reinsurance demand. On the other hand, reinsurance foreign owned companies could access reinsurance market at lower price, indicating more demand for reinsurance. Ownership structure is measured by the share of foreigners in the capital of insurance company.

The importance of non-life insurance or share of non-life insurance premiums in total premiums is used to control relationship between independent and dependent variables for including non-life, life and composite insurer in the sample. The reason is that for most of the years there are no separated data for life and non-life insurance business for composite insurance companies, which dominate Croatian insurance market. In comparison to life insurance, losses related to non-life insurance are less predictable and could have catastrophic character. Therefore, the positive sign of the importance of non-life insurance variable is expected.

Asset volatility reflects the degree of instability of insurance companies business. Higher volatility implies greater risk. As the risk is increasing, insurance companies buy more reinsurance. The variable is measured by the ratio of difference between value of the assets in time t and $t-1$ to the asset value in time $t-1$.

We form the following model of reinsurance demand:

$$y_{it} = \alpha + \beta X_{it} + u_{it} \quad (1)$$

where the subscripts i and t represent company and time, respectively. α is the intercept term. Y is the dependent variable, that is, reinsurance ratio. X is the vector of observations on the explanatory variables that include leverage, size, underwriting result, investment return, ownership structure, the share non-life insurance premiums in total insurance premium, and volatility of asset; β is the vector of coefficients to be estimated on the explanatory variables. The error term is u_{it} .

4. EMPIRICAL RESULTS

Table 1 shows descriptive statistics for all variables included in the model. The data show that the insurers transfer 8.7 percent written gross premiums to the reinsurance on average. Minimum value of reinsurance ratio is 0 while the highest value of reinsurance ratio is 46.65 percent. Standard deviation of the variable has value 9.32 percent.

The pair-wise correlation coefficients for all variables used in the analyses are given in Table 2. According to Gujaraty (2000) there is no problem of multicollinearity in our model. The data indicate that ownership variable has the greatest positive impact on the dependent variable. Correlation coefficient between those variables is 0.4456. The smallest correlation is between volatility of assets and reinsurance. The coefficient has value 0.0088.

Table 1

Descriptive statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Reinsurance ratio	0.0875	0.0932	0.0000	0.4665
Leverage	0.7329	0.2318	0.0500	0.9400
Size	20.3103	1.4606	17.1793	22.7774
Underwriting result	0.7322	0.2150	0.1573	2.0743
Investment return	0.0389	0.0330	-0.0785	0.1040
Ownership	49.7729	48.8076	0.0000	100.0000
Non-life share	53.7396	38.1465	0.0000	100.0000
Asset volatility	0.9231	5.2436	-0.8502	44.2209

Source: Authors' calculations

The results of panel estimations are shown in Table 3. At first we run dynamic panel model estimation using two-step Generalized Method of Moments (GMM) estimator developed by Arellano-Bond (1991) and Arellano and Bover

(1995). However, negative and statistically insignificant coefficient of lagged dependent variable suggests that the nature of the model is not dynamic. Therefore we switch to static panel model estimator. We run both, fixed and random effects model. The choice between fixed and random effects is based on a Hausman test which tests more efficient model against a less efficient but consistent model. As it is indicated in the Table 3, p-value is statistically insignificant, implying using of random effects model.

Table 2

Pairwise Correlations

Variable	Reinsurance ratio	Leverage	Size	Underwriting result	Investment return	Ownership	Non-life share	Asset volatility
Reinsurance ratio	1.0000							
Leverage	0.3714	1.0000						
Size	0.0415	0.6962	1.0000					
Underwriting result	0.1043	0.0693	-0.0113	1.0000				
Investment return	0.2210	0.2099	0.1989	0.2296	1.0000			
Ownership	0.4456	0.4053	0.1663	-0.0338	0.0055	1.0000		
Non-life share	0.1683	0.0442	0.2847	0.0629	0.1016	-0.2485	1.0000	
Asset volatility	0.0088	-0.0245	0.1619	-0.0244	-0.0298	-0.1556	0.1610	1.0000

Source: Authors' calculations

Table 3

Determinants of reinsurance demand (Panel estimation – random effects model)

Variable	Coef.	Std. Err.	z	P> z	95% Conf. Interval
Constant	0.3253	0.2015	1.6100	0.1060	-0.0697 0.7202
Leverage	0.1891	0.0777	2.4300	0.0150	0.0368 0.3415
Size	-0.0247	0.0113	-2.1800	0.0290	-0.0469 -0.0025
Underwriting risk	0.0545	0.0551	0.9900	0.3220	-0.0534 0.1625
Investment result	0.4362	0.1918	2.2700	0.0230	0.0603 0.8121
Ownership	0.0007	0.0003	1.9800	0.0480	5.31e-06 0.0013
Non-life share	0.0007	0.0004	1.7800	0.0760	-0.0001 0.0015
Asset volatility	0.0014	0.0011	1.3100	0.1910	-0.0007 0.0034
Wald chi 2(7), p-value	0.0015				
Hausman test, p-value	0.2014				

Source: Authors' calculations

According to the results given in the Table 3, statistically significant factors of insurance companies' decision making on reinsurance purchasing are leverage, size of insurers, return on investment, ownership structure and share of non-life insurance in total insurance business. Insignificance is shown by underwriting results as well as volatility of assets. Taking into consideration the sign of the statistically significant coefficients, the results confirm most of our predictions. The exception is investment return variable.

As it is predicted by theoretical considerations, and confirmed by existing empirical research, leverage is positively correlated with reinsurance demand. Higher level of leverage implies higher exposure to risk and greater demand for reinsurance. The same result is found in most empirical studies (Adams, 1995; Powell and Sommer 2002; Garven and Tennant, 2003; Carneiro and Sherris, 2005; Reissaus and Wambach 2005; Kader and Adams, 2007; Lei and Schmit, 2008).

Insurance company size negatively influences reinsurance purchasing. Larger company is more able to manage risk by itself and to reduce probability of bankruptcy. Precisely, larger companies are more successful in underwriting activities since they have large number of units exposed to risk which enable reduction of deviation actual losses from those expected. The result complies with the theory and with the results of existing empirical studies (Mayers and Smith, 1990; Adams, 1995; Powell and Sommer 2002; Garven and Tennant, 2003; Reissaus and Wambach 2005, Lei and Schmit, 2008).

Foreign owned insurance companies buy more reinsurance in comparison to the domestic ones. Easier access to reinsurance market at more favourable terms is the advantage for foreign owned companies in their risk management.

As it is expected, share of non-life insurance in total insurance business is positively correlated to reinsurance. As insurance company is more engaged in non-life insurance, more losses are less predictable and it is more exposed to the risk of catastrophic losses.

5. CONCLUSION

In this paper we investigate the internal characteristics of reinsurance demand. The analysis is performed on the sample of Croatian insurance companies in the period from 2006 to 2011 by using the static panel data methodology.

The results show that insurance companies' leverage, foreign ownership, and a share of non-life insurance in total insurance business positively affect reinsurance demand. Additionally, reinsurance purchasing is negatively related to

size. Contrary to the expectations, investment return shows positive impact on reinsurance purchasing.

Thus, in order to achieve adequate reinsurance program which provides risk protection and insurance business stability as well as companies' profitability, the insurance companies' risk managers should take into account internal characteristics confirmed by this research in their decision making of reinsurance purchase.

The study is limited by the fact that the data do not allow for the distinction among life and non-life insurance, as well as among various line of insurers' business, especially in the field of non-life insurance which is characterized by heterogeneous insurance product with respect to risk. Thus, there is suggestion for the future research to take this into account when longer time series become available. Additionally, the existing model could be expanded for insurance and reinsurance industry (both domestic and foreign) factors. The cross-country analysis with a sample of emerging countries is suggested, along with including influences from macroeconomic and institutional environment of the insurance companies.

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SPECIFIČNE KARAKTERISTIKE TVRTKI I REOSIGURANJE – PRIKAZI HRVATSKIH OSIGURAVAJUĆIH KUĆA

Sažetak

Reosiguranje predstavlja najznačajniju metodu upravljanja statističkim rizicima društava za osiguranje. U ovom radu analiziraju se unutarnji čimbenici koji određuju potražnju za reosiguranjem društava za osiguranje u Republici Hrvatskoj. Korištenjem podataka o karakteristikama 19 osiguratelja u razdoblju od 2006. do 2011. godine, procijenjen je panel model sa slučajnim učincima. Rezultati empirijske analize pokazuju da su važni čimbenici odluke društava za osiguranje o kupnji reosiguranja: instrumentu, veličina, investicijski prinos, vlasnička struktura i udio neživotnog osiguranja u ukupnim poslovima osiguranja. Rezultat preuzimanja rizika i nestalnost imovine nemaju statistički značajan učinak na potražnju za reosiguranjem na hrvatskom tržištu osiguranja.

Ključne riječi: reosiguranje, društva za osiguranje, interne karakteristike osiguratelja.

JEL klasifikacija: G22