THE CORRELATION AND REGRESSION ANALYSIS OF CADASTRAL VALUE OF REAL ESTATE OBJECTS AND PRICE-FORMING FACTORS (ON THE EXAMPLE OF LAND PARCEL OF THE TYUMEN, INTENDED FOR INDIVIDUAL RESIDENCE)

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Nowadays the cadastral value of real estate is determined not only for the formation of the tax base, but is also the main instrument for regulating property relations between citizens and the state. The cadastral value of real estate located on the territory of the constituent entities of the Russian Federation can be determined in the process of state cadastral valuation with minimum labor. The legal and methodological support of the state cadastral valuation has changed significantly in recent years: this type of work has been transferred to the state institutions of the constituent entities of the Russian Federation, which will allow ensuring in the future continuity of information, unity of technology and increasing responsibility for the results of the valuation. However, the issue of mathematical justification of the pattern of change in cadastral value from heterogeneous price-forming factors remains an important issue. The article conducted a three-stage selection of price-forming factors and identified the factors that have the largest impact on the cadastral value of land parcel of the Tyumen, intended for individual residence. The method of the correlation and regression analysis on classical statistical formula was used to analyze the relationship between cadastral value of real estate objects and price-forming factors. The obtained equations of cadastral value of land of land parcel of the Tyumen, intended for individual residence and price-forming factors are analyzed in terms of the main indicators of quality of the correlation and regression analysis and statistical coefficients.

Key words: state cadastral valuation, price-forming factor, correlation and regression analysis, cadastral value, geographic information systems.

REFERENCE

1. Smirnova, E. A. & Zasyazh-Wolf, V. V. (2016). Cadastral value of land plots as one of the factors of land relations of the territory. *Nauchnye vedomosti Belgorodskogo gosudarstvennogo universiteta. Seriya: estestvennye nauki* [*Scientific Statements of the Belgorod State University. Series: Natural Sciences*], 18(239), 142–147 [in Russian].

2. Lipski, S. A. (2016). Problems and prospects of legislative regulation of state cadastral assessment. *Pravovye voprosy nedvizhimosti [Legal Issues of Real Estate]*, 2, 33–36 [in Russian].

3. Order of the Ministry of Economic Development RF of May 12, 2017, № 226. On approval of methodological instructions on state cadastral valuation. Retrieved from ConsultantPlus online database [in Russian].

4. Zhdanova, R. V. (2019). Peculiarities of regulatory regulation of state cadastral valuation of real estate at the present stage. *Moskovskiy ekonomicheskiy zhurnal [Moscow Economic Journal]*, 3, 59–64 [in Russian].

5. Shapovalov, D. A. & Sahakyan, A. A. (2019). Forecasting of the use of land resources of the municipality (on the example of SP «Desenevskoe» NAO of Moscow). In *Sbornik nauchnykh trudov: Sovremennye problemy effektivnogo zemlepol'zovaniya [Collection of Scientific Paper: Modern Problems of Effective Land Use]* (pp. 31–38) [in Russian].

6. Varlamov, A. A. & Galchenko, S. A. & Zhdanov, R. V. (2019). *U istokov otsenochnoy deyatel'nosti v Rossii [At the origin of evaluation activity in Russia]*. Moscow: GUZ Publ., 326 p. [in Russian].

7. Moskvin, V. N. & Sokolova, T. A. (2018). Methodology of expert assessment of lands of settlements of industrial purpose to challenge their cadastral value in the Commission of Rosreestra and in court. *Vestnik SGUGiT [Vestnik SSUGT]*, *23*(2), 185–199 [in Russian].

8. Bykova, E. N. & Senkovskaya, K. E. & Dotsenko, Y. N. (2017). Some aspects of the mass assessment of the lands of settlements: problems and solutions. *Uspekhi sovremennoy nauki i obrazovaniya [Successes in Modern Science and Education]*, 2(8), 208–211 [in Russian].

9. Gribovsky, S. V. & Sivets, S. A. (2008). *Matematicheskie metody otsenki stoimosti nedvizhimogo imushchestva [Mathematical methods for assessing the value of real estate]*. Moscow: Finansy i kredit Publ., 368 p. [in Russian].

10. Radchenko, S. G. (2011). *Metodologiya regressionnogo analiza [Methodology of regression analysis]*. Kiev: Korniychuk Publ., 376 p. [in Russian].

11. Sedova, E. N. (2014). Modeling the cost of secondary housing in the regional market: a spatial approach. *Vestnik OGU [Vestnik OSU]*, 14(175), 458–464 [in Russian].

12. Chernykh, E. G. & Novikov, Y. A., & Schukina, V. N. (2019). Features of determining the cadastral value on the example of the Tyumen region. *Mezhdunarodnyy sel'skokhozyaystvennyy zhurnal [International Agricultural Journal]*, 3(369), 45–47 [in Russian].

13. Official Site of Rosregister. (n. d.). Retrieved from https://rosreestr.ru/wps/ portal/.

14. Federal Law of July 29, 1998 № 135–FZ. On appraisal activity in the Russian Federation. Retrieved from ConsultantPlus online database [in Russian].

15. Dubrovsky, A. V. & Podryadchikova, E. D. (2014). On the issue of improving the system for assessing real estate based on the calculation of the indicator of social comfort. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 4/S, 153–157 [in Russian].

16. Renigier-Bilozor, M. & Janowski, A. (2019). Geoscience Methods in Real Estate Market Analyses Subjectivity Decrease. *[Geosciences]*, 9, 130–138.

17. Gladkikh, N. I. & Kuznetsova, V. V. (2016) Determination of the required number of analogues for a given number of pricing factors for the purpose of real estate valuation by correlation and regression analysis. *Imushchestvennye otnosheniya v Rossiyskoy Federatsii [Property relations in the Russian Federation]*, 6(177), 75–84 [in Russian].

18. Dubrovsky, A. V., Ilyinykh, A. L., Malygina, O. I., Moskvin, V. N., & Vishnyakova, A. V. (2019). Analysis of pricing factors affecting the cadastral value of real estate. *Vestnik SGUGiT [Vestnik SSUGT]*, *24*(2), 150–169 [in Russian].

19. Lepikhina, O. Y., & Pravdina, E. A. (2019). Variable accounting of pricing factors at cadastral assessment of lands (on cadastral assessment of lands (on the example of the city of St. Petersburg). *Izvestiya Tomskogo politekhnicheskogo universiteta. Inzhiniring georesursov [News of the Tomsk Polytechnic University. Engineering Georesurs]*, 2(330), 65–74 [in Russian].

20. Chun, Y. (2018). Modelling network autocorrelation within migration flows by eigenvector spatial filtering. *Journal of Geographical Systems*, 10(4), 317–344.

21. Basu, S., & Thibodeau, T. G. (2016). Analysis of spatial autocorrelation in housing prices. *Journal of Real Estate Finance and Economics*, 17, 61–85.

22. Quintos, C. (2013). Spatial weight matrices and their use as baseline values and location–adjustment factors in property assessment models. *Cityscape*, 15, 295–306.

23. Grigoryev, V. V. (2018). The rationale for the need for a correction factor for calculating the cadastral value of real estate. *Ekonomicheskie strategii [Economic strategies]*, 3(153), 110–117 [in Russian].

24. Driscoll, J. C., & Kraay, A. (2015). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, 80, 549–604.

25. Griffith, D. (2011). Visualizing analytical spatial autocorrelation components latent in spatial interaction data: an eigenvector spatial filter approach. *Compute Environ Urban System*, 35, 140–149.

26. Podryadchikova, E. D. (2015). Improvement of land appraisal methods based on geoinformation analysis of socio-territorial relationships of urban infrastructure elements. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 5/S, 230–234 [in Russian].

27. Dubrovsky, A. V., & Podryadchikova, E. D. (2013). On the approach to calculating the indicator of social comfort of the population to improve the real estate assessment system. *Vestnik SGGA [Vestnik SGGA]*, 3(23), 94–100 [in Russian].

28. Nosov, V. V., & Tsypin, A. P. (2015). Econometric modeling of the price of a one-room apartment by the method of geographically weighted regression. *Izvestiya Saratovskogo universiteta. Novye serii. Ekonomika. Upravlenie. Pravo [Bulletin of the University of Saratov. New episodes. Economy. Control. Right]*, 4, 381–387 [in Russian].

29. Ferretti, V., & Montibeller, G. (2016). Key challenges and meta-choices in designing and applying multicriteria spatial decision support systems. *Decis. Support System*, 84, 41–52.

30. Draper, N. R., & Smith, A. G. (2007). *Prikladnoy regressionnyy analiz [Applied regression analysis]*. Moscow: Williams Publ., 912 p. [in Russian].

31. Belyaeva, A. V. (2012). The use of spatial models in the mass valuation of real estate. *Komp'yuternye issledovaniya i modelirovanie [Computer Research and Modeling]*, 3, 639−650 [in Russian].

32. Mark, J., & Goldberg, M. (2016). Multiple regression analysis and mass assessment. *A Review of the Issue. Apprais*, 56, 89–109.

33. Karpik, A. P., Lisitsky, D. V., Baykov, K. S., Osipov, A. G., & Savinykh, V. N. (2017). Geospatial discourse of advanced and breakthrough thinking. *Vestnik SGUGiT [Vestnik SSUGiT]*, 22(4), 53–67 [in Russian].

34. Kovyazin, V. F., Lepikhina, O. Y., & Zimin, V. P. (2018). Development of a forecast model of land value of single-industry towns taking into account economic factors of activity of city-forming enterprises (on the example of the Murmansk region). *Vestnik Moskovskogo gosudarstvennogo oblastnogo universiteta. Seriya: Estestvennye nauki [Vestnik Moscow State Regional University. Series: Natural Sciences]*, 1, 51–65 [in Russian].

35. Cellmer, R., Bełej, M., Zrobek, S., & Subic-Kovac, M. (2014). Urban Land Value Maps. *Methodological Approach. Geod. Vestnik*, 58, 535–551.

36. Avrunev, E. I., Gatina, N. V., Kozina, M. V., & Popov, V. K. (2019). Three-dimensional visualization of adverse environmental conditions for adjusting the cadastral value of land. *Izvestiya Tomskogo politekhnicheskogo universiteta. Inzhiniring georesursov [Bulletin of the Tomsk Polytechnic University. Geo-Resource Engineering]*, 1(330), 181–190 [in Russian].