# The effect of financing hospital health care providers through updated Diagnosis Related Groups. Case studies: the municipal hospitals in Romania

Emil OLTEANU[1], Attila TAMAS SZORA[2], Iulian Bogdan DOBRA[3]

*[1,2,3]1 Decembrie 1918" University of Alba Iulia, Faculty of Science*

*eolteanu@uab.ro, attaconsulting@yahoo.com, dobra.iulian@uab.ro*

**Abstract.** *In our scientific approach we tried to develop a model with which to highlight the effect of financing hospital health care providers using the hospital's Diagnosis Related Groups (DRG) and Mean Relative Values (MRV). The econometric model used is simple linear regression model form. Development of the model was performed by using the EViews 7 to the municipal hospitals in Romania during 2010-2012, being considered DRG dependent variable and independent variables: C and MRV. Analyzing in detail the results recorded by providers following simple regression model is observed that there are units which, although recorded low values in the number of patients discharged, they were able to achieve a relatively high VRM or to contract a level of TAC over average of the entire sample.*

**Keywords: DRG, Mean Relative Value, financing hospitals, municipal hospitals**

**JEL Code: H51, I11, I12, I18**

## 1. Introduction

The future of hospital financing is one big concern for Romania, other Member States, and in general, for every country all over the world. The evolution of pharmaceutical markets and new developments in medical technology continually expand the range of health issues that can be treated, while ageing populations and increasing expectations create upwards pressure on costs which stretch the limits of countries` ability to find acceptable financing.

It is known that the DRG system, as a policy tool for cost containment and improved hospital efficiency, transfers the financial responsibility from insurers to hospitals and increases providers' cost consciousness (Ellis RP, McGuire TG., 1996).

Since the health care providers bear the financial risk of treating each patient under the DRG payment scheme, hospitals tend to decrease the health care resource used for each patient. (S-H Cheng, et al., 2012:203).

It is known that hospital health care providers in Romania and not only use significant resources within the health system. Because of the importance and role of hospital units for their patients' health, we believe in the business analysis and to identify the appropriate ways of financing which can help increase the financial resources they use. The purpose of this paper is to identify a model that would increase the DRG value contracted by hospital units with the County Health Insurance Houses (CHIH) from Romania.

Given that relative value is a key element in the consumption of resources used by the hospitals, respectively, its updating is quite difficult we are trying to emphasize its importance in the process of contracting and financing of health care providers, without minimizing the role and contribution of Case Mix Index. Also, to ensure a "real minimum" value of financing hospital units, we believe that the Tariff for Average Case ($TAC_{inf}$) must be updated with the inflation rate every year.

Structure is as follows: a) literature review - which briefly highlights the contribution of various authors on the topic addressed in this paper, b) research methodology - emphasizes the collection and processing of data from hospital units (i.e. 2010-2012), the source data, method used (i.e. Least Squares), the econometric model used (i.e. simple linear regression) with the presentation of its variables, the type of panel data, the application software used within research, research limits, c) results and discussion, d) conclusions and acknowledgements.

## 2. Research and Methodology. *Literature review*

In the literature there are several approaches that DRG is influenced by a number of factors, namely, the average of specialization, the services provided the cost of medical services, etc.

Each DRG is associated with a specific cost weight or tariff, which is usually calculated from information about average treatment costs of patients falling within a specific DRG in at least a sample of other hospitals in the past. Depending on the country, hospitals under DRG-based hospital payment systems either receive a DRG-based case payment or a DRG-based budget allocation. In both variants, however, hospitals are exposed to the financial risk of having costs above the payment rate and are rewarded for keeping costs below (Scheller-Kreinsen D., et al, 2011:1166).

The German researcher Matthias Vogl considers that (2012:290): DRGs serve as the basis for budgeting and cost control in hospital management. Thus, the full costs of the complete cycle of care for a medical condition should be addressed through accurate costing systems. Comparative research on DRG costing standards started in 2006 and has been developed recently in Europe and the U.S. Authors like Coulam R.F. & Gaumer G.L. (1991), Culter D.M, Zeckhauser RJ. (2000) and Rosenberg MA, Browne MJ. (2001) have expressed that the DRG payment shortens patients' length of hospital stay significantly. Others researchers found in their articles that medical suppliers reduced the intensity after the operation of DRG payment program (Long MJ, et al., 1987; Palmer RM, 1989).

Another major concern about the DRG payment is its potential adverse outcome of patients due to early discharge. Reduced length of stay or intensity of care might result in worse health care outcomes (S-H Cheng, et al., 2012:203).

In their study Hafsteinsdóttir and Siciliani (2012:541), estimated the degree and the source of cost sharing associated with the NordDRG classification system (i.e. specific to Iceland DRG classification), using data from Landspítali in Iceland for the years 2003–2005. Under the assumption that cost is exogenous, Ordinary Least Squares (OLS) estimation indicates that cost sharing of the NordDRG system at Landspítali remained relatively stable, at around 0.17, over the 3-year period under study... The results also suggest that the majority of cost sharing is associated with procedural DRGs which include surgical procedures or other invasive treatments.

In their study entitled *Appendectomy and diagnosis-related groups (DRGs): patient classification and hospital reimbursement in 11 European* countries, authors Quentin W., Scheller-Kreinsen D., Geissler A. and Busse R. (2012:317) performs a comprehensive assessment of DRG systems based on three main objectives: (1) to assess classification variables and algorithms used to group patients with appendectomy into DRGs, (2) to compare the composition of these DRGs and variations in relative resource intensity, and (3) to determine DRGs and hospital price levels for six case vignettes of appendectomy patients with different combinations of demographic, diagnostic, and treatment variables. Also the research results of Quentin W., Scheller-Kreinsen D., Geissler A. and Busse R. showed that (2012:317): *European DRG systems vary widely: they classify appendectomy patients according to different sets of variables (between two and six classification variables) into diverging numbers of DRGs (between two and 11 DRGs). The most*

*complex DRG is valued 5.1 times more resource intensive than an index case in France but only 1.1 times more resource intensive than an index case in Finland.*

To achieve the objectives of our research we studied the literature, we analyzed data reported by hospital units in Romania, setting rules of the National Health Insurance House (NHIH) and legislation.

The necessary data were collected from the website of the Center for Research and Assessment for Health Services[1] (CRAHS) and refers to the Relative Value for each DRG[2], respectively, Number of Discharged Cases to acute and chronic patients. CRAHS data indicators were reported by hospital units in Romania, and they were selected for 2010-2012, so subsequently be analyzed and processed in our research.

Out of hospital care providers (i.e. more than 500 public and private providers) were selected only the Municipal Hospital units that have kept administrative status during the period, the number of these suppliers amounted to 48.

During the reviewed period there is a change in the number of hospitals from municipal tows in Romania, as follows: in 2010 - a total of 66 units as follows: 5 municipal clinical units, clinical emergency unit 3 municipal clinical units, one municipal clinical emergency unit and 57 municipalities, namely 2011-2012 - a total of 63 units as follows: 5 municipal clinical units, clinical emergency unit 2 municipal clinical units, one municipal clinical emergency unit and 55 municipal units.

Of all hospital providers (i.e. max. 66 units) in the analyzed period have not been changes in terms of reporting structure, respectively, changes in the institutional and organizational point of view only 48 units.

We note that before being placed in the application EViews 7 data had to be processed in order to be recognized by the software application.

Starting from the relationship for determining the DRG contracted (DRG$_{co}$) for acute patients (the product of the Number of Discharged Cases - NDC, Case Mix Index - CMI and the Tariff per Average Case - TAC), under which hospitals are funded (i.e. between 70 % and 90% of total budget) we tried to establish a new relationship that is the foundation of our scientific .

$$DRG_{co} = NDC \times CMI \times TAC \quad (1)$$

The analysis reported data and indicators set out in the applicable framework it was found that in the period 2010-2012, TAC[3] was not updated to the inflation rate. Average Case Mix Index[4] at the level of the 48 suppliers grew 14.3% compared to the base period, respectively from 0.8398 in 2010 to 0.9599 in 2012. According to specialists of CHIH for acute cases are allocated between 70% -90% of the total budget of the contract (DRG$_{co}$) and for chronic cases between 5% -20% of the total budget. In these circumstances it was desired in each year, changing the relationship of DRG$_{co}$ determination to observe the effects in terms of budget size units surveyed, namely, the elaboration of an econometric model with which to observe and analyze the desired phenomenon.

Therefore, to observe the effect of changing relationship of DRG$_{co}$ calculus for each individual year, were taken into account the following indicators: total Number of Discharged Cases (NDC$_t$ - acute cases and chronic cases), the Case Mix Index (CMI)

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[1] Center for Research and Assessment for Health Services is the structure of the National School of Public Health, Management and Professional Development in Health Care (NSPHMPDHC) which aims to collect and manage the minimum set of data on patients under continuous hospitalization and day, from all hospitals in Romania, based on existing rules of the National Health Insurance and the Ministry of Public Health;

[2] MRV is a number without unit expressing the ratio of the average rate of DRG value and average value of all DRG's, coefficient given by the relative amount of labor, consumables and capital resources necessary to complete treatment of the patient with a condition.

[3] TAC represents the reimbursement value of an of an average case at hospital level for a particular year;

[4] CMI represents is a number without unit expressing hospital resources according to patients treated.

units registered hospitals and the TAC ($TAC_{inf}$) updated annual inflation rate of the previous year (4.74% update for 2010, 7.96% in 2011, 3.14% for 2012). By multiplying the three indicators resulted of $DRG_{co}$ new value (i.e. [New] $DRG_{co}$), a value that has been considered for developing the econometric model.

$$[New]DRG_{co} = NDC_t \times CMI \times TAC_{inf} \ (2)$$

Statistical model that we wanted to develop aims to highlight the financial resources of municipal units in Romania, given that all cases are considered external ($NDC_t$ - total acute cases and chronic cases), the resources needed to treat all patients, as reflected by the values of MRV, respectively, and a TAC indexed year inflation rate. Consequently, in our opinion it can be a "tool" for analysis and forecasting of resources used, useful for top management of hospital units, respectively, for the decision makers of public funds, or one auditing the activity and how to use these providers public money.

Due to the fact that data were only for 3 calendar years (because of module data collected and reported by the hospitals, the transmitted data have not been submitted for the entire calendar period - i.e. 2009, respectively, the structure of the data submitted did not allow the use of indicators in the model analyzed in this paper - i.e. 2008), with the help of the model we were able to estimate / simulate DRG value of contract only in the years 2010 to 2012, without being able to forecast its value in a short or medium term.

### 3. Empirical Results

*Developing an econometric model to estimate the new DRG value*
The sample considered for the development of the model includes 48 hospital health care providers in Romania. Data sources were the Center for Research and Evaluation of Health Services, National Health Insurance and National Bank of Romania. We conducted an econometric model for the 48 hospitals based on MRV 2010-2012 values.

### The Model:
Diagnosis Related Groups = F(Mean Relative Value) (3)

It is known that the specification of an econometric model also requires the choice of a mathematical function ($f(x)$) can be described by the relationship between variables. The form of the multiple linear regression model is:

$$LOG(DRG) = c(1) + c(2)*MRV \ (4)$$

*Estimation of the parameter of simple regression model*
After estimating parameters in EViews 7 we obtained:

**Table 1. Testing parameters of simple regression model LOG(DRG)**

Estimation Command:
LS(?) LOG(DRG) C MRV
Estimation Equation:
LOG(DRG) = C(1) + C(2)*MRV
Substituted Coefficients:
LOG(DRG) = 13.606688 + 2.352941*MRV

Source: data processed by the authors in EViews 7, 2014

Using the data from Appendix A and the regression (4), we acquire the following results:

**Table 2. Testing parameters of simple regression model LOG(DRG)**

| LOG(DR̂G) $=$ | 13.60669 | 2.352941MRV | |
|---|---|---|---|
| se $=$ | (0.288429) | (0.251419) | |
| t $=$ | (47.17511) | (9.358643) | |
| | (0.0000)* | (0.0000)* | $R^2 = 0.381491$ |

Source: data processed by the authors in EViews 7, 2014

Where * indicates the *p* values.

It can be seen from the model that a change of 1% in an independent variable – MRV would associated with a 2.3529 change in the dependent variable – $LOG(DR̂G)$. As can be seen from the last row of the Table 2 the p value is 0.000, which shows that MRV is an important factor influencing the LOG(DRG). Here it may be noted that the term free is also a factor influencing the DRG.

R-squared value is 0.3815 which highlights the fact that the model is not representative. This leads us to use in the future other independent variables, respectively, some variables dummies.

### 4. Conclusions

The statistical model that we wanted to elaborate aimed to draw up the necessary financial resources for the hospital health care providers, municipal hospital category units in Romania. Given that all the discharged cases are considered, all the resources required to treat patients, as reflected by the values of MRV, respectively, a TAC indexed with the annual rate of inflation, we consider this scientific approach useful for both decision makers local and central (e.g. government, ministry, NHIH, etc.). Also we consider that this model can be a tool of analysis used by hospital unit manager, public internal auditor, external public auditors (i.e. Supreme Audit Court).

Effects of using VRM and TAC indexed (with the inflation rate), indicators that have changed from the computing relationship currently used to determine budgets and contracting hospital health care providers in Romania, have been observed in all the 48 units analyzed. Analyzing in detail the results recorded by providers following simple regression model is observed that there are units which, although recorded low values in the number of patients discharged, they were able to achieve a relatively high VRM or to contract a level of TAC over average of the entire sample. So updating both the relative ( resources used to treat patients) and the tariff (inflation) should be considered when decision-makers, establish the contractor value of the DRG, respectively, when determining the amount of resources allocated to the hospital health care providers hospital.

Consequently the value of the DRG could provide an optimal level of financing sources, for most hospital units, above the initially calculated value using the model.

As future research we want to extend the period under review, the number of hospitals and include more independent variables in the model, namely the production of short and medium term forecasts on the value of the DRG contracted.

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| Unit/An | LOG(DRG) | VRM |
|---|---|---|
| 1 - 10 | 16.4300 | 1.2134 |
| 1 - 11 | 16.5427 | 1.3916 |
| 1 - 12 | 16.4381 | 1.3306 |
| 2 - 10 | 16.3756 | 1.2856 |
| 2 - 11 | 16.3320 | 1.3090 |
| 2 - 12 | 16.4376 | 1.2602 |
| 3 - 10 | 16.2067 | 1.0932 |
| 3 - 11 | 16.1643 | 1.0845 |
| 3 - 12 | 16.2309 | 1.0651 |
| 4 - 10 | 16.4459 | 1.1487 |
| 4 - 11 | 16.5123 | 1.1677 |
| 4 - 12 | 16.6206 | 1.2154 |
| 5 - 10 | 17.3391 | 1.2648 |
| 5 - 11 | 17.2777 | 1.3611 |
| 5 - 12 | 17.2703 | 1.3636 |
| 6 - 10 | 16.3350 | 1.1388 |
| 6 - 11 | 16.2176 | 1.1419 |
| 6 - 12 | 16.1543 | 1.1246 |
| 7 - 10 | 16.2831 | 1.3454 |
| 7 - 11 | 16.2452 | 1.2041 |
| 7 - 12 | 16.4361 | 1.2036 |
| 8 - 10 | 15.6176 | 1.1205 |
| 8 - 11 | 15.5895 | 1.1602 |
| 8 - 12 | 15.5657 | 1.1619 |
| 9 - 10 | 16.5004 | 1.2310 |
| 9 - 11 | 16.5271 | 1.1555 |
| 9 - 12 | 16.6584 | 1.2124 |
| 10 - 10 | 16.3469 | 1.1844 |
| 10 - 11 | 16.2203 | 1.1461 |
| 10 - 12 | 16.3493 | 1.1811 |
| 11 - 10 | 15.7974 | 0.9475 |
| 11 - 11 | 15.8121 | 0.9307 |
| 11 - 12 | 15.8688 | 1.0542 |
| 12 - 10 | 16.6374 | 1.1948 |
| 12 - 11 | 16.6295 | 1.2566 |
| 12 - 12 | 16.6709 | 1.2252 |
| 13 - 10 | 16.7403 | 1.2646 |
| 13 - 11 | 16.8445 | 1.2237 |
| 13 - 12 | 16.7806 | 1.1547 |
| 14 - 10 | 15.6565 | 0.9935 |
| 14 - 11 | 15.5690 | 0.9309 |
| 14 - 12 | 15.4731 | 0.8722 |
| 15 - 10 | 16.7103 | 1.1409 |
| 15 - 11 | 16.6824 | 1.1209 |
| 15 - 12 | 16.7926 | 1.1553 |
| 16 - 10 | 15.9682 | 1.1579 |
| 16 - 11 | 16.2440 | 1.1266 |
| 16 - 12 | 16.1931 | 1.0684 |
| 17 - 10 | 15.9490 | 0.9219 |
| 17 - 11 | 15.8243 | 0.9967 |
| 17 - 12 | 15.7123 | 0.8014 |
| 18 - 10 | 16.2727 | 0.9556 |
| 18 - 11 | 16.1997 | 0.9926 |
| 18 - 12 | 16.4431 | 0.9138 |
| 19 - 10 | 16.5793 | 1.0117 |
| 19 - 11 | 16.6082 | 1.1300 |
| 19 - 12 | 16.6728 | 1.1562 |
| 20 - 10 | 16.0644 | 0.9581 |
| 20 - 11 | 15.9829 | 0.9865 |
| 20 - 12 | 16.0244 | 1.0064 |
| 21 - 10 | 17.0862 | 1.3497 |
| 21 - 11 | 17.1911 | 1.3375 |
| 21 - 12 | 17.1537 | 1.2867 |
| 22 - 10 | 16.0093 | 1.2250 |
| 22 - 11 | 15.9428 | 1.1723 |
| 22 - 12 | 15.9430 | 1.1272 |
| 23 - 10 | 16.0075 | 1.1498 |
| 23 - 11 | 15.8765 | 1.1769 |
| 23 - 12 | 15.7544 | 1.1934 |
| 24 - 10 | 17.3841 | 1.3481 |
| 24 - 11 | 17.3040 | 1.3063 |
| 24 - 12 | 17.3396 | 1.4110 |
| 25 - 10 | 16.0796 | 1.2405 |
| 25 - 11 | 16.1387 | 1.2938 |
| 25 - 12 | 16.0221 | 1.1940 |
| 26 - 10 | 15.3899 | 1.0180 |
| 26 - 11 | 15.4196 | 0.9755 |
| 26 - 12 | 15.3235 | 0.9082 |
| 27 - 10 | 16.0335 | 1.1050 |
| 27 - 11 | 15.9105 | 1.0249 |
| 27 - 12 | 15.8696 | 1.0197 |
| 28 - 10 | 15.8004 | 1.0786 |
| 28 - 11 | 15.7941 | 1.1436 |
| 28 - 12 | 15.7912 | 1.0692 |
| 29 - 10 | 15.6489 | 1.1792 |
| 29 - 11 | 15.6545 | 1.1888 |
| 29 - 12 | 15.5763 | 1.1149 |
| 30 - 10 | 15.8136 | 1.1065 |
| 30 - 11 | 15.7908 | 1.1513 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 30 - 12 | 15.9756 | 1.1351 | 37 - 10 | 16.0310 | 0.8245 | 43 - 11 | 15.7479 | 1.0309 |
| 31 - 10 | 16.4394 | 1.0806 | 37 - 11 | 16.1713 | 1.0579 | 43 - 12 | 15.7930 | 1.0438 |
| 31 - 11 | 16.4463 | 1.1531 | 37 - 12 | 16.1495 | 0.9356 | 44 - 10 | 16.5431 | 1.0035 |
| 31 - 12 | 16.4896 | 1.2009 | 38 - 10 | 16.1852 | 1.1950 | 44 - 11 | 16.2778 | 1.0334 |
| 32 - 10 | 16.6754 | 1.3232 | 38 - 11 | 16.1289 | 1.1877 | 44 - 12 | 16.3990 | 0.9798 |
| 32 - 11 | 16.7641 | 1.2473 | 38 - 12 | 16.1997 | 1.2480 | 45 - 10 | 16.6233 | 1.1992 |
| 32 - 12 | 16.6611 | 1.1645 | 39 - 10 | 16.4098 | 1.3656 | 45 - 11 | 16.5524 | 1.1195 |
| 33 - 10 | 15.3993 | 1.0656 | 39 - 11 | 16.6329 | 1.1818 | 45 - 12 | 16.4604 | 1.1877 |
| 33 - 11 | 15.4655 | 1.0376 | 39 - 12 | 16.5914 | 1.1472 | 46 - 10 | 16.7373 | 1.1289 |
| 33 - 12 | 15.5707 | 1.0401 | 40 - 10 | 16.3697 | 1.1166 | 46 - 11 | 16.7608 | 1.2158 |
| 34 - 10 | 16.3112 | 1.2488 | 40 - 11 | 16.5404 | 1.2104 | 46 - 12 | 16.7454 | 1.1977 |
| 34 - 11 | 16.5338 | 1.2637 | 40 - 12 | 16.5979 | 1.1521 | 47 - 10 | 16.4116 | 0.9105 |
| 34 - 12 | 16.4723 | 1.2402 | 41 - 10 | 16.6378 | 1.2452 | 47 - 11 | 16.4368 | 1.0873 |
| 35 - 10 | 16.2420 | 1.1979 | 41 - 11 | 16.9434 | 1.2997 | 47 - 12 | 16.1873 | 0.9560 |
| 35 - 11 | 16.2198 | 1.2357 | 41 - 12 | 17.1098 | 1.2195 | 48 - 10 | 16.2890 | 1.1342 |
| 35 - 12 | 16.3126 | 1.1774 | 42 - 10 | 15.8526 | 1.0255 | 48 - 11 | 16.3865 | 1.1735 |
| 36 - 10 | 17.0924 | 1.1799 | 42 - 11 | 15.8708 | 1.0512 | 48 - 12 | 16.4113 | 1.1475 |
| 36 - 11 | 16.9292 | 1.2400 | 42 - 12 | 15.8332 | 0.9928 | | | |
| 36 - 12 | 16.9633 | 1.2134 | 43 - 10 | 15.7754 | 1.0085 | | | |

Source: data processed by the authors in EViews 7, 2014

| | | 2010 | | | | 2011 | | | | 2012 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | Spital Municipal | $NCE_t$ | ICM | $TCP_{inf}$ | $DRG_{co}$ | $NCE_t$ | ICM | $TCP_{inf}$ | $DRG_{co}$ | $NCE_t$ | ICM | $TCP_{inf}$ | $DRG_{co}$ |
| 1 | SM Blaj | 11,164 | 0.8803 | 1,456 | 14,309,086 | 9,462 | 1.1276 | 1,572 | 16,772,220 | 8,364 | 1.1490 | 1,621 | 15,578,193 |
| 2 | SM Aiud | 10,145 | 0.9174 | 1,456 | 13,551,025 | 9,428 | 0.9167 | 1,572 | 13,586,242 | 9,141 | 1.0508 | 1,621 | 15,570,293 |
| 3 | SM Sebeş | 9,103 | 0.8635 | 1,456 | 11,444,801 | 8,253 | 0.8855 | 1,572 | 11,488,226 | 8,103 | 0.9640 | 1,621 | 12,662,104 |
| 4 | SM Curtea de Argeş | 12,503 | 0.7986 | 1,456 | 14,538,008 | 11,103 | 0.9322 | 1,572 | 16,270,540 | 10,297 | 1.1201 | 1,621 | 18,696,079 |
| 5 | SM Oneşti | 23,041 | 1.0587 | 1,456 | 35,516,946 | 20,921 | 1.0636 | 1,572 | 34,979,477 | 20,723 | 1.0659 | 1,621 | 35,805,695 |
| 6 | SM "Episcop N. Popovici" Beius | 10,413 | 0.8582 | 1,456 | 13,011,452 | 8,514 | 0.9054 | 1,572 | 12,117,881 | 7,787 | 0.9292 | 1,621 | 11,729,038 |
| 7 | SM "Dr. Pop Mircea" Marghita | 8,844 | 0.9594 | 1,456 | 12,354,063 | 8,726 | 0.9081 | 1,572 | 12,456,655 | 8,525 | 1.1250 | 1,621 | 15,546,403 |
| 8 | SM Salonta | 5,659 | 0.7707 | 1,456 | 6,350,186 | 4,654 | 0.8838 | 1,572 | 6,465,959 | 4,195 | 0.9575 | 1,621 | 6,511,091 |
| 9 | SM Dorohoi | 16,265 | 0.6483 | 1,456 | 15,352,937 | 15,419 | 0.6813 | 1,572 | 16,513,805 | 13,017 | 0.9202 | 1,621 | 19,416,733 |
| 10 | SM Fagaras | 10,001 | 0.9043 | 1,456 | 13,167,925 | 9,341 | 0.8275 | 1,572 | 12,151,053 | 9,206 | 0.9552 | 1,621 | 14,254,379 |
| 11 | SM Oltenita | 8,038 | 0.6495 | 1,456 | 7,601,312 | 7,835 | 0.6559 | 1,572 | 8,078,471 | 7,055 | 0.7709 | 1,621 | 8,816,132 |
| 12 | SM Dej | 13,863 | 0.8723 | 1,456 | 17,606,964 | 13,528 | 0.8602 | 1,572 | 18,293,027 | 12,518 | 0.9689 | 1,621 | 19,660,607 |
| 13 | SM Turda | 15,509 | 0.8642 | 1,456 | 19,514,590 | 14,819 | 0.9737 | 1,572 | 22,682,797 | 13,255 | 1.0212 | 1,621 | 21,941,866 |
| 14 | SM Gherla | 5,514 | 0.8223 | 1,456 | 6,601,740 | 5,258 | 0.7664 | 1,572 | 6,334,737 | 4,743 | 0.7719 | 1,621 | 5,934,678 |
| 15 | SM Medgidia | 14,686 | 0.8857 | 1,456 | 18,938,760 | 14,372 | 0.8537 | 1,572 | 19,287,460 | 13,879 | 0.9870 | 1,621 | 22,205,387 |
| 16 | SM Mangalia | 8,430 | 0.7346 | 1,456 | 9,016,539 | 8,103 | 0.9768 | 1,572 | 12,442,396 | 7,406 | 1.0156 | 1,621 | 12,192,406 |
| 17 | SM Bailesti | 6,841 | 0.8880 | 1,456 | 8,844,920 | 5,787 | 0.8989 | 1,572 | 8,177,441 | 5,337 | 0.8714 | 1,621 | 7,538,723 |
| 18 | SM Calafat | 11,651 | 0.7207 | 1,456 | 12,225,851 | 11,075 | 0.6837 | 1,572 | 11,903,149 | 10,904 | 0.8858 | 1,621 | 15,656,855 |
| 19 | SM "Anton Cincu" Tecuci | 16,811 | 0.6787 | 1,456 | 16,612,415 | 15,209 | 0.7490 | 1,572 | 17,907,502 | 14,647 | 0.8297 | 1,621 | 19,699,390 |
| 20 | SM Motru | 7,362 | 0.9261 | 1,456 | 9,926,933 | 6,999 | 0.8710 | 1,572 | 9,583,115 | 6,979 | 0.9105 | 1,621 | 10,300,449 |
| 21 | SM Odorheiul Secuiesc | 20,153 | 0.9399 | 1,456 | 27,579,268 | 19,422 | 1.0507 | 1,572 | 32,079,325 | 18,567 | 1.0587 | 1,621 | 31,863,807 |
| 22 | SM Gheorgheni | 7,924 | 0.8143 | 1,456 | 9,394,859 | 7,138 | 0.8204 | 1,572 | 9,205,656 | 6,543 | 0.8952 | 1,621 | 9,494,673 |
| 23 | SM Toplita | 6,933 | 0.9290 | 1,456 | 9,377,742 | 6,102 | 0.8982 | 1,572 | 8,615,843 | 5,321 | 0.9116 | 1,621 | 7,862,861 |

| # | Name | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | SM "Dr. A. Simionescu" Hunedoara | 20,036 | 1.1976 | 1,548 | 37,144,436 | 19,661 | 1.1619 | 1,671 | 38,172,518 | 18,451 | 1.2830 | 1,724 | 40,811,619 |
| 25 | SM Lupeni | 8,009 | 0.8437 | 1,491 | 10,074,975 | 7,101 | 1.0032 | 1,610 | 11,469,194 | 6,077 | 1.0432 | 1,661 | 10,529,953 |
| 26 | SM Vulcan | 3,636 | 0.8622 | 1,613 | 5,056,689 | 3,672 | 0.9258 | 1,741 | 5,918,595 | 3,128 | 0.9872 | 1,796 | 5,545,979 |
| 27 | SM Brad | 6,600 | 1.0016 | 1,456 | 9,624,975 | 6,714 | 0.8445 | 1,572 | 8,913,198 | 5,553 | 0.9802 | 1,621 | 8,823,185 |
| 28 | SM Orastie | 6,123 | 0.8552 | 1,456 | 7,624,183 | 5,567 | 0.9066 | 1,572 | 7,933,950 | 5,386 | 0.9344 | 1,621 | 8,157,972 |
| 29 | SM Urziceni | 5,724 | 0.7862 | 1,456 | 6,552,304 | 5,236 | 0.8383 | 1,572 | 6,900,041 | 4,461 | 0.9100 | 1,621 | 6,580,466 |
| 30 | SM Feteşti | 8,294 | 0.6397 | 1,456 | 7,725,058 | 7,780 | 0.6466 | 1,572 | 7,908,021 | 6,974 | 0.8677 | 1,621 | 9,809,222 |
| 31 | SM Paşcani | 10,635 | 0.9328 | 1,456 | 14,443,998 | 10,911 | 0.8880 | 1,572 | 15,231,058 | 10,860 | 0.9317 | 1,621 | 16,401,703 |
| 32 | SM Sighetu Marmatiei | 17,626 | 0.7126 | 1,456 | 18,287,779 | 14,265 | 0.9333 | 1,572 | 20,928,861 | 13,200 | 0.9099 | 1,621 | 19,469,312 |
| 33 | SM Orşova | 4,920 | 0.7126 | 1,456 | 5,104,724 | 4,730 | 0.7682 | 1,572 | 5,711,997 | 4,549 | 0.8874 | 1,621 | 6,543,625 |
| 34 | SM Sighişoara | 9,356 | 0.9327 | 1,456 | 12,705,553 | 9,161 | 1.1544 | 1,572 | 16,624,621 | 9,001 | 1.1048 | 1,621 | 16,119,718 |
| 35 | SM "Dr. E. Nicoara" Reghin | 9,533 | 0.8542 | 1,456 | 11,856,337 | 8,748 | 0.8831 | 1,572 | 12,144,264 | 9,019 | 0.9399 | 1,621 | 13,741,149 |
| 36 | SM Caracal | 21,391 | 0.8910 | 1,456 | 27,750,459 | 15,867 | 0.9897 | 1,572 | 24,686,012 | 14,040 | 1.1573 | 1,621 | 26,338,806 |
| 37 | SM Ploieşti | 7,391 | 0.8251 | 1,574 | 9,598,746 | 7,361 | 0.9998 | 1,700 | 12,511,197 | 7,178 | 1.0032 | 1,753 | 12,623,300 |
| 38 | SM Cărei | 7,971 | 0.9652 | 1,456 | 11,201,895 | 7,793 | 0.9052 | 1,572 | 11,089,239 | 7,811 | 0.9694 | 1,621 | 12,274,185 |
| 39 | SM Mediaş | 14,062 | 0.6849 | 1,456 | 14,022,829 | 12,009 | 0.9724 | 1,572 | 18,357,111 | 11,845 | 0.9457 | 1,621 | 18,158,145 |
| 40 | SM Fălticeni | 13,509 | 0.6849 | 1,456 | 13,471,369 | 12,327 | 0.8636 | 1,572 | 16,734,879 | 12,106 | 0.9314 | 1,621 | 18,277,632 |
| 41 | SM Radauti | 17,314 | 0.6987 | 1,456 | 17,613,657 | 17,182 | 0.9271 | 1,572 | 25,041,067 | 17,024 | 1.1050 | 1,621 | 30,493,474 |
| 42 | SM Vatra Dornei | 7,896 | 0.6987 | 1,456 | 8,032,658 | 7,498 | 0.7268 | 1,572 | 8,566,687 | 7,228 | 0.7261 | 1,621 | 8,507,415 |
| 43 | SM Turnu Măgurele | 7,880 | 0.6481 | 1,456 | 7,435,833 | 7,530 | 0.6400 | 1,572 | 7,575,782 | 7,191 | 0.7011 | 1,621 | 8,172,450 |
| 44 | SM "Caritas" Roşiori de Vede | 11,339 | 0.9705 | 1,456 | 16,022,551 | 10,945 | 0.7480 | 1,572 | 12,869,744 | 10,607 | 0.8713 | 1,621 | 14,981,086 |
| 45 | SM Lugoj | 11,868 | 1.0047 | 1,456 | 17,361,023 | 10,670 | 1.0097 | 1,572 | 16,935,940 | 9,853 | 0.9973 | 1,621 | 15,928,589 |
| 46 | SM Husi | 13,301 | 1.0047 | 1,456 | 19,457,277 | 12,912 | 1.0277 | 1,572 | 20,859,909 | 12,189 | 1.0721 | 1,621 | 21,182,947 |
| 47 | SM "Costache Nicolescu" Dragasani | 13,111 | 0.7359 | 1,456 | 14,048,048 | 11,870 | 0.8086 | 1,572 | 15,088,185 | 9,498 | 0.7874 | 1,621 | 12,123,014 |

48  SM Adjud     10,882  0.7843  1,456  12,426,600  10,913  0.8363  1,572  14,346,924  10,476  0.8931  1,621  15,166,263
Source: data processed by the authors, with data from www.drg.ro, 2013

**APPENDIX C**

| | 2010 | | | | 2011 | | | | 2012 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr. | $NCE_t$ | ICM | TCP | $DRG_{co}$ | $NCE_t$ | ICM | TCP | $DRG_{co}$ | $NCE_t$ | ICM | TCP | $DRG_{co}$ |
| 1 | 11,164 | 0.8803 | 1,390 | 13,660,460 | 9,462 | 1.1276 | 1,433 | 15,289,180 | 8,364 | 1.1490 | 1,433 | 13,771,468 |
| 2 | 10,145 | 0.9174 | 1,390 | 12,936,762 | 9,428 | 0.9167 | 1,433 | 12,384,914 | 9,141 | 1.0508 | 1,433 | 13,764,485 |
| 3 | 9,103 | 0.8635 | 1,390 | 10,926,012 | 8,253 | 0.8855 | 1,433 | 10,472,409 | 8,103 | 0.9640 | 1,433 | 11,193,581 |
| 4 | 12,503 | 0.7986 | 1,390 | 13,879,005 | 11,103 | 0.9322 | 1,433 | 14,831,860 | 10,297 | 1.1201 | 1,433 | 16,527,749 |
| 5 | 23,041 | 1.0587 | 1,390 | 33,906,974 | 20,921 | 1.0636 | 1,433 | 31,886,508 | 20,723 | 1.0659 | 1,433 | 31,653,029 |
| 6 | 10,413 | 0.8582 | 1,390 | 12,421,647 | 8,514 | 0.9054 | 1,433 | 11,046,389 | 7,787 | 0.9292 | 1,433 | 10,368,730 |
| 7 | 8,844 | 0.9594 | 1,390 | 11,794,058 | 8,726 | 0.9081 | 1,433 | 11,355,207 | 8,525 | 1.1250 | 1,433 | 13,743,366 |
| 8 | 5,659 | 0.7707 | 1,390 | 6,062,334 | 4,654 | 0.8838 | 1,433 | 5,894,223 | 4,195 | 0.9575 | 1,433 | 5,755,949 |
| 9 | 16,265 | 0.6483 | 1,390 | 14,656,993 | 15,419 | 0.6813 | 1,433 | 15,053,614 | 13,017 | 0.9202 | 1,433 | 17,164,823 |
| 10 | 10,001 | 0.9043 | 1,390 | 12,571,027 | 9,341 | 0.8275 | 1,433 | 11,076,628 | 9,206 | 0.9552 | 1,433 | 12,601,188 |
| 11 | 8,038 | 0.6495 | 1,390 | 7,256,747 | 7,835 | 0.6559 | 1,433 | 7,364,153 | 7,055 | 0.7709 | 1,433 | 7,793,656 |
| 12 | 13,863 | 0.8723 | 1,390 | 16,808,846 | 13,528 | 0.8602 | 1,433 | 16,675,514 | 12,518 | 0.9689 | 1,433 | 17,380,413 |
| 13 | 15,509 | 0.8642 | 1,390 | 18,630,000 | 14,819 | 0.9737 | 1,433 | 20,677,130 | 13,255 | 1.0212 | 1,433 | 19,397,097 |
| 14 | 5,514 | 0.8223 | 1,390 | 6,302,485 | 5,258 | 0.7664 | 1,433 | 5,774,605 | 4,743 | 0.7719 | 1,433 | 5,246,387 |
| 15 | 14,686 | 0.8857 | 1,390 | 18,080,272 | 14,372 | 0.8537 | 1,433 | 17,582,016 | 13,879 | 0.9870 | 1,433 | 19,630,055 |
| 16 | 8,430 | 0.7346 | 1,390 | 8,607,822 | 8,103 | 0.9768 | 1,433 | 11,342,210 | 7,406 | 1.0156 | 1,433 | 10,778,358 |
| 17 | 6,841 | 0.8880 | 1,390 | 8,443,983 | 5,787 | 0.8989 | 1,433 | 7,454,372 | 5,337 | 0.8714 | 1,433 | 6,664,398 |
| 18 | 11,651 | 0.7207 | 1,390 | 11,671,657 | 11,075 | 0.6837 | 1,433 | 10,850,644 | 10,904 | 0.8858 | 1,433 | 13,841,008 |
| 19 | 16,811 | 0.6787 | 1,390 | 15,859,380 | 15,209 | 0.7490 | 1,433 | 16,324,078 | 14,647 | 0.8297 | 1,433 | 17,414,699 |
| 20 | 7,362 | 0.9261 | 1,390 | 9,476,948 | 6,999 | 0.8710 | 1,433 | 8,735,753 | 6,979 | 0.9105 | 1,433 | 9,105,826 |
| 21 | 20,153 | 0.9399 | 1,390 | 26,329,109 | 19,422 | 1.0507 | 1,433 | 29,242,795 | 18,567 | 1.0587 | 1,433 | 28,168,313 |
| 22 | 7,924 | 0.8143 | 1,390 | 8,968,993 | 7,138 | 0.8204 | 1,433 | 8,391,670 | 6,543 | 0.8952 | 1,433 | 8,393,502 |
| 23 | 6,933 | 0.9290 | 1,390 | 8,952,652 | 6,102 | 0.8982 | 1,433 | 7,854,010 | 5,321 | 0.9116 | 1,433 | 6,950,944 |
| 24 | 20,036 | 1.1976 | 1,478 | 35,464,778 | 19,661 | 1.1619 | 1,433 | 32,735,618 | 18,451 | 1.2830 | 1,433 | 33,922,883 |
| 25 | 8,009 | 0.8437 | 1,424 | 9,622,243 | 7,101 | 1.0032 | 1,433 | 10,208,295 | 6,077 | 1.0432 | 1,433 | 9,084,541 |

| 26 | 3,636 | 0.8622 | 1,540 | 4,827,837 | 3,672 | 0.9258 | 1,463 | 4,973,524 | 3,128 | 0.9872 | 1,463 | 4,517,688 |
|----|-------|--------|-------|-----------|-------|--------|-------|-----------|-------|--------|-------|-----------|
| 27 | 6,600 | 1.0016 | 1,390 | 9,188,678 | 6,714 | 0.8445 | 1,433 | 8,125,071 | 5,553 | 0.9802 | 1,433 | 7,799,892 |
| 28 | 6,123 | 0.8552 | 1,390 | 7,278,582 | 5,567 | 0.9066 | 1,433 | 7,232,411 | 5,386 | 0.9344 | 1,433 | 7,211,828 |
| 29 | 5,724 | 0.7862 | 1,390 | 6,255,290 | 5,236 | 0.8383 | 1,433 | 6,289,923 | 4,461 | 0.9100 | 1,433 | 5,817,278 |
| 30 | 8,294 | 0.6397 | 1,390 | 7,374,884 | 7,780 | 0.6466 | 1,433 | 7,208,775 | 6,974 | 0.8677 | 1,433 | 8,671,570 |
| 31 | 10,635 | 0.9328 | 1,390 | 13,789,256 | 10,911 | 0.8880 | 1,433 | 13,884,291 | 10,860 | 0.9317 | 1,433 | 14,499,469 |
| 32 | 17,626 | 0.7126 | 1,390 | 17,458,800 | 14,265 | 0.9333 | 1,433 | 19,078,281 | 13,200 | 0.9099 | 1,433 | 17,211,304 |
| 33 | 4,920 | 0.7126 | 1,390 | 4,873,329 | 4,730 | 0.7682 | 1,433 | 5,206,929 | 4,549 | 0.8874 | 1,433 | 5,784,709 |
| 34 | 9,356 | 0.9327 | 1,390 | 12,129,614 | 9,161 | 1.1544 | 1,433 | 15,154,632 | 9,001 | 1.1048 | 1,433 | 14,250,189 |
| 35 | 9,533 | 0.8542 | 1,390 | 11,318,893 | 8,748 | 0.8831 | 1,433 | 11,070,439 | 9,019 | 0.9399 | 1,433 | 12,147,481 |
| 36 | 21,391 | 0.8910 | 1,390 | 26,492,540 | 15,867 | 0.9897 | 1,433 | 22,503,216 | 14,040 | 1.1573 | 1,433 | 23,284,089 |
| 37 | 7,391 | 0.8251 | 1,503 | 9,165,766 | 7,361 | 0.9998 | 1,433 | 10,546,203 | 7,178 | 1.0032 | 1,433 | 10,318,989 |
| 38 | 7,971 | 0.9652 | 1,390 | 10,694,117 | 7,793 | 0.9052 | 1,433 | 10,108,702 | 7,811 | 0.9694 | 1,433 | 10,850,652 |
| 39 | 14,062 | 0.6849 | 1,390 | 13,387,179 | 12,009 | 0.9724 | 1,433 | 16,733,931 | 11,845 | 0.9457 | 1,433 | 16,052,203 |
| 40 | 13,509 | 0.6849 | 1,390 | 12,860,717 | 12,327 | 0.8636 | 1,433 | 15,255,141 | 12,106 | 0.9314 | 1,433 | 16,157,832 |
| 41 | 17,314 | 0.6987 | 1,390 | 16,815,236 | 17,182 | 0.9271 | 1,433 | 22,826,876 | 17,024 | 1.1050 | 1,433 | 26,956,908 |
| 42 | 7,896 | 0.6987 | 1,390 | 7,668,540 | 7,498 | 0.7268 | 1,433 | 7,809,200 | 7,228 | 0.7261 | 1,433 | 7,520,743 |
| 43 | 7,880 | 0.6481 | 1,390 | 7,098,769 | 7,530 | 0.6400 | 1,433 | 6,905,914 | 7,191 | 0.7011 | 1,433 | 7,224,627 |
| 44 | 11,339 | 0.9705 | 1,390 | 15,296,254 | 10,945 | 0.7480 | 1,433 | 11,731,770 | 10,607 | 0.8713 | 1,433 | 13,243,613 |
| 45 | 11,868 | 1.0047 | 1,390 | 16,574,054 | 10,670 | 1.0097 | 1,433 | 15,438,424 | 9,853 | 0.9973 | 1,433 | 14,081,227 |
| 46 | 13,301 | 1.0047 | 1,390 | 18,575,285 | 12,912 | 1.0277 | 1,433 | 19,015,426 | 12,189 | 1.0721 | 1,433 | 18,726,196 |
| 47 | 13,111 | 0.7359 | 1,390 | 13,411,255 | 11,870 | 0.8086 | 1,433 | 13,754,052 | 9,498 | 0.7874 | 1,433 | 10,717,013 |
| 48 | 10,882 | 0.7843 | 1,390 | 11,863,306 | 10,913 | 0.8363 | 1,433 | 13,078,335 | 10,476 | 0.8931 | 1,433 | 13,407,314 |

Source: data processed by the authors, with data from www.drg.ro, 2013