Prospects for reducing the volume of the regional shadow real estate market of St. Petersburg in the context of digitalization of society

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Abstract. The paper discusses the reduction of losses from the shadow economy in the city of St. Petersburg of the Russian Federation. 230 households representing different sectors of society were analyzed. Based on the analysis, an econometric model was developed, with the help of which it was possible to calculate the effectiveness of increasing the proposed non-linear tax rate, as well as the amount of losses that the city budget loses annually, due to the concealment of rental income. Based on the data obtained, it was concluded that with the help of advanced digital tools for tracking the availability of property and generating income from it, the city budget can receive a fairly significant part of the income that can be used in good state intentions. In addition, the paper presents an analytical structure of the state of households of state and municipal employees living and working in St. Petersburg, as well as deputies of various levels. The amount of income that the city does not receive due to the shadow real estate rental market is estimated at $ 4.4 million annually, which is a very significant indicator for Russia.

Keywords. regional economy; real estate market; shadow sector of the economy; socio-economic inequality; taxes.

1. Introduction

The digitalization of society has now reached a high level, but insufficient implementation of the most progressive achievements of this mechanism in the state apparatus remains a crucial issue. In particular, the government has big data on the property and income of citizens, but does not compare it to discover potential shadow sources of income. At the current level of development of digitalization, this procedure can be automated using a neurointerface or even a standard analytical model as the one presented in this paper.

This study is devoted to the possibility of stabilizing the socio-economic situation in a region as a whole. Scientific literature often addresses the problems of economic development of regions and countries (see papers by Skhvediani, A.E., Kudryavtseva, T.Y. Didenko, N.I., Skripnuk, D.F., Mirolyubova, O.V. Demidenko, D.S., Gorovoy, A.A., Malevskia-Malevich, E.D, etc.) [1,2,3]. Many works aim to find additional ways to improve economic efficiency [4]. Among the causes that could facilitate a regional economic growth researchers name development of human potential (Rodionov, D.G., Kudryavtseva, T.J., Shabunina, T.V., Shchelkina, S.P. [5,6]) and housing improvement. However, these solutions do not reduce the problems associated with the digital development of society, but rather make allowance for their proportional growth.
In addition, analyses of regional economy often focus on neural networks [8], rather than the applicability of these tools for the state apparatus. Ex ante and ex post approaches are also used [9]. Nowadays, economic modeling is a rather common phenomenon that helps to efficiently predict the long-term development of a certain region or the processes of neutralizing its problems [10,11]. The developed economic models can also be used in environmental assessments [12]. However, it should be noted that most models developed so far are aimed at improving the socio-economic situation in Russian regions according to the innovative scenario of their development [13,14,15], but these are development models that often neglect finding solutions to the existing problems. Scientific literature mainly focuses on the social development of citizens to create balanced demand within the regional economic system, as pointed out in the works of Farvaque, E, Mihailov, A, Naghavi, A, Stroeva, O.A., Mironenko, N.V., Lyapina, I.R., Petrukhina, E.V. [16, 17].

The issues of the economy being premised on a digital basis are widely discussed in business papers but are very often overlooked in the public sector. The problem of digitalization of the state apparatus is often a secondary concern in practical work. At the same time, the problems of digitalization taking root in the society are addressed in many papers. In this regard, Bataev, A.V., Plotnikova, E.V. bring up the positive aspects and efficiency of digital banking, examining the issues of inaccessibility of this tool for middle-aged and senior citizens and the economic risks they bear attempting to use these services, which give a wide range of economic preferences to young people [18]. The digital component is involved in economic assessments only to the extent of using digitalization at the level of various enterprises. For example, Demidenko, D.S., Kulibanova, V.V., Maruta, V.G. use digitalization to assess the capitalization of companies [19], while Gromova, E.A. uses it to assess the automotive industry in Russia [20].

The problem of applying tax legislation is also widely discussed in the European and American environment. Milenka Villca-Pozo, Juan Pablo Gonzales-Bustos evaluate tax legislation in terms of promoting the construction of energy-efficient buildings [21], Nasir Javed, Ehsan Saqib, Abdul Razaq, and Urooj Saeed provide a substantial evidence base for revising the taxable property base using GIS and MIS systems [22]. Recent technological innovations in the tax system are also examined by Bernardo D. Olivares Olivares [23]. Furthermore, there are many papers on tax behavior, including works by Eugenia Politou, Efthimios Alepis, Constantinos Patsakis [24], and also by Muhammad Shakaib Akram, Anecla Malik, Mahmud Akhter Shareef, M. Awais Shakir Goraya [25]. To better understand this paper, it is also highly recommendable to read an article by Walter Didimo, Luca Giamminonni, Giuseppe Liotta, Fabrizio Montecchiani, and Daniele Pagliuca, which is an extensive study of tax evasion using TaxNet – a digital network visualization system [26]. Rather common are also works devoted to the standard of living of the elderly generation [27].

It is stated the issues and problems of the state apparatus associated with using the most advanced technologies are disregarded, despite the conceptual immaturity of digital mechanisms and problems generated by the shadow sector, which can be easily solved at the current stage of development.

2.Methods.

To reduce the segment of the shadow economy in the real estate sector, this study proposes shifting the method for determining the population's tax burden from income to the fact of ownership, as in Norway and Denmark. Below we provide an economic justification of this measure and its results.

One of the typical problems of a densely populated region with developed tourism like St. Petersburg is the concealment of the taxable base from short- and long-term property rental.

This problem can be liquidated using the Norwegian taxation mechanism. A person who owns more than one property, excluding a garage and a summer cottage/residential building with a plot of land, most likely rents it out and even more likely does not declare this income annually to conceal this activity.

In particular, this fact can be proved by considering the examples of citizens who own several properties of a similar type, e.g. apartments. These people are often not registered as sole proprietors, although they could take advantage of the simplified tax system, paying 6% of income from this activity
instead of the 13% payable as personal income tax. Therefore, it can be concluded that this type of income is concealed from government taxation.

Generally, we understand that owning more than one item of property is not a prerequisite for comfortable existence and is luxury, which is being increasingly taxed in a number of countries. This is why this study proposes imposing taxes on the income-generating property of individuals.

To calculate the economic effect, we conducted an empirical study of data on the income, property, and property obligations of the public officials of St. Petersburg, municipal officials of the inner city municipalities of St. Petersburg, members of the Legislative Assembly of St. Petersburg and members of the municipal councils of the inner city municipalities of St. Petersburg. The sample included 230 households in total, and it is rather representative due to the large number of officials of all ranks and deputies engaged in various activities.

The following assumptions were used in the sampling and assessment of the final economic effect:

1. In this study, almost every respondent has a university degree. Thus, an assumption is made that residents of St. Petersburg without a university degree do have enough money to buy two or more items of properties for rent.

2. It is assumed that there is a category of citizens who use property for personal purposes. The number of people receiving income from property is determined according to the Pareto principle, where 80% of respondents are actually engaged in illegal income generation.

3. When calculating the introduction of a new tax rate on personal property it is possible to avoid this tax by making the property over to other people, which is estimated at 20% according to the Pareto principle.

4. Since data on income and property is publicly available by household, and the average number of household members in St. Petersburg is three, the calculation is made by the number of households with the assumption that two out of three household members have university degrees and one is a minor, with the average number of household members in the sample at 2.23.

5. Increased taxes should be imposed not on the second piece of property, but on the part that is greater than the whole value (when considered from the perspective of a large number of shares in the property).

6. As of today, a 2% personal property tax is imposed on taxable assets included in the list determined in accordance with Article 378.2 (7) of the Tax Code of the Russian Federation, taxable assets stipulated in the second paragraph of Article 378.2 (10) of the Tax Code of the Russian Federation, and taxable assets with a cadastral value of more than 300 million rubles. Taking into account the taxation of these categories, which are not left out of this study, we introduced a correction factor of 0.4, assuming that this category accounts for 60% of income in the tax structure due to the fact that the aforementioned articles of the Russian Tax Code concern commercial property owned by individuals, which is not a subject of this study.

7. Due to the complexity of the created model and the fact that citizens gain most commercial profit from such pieces of property as apartments/rooms, we introduced a correcting factor of 0.75, concluding that 30% of budget revenues comes from taxes on personal property of the apartment/room type. Subsequent calculations are made based on this amount.

8. The calculations do not make allowance for tax deductions (10 or 20 sq. m. per owner in the first property) and the differentiation of this tax depending on property value (7-20 million — 0.15, more than 20 million — 0.2% for apartments and rooms) — we chose to ignore them for the sake of convenience.

Source data:
1. The population of St. Petersburg as of January 1, 2019, is 5,383,890 people [28].
2. The percentage of persons over the age of 18 with a university degree or incomplete higher education in St. Petersburg is 45.12% [29].
3. Plots of land are taxed at a rate of 0.5% of the cadastral value of property (for St. Petersburg) [30].
4. As of 2017, the following public authorities were selected for the analysis (income and property information for 2018 had not been published at the time of the study):
- Administration of the Vyborgsky District of St. Petersburg (100 people);
- transport Committee of St. Petersburg (52 people);
- Legislative Assembly of St. Petersburg (15 deputies and 19 staff members were selected due to the large number of persons in the "leader" category, which could reduce the representativeness of the sample study to a minimum);
- Intra-city municipal formation of St. Petersburg Vasileostrovsky municipal district (8 deputies, 14 administrative and institutional officers and 1 council member).
- Intra-city municipal formation of St. Petersburg Svetlanovskoye municipal district (20 deputies, 1 administrative officer).

3. Results and discussion
The cumulative findings of the study are presented in the table.

Table 1 - Empirical assessment summary

| Indicator names                                      | Administration of the Vyborgsky District of St. Petersburg | Transport Committee of St. Petersburg | Legislative Assembly of St. Petersburg | Vasileostrovsky MD | Svetlanovskoye MD | TOTAL |
|------------------------------------------------------|----------------------------------------------------------|--------------------------------------|---------------------------------------|--------------------|------------------|-------|
| Number of respondents                                | 100                                                      | 52                                   | 34                                    | 23                 | 21               | 230   |
| Average number of household members                  | 2.19                                                     | 2.35                                 | 2.06                                  | 2.22               | 2.43             | 2.23  |
| Average monthly salary per family member (rubles)    | 63,709.02                                                | 75,818.65                            | 143,501.42                            | 45,189.54          | 107,152.05       | 79,954.53 |
| Number of first properties of respondents             | 64.08                                                    | 39.82                                | 29.76                                 | 14.60              | 16.36            | 164.62 |
| Number of households owning the first property        | 83                                                       | 46                                   | 31                                    | 18                 | 17               | 195   |
| Share of households with one residential property or a part of it | 83.00%                                                   | 88.46%                               | 91.18%                                | 78.26%             | 80.95%           | 84.78% |
| Number of second and subsequent properties owned by respondents as a whole | 28.30                                                    | 23.25                                | 10.54                                 | 7.43               | 8.02             | 77.53 |
| Number of households owning second and subsequent properties | 42                                                       | 35                                   | 15                                    | 11                 | 13               | 116   |
| Share of households with two and more residential properties or parts of it | 42.00%                                                   | 67.31%                               | 44.12%                                | 47.83%             | 61.90%           | 50.43% |
It should be noted that the "number of households owning the second and subsequent items of properties" indicator is aggregated and effectively reflects 2-5 apartments/rooms in households in total, even if ownership is partial.

As can be seen from this table, 230 households account for 242.15 properties (apartments/rooms) taxed primarily at a rate of 0.1% of their cadastral value.

The "share adjustment with allowance for partial property ownership" indicator, which is used in the further study, is also aggregated and means not the percentage of households with 2 or more properties, but the percentage of households that would wholly own a second property if persons owning 3 and more properties assigned their shares to those who do not wholly own the first or second property.

Below we provide a description of the calculation steps.

To assess the efficiency of the proposed measure aimed at increasing this tax rate, let us make the following calculations:

1. 33.71% of households have two or more items of properties, including partial ownership (in aggregated form).
2. A correction factor of 0.4512 shall be applied to this number due to the fact that the sample mostly includes people with university degrees, without which citizens have a rather low chance of earning enough money to afford two properties.
3. Then among the total tax revenues from properties of the apartment/room type we have 15.21% of objects that are subject to the proposed increased tax.

The amount of taxes paid by citizens from apartments/rooms is calculated as follows:

1. The total revenue from personal property taxes is 3,296,242.9 thousand rubles.
2. A correction factor of 0.4 is applied under assumption No. 6.
3. A correction factor of 0.75 is applied under assumption No. 7.
4. A correction factor of 0.8 is applied under assumption No. 3 due to the desire of citizens not to pay taxes in full.
5. As a result, the budget of St. Petersburg receives 791,098.3 thousand rubles from taxes on personal property if the apartment/room type.

15.21% of this sum equals 120,326.05 thousand rubles. Thus, if this sum, which is the tax on the second and subsequent properties, is subject to a 2% tax, the city will receive an additional 2,406,521.02 thousand rubles, increasing tax revenue by 0.41%.

According to our study, the city's losses from non-payment of personal income taxes are estimated at the sum specified in Table 2.

| Residents, people | 5,383,890 |
|-------------------|-----------|
| Households, units | 2,413,829.82 |
| Households with 2 properties (aggr.), units. | 127,511.20 |
| Total revenue from them, thousand rubles. | 3,247,353.23 |
| Payable tax, without assumptions, thousand rubles. | 422,155.92 |
| Total tax losses, thousand rubles. | 337,724.74 |
The calculation is provided with allowance for assumption 2. The assessment is based on the average apartment rental price in St. Petersburg of 31,834 rubles [31]. The calculation uses the absolute number of property items owned by the population without applying the correction factor of education.

It should be noted that this model does not take into account the income from other types of property, which is done so as to not overcomplicate it. The model also ignores cross-regional interactions, i.e. it does not take into account people who live in one region and work in another, which is rather common for St. Petersburg as a city of federal importance.

4. Conclusions

In conclusion, it should be noted that the measures proposed in this paper could reduce socio-economic inequality without loss. The city's budget would receive additional inflows, using them to improve the region's investment attractiveness and the population's well-being.

Furthermore, the implementation of modern technologies of objective automated control over the citizens' income could significantly relieve the tax burden placed on organizations and citizens with an average income, redirecting it towards people with the highest income. New technologies, such as digital banking and Internet of things along with artificial intelligence, allow the government to create a fully autonomous system that could use big data to identify disproportions between expenses and income, thereby revealing concealed sources of income. Unfortunately, today these procedures are entirely manual and concern rather significant sums that could cover staff expenses at least to some extent. Such low efficiency can never have a meaningful impact on taxation and needs to be reorganized towards relying more on digitalization and less on the human factor.

References

1. Skhvediani, A.E., Kudryavtseva, T.Y. The socioeconomic development of Russia: Some historical aspects (2018) European Research Studies Journal, 21 (4), 195-207.
2. Didenko, N.I., Skripnuk, D.F., Miroyubova, O.V. Big data and the global economy (2017) Proceedings of 2017 10th International Conference Management of Large-Scale System Development, MLSD 2017
3. Demidenko, D.S., Gorovoy, A.A., Malevskaia-Malevich, E.D. Specifics of indicative macroeconomic planning (2017) Proceedings of the 29th International Business Information Management Association Conference - Education Excellence and Innovation Management through Vision 2020: From Regional Development Sustainability to Global Economic Growth, pp. 2222-2227.
4. Rudskaya, I.A., Rodionov, D.G. Comprehensive evaluation of Russian regional innovation system performance using a two-stage econometric model (2018) Espacios, 39 (4), article № 40.
5. Rodionov, D.G., Kudryavtseva, T.J., Skhvediani, A.E. Human development and income inequality as factors of regional economic growth (2018) European Research Studies Journal, 21 (Special Issue 2), pp. 323-337.
6. Shabunina, T.V., Shchelkina, S.P., Rodionov, D.G. Regional habitat as a factor of the human capital assets development in Russian regions // Journal of Social Sciences Research (2018) https://www.scopus.com/record/display.url?eid=2-s2.0-85059518066&korig=resultslist (Date of the application 15.07.2019)
7. Zaborovskaia, O.V., Plotnikova, E.V. Assessment of the housing stock condition as an element for estimating the conditions for human capital development in the regions of the Russian Federation (2016) Proceedings of the 28th International Business Information Management Association Conference - Vision 2020: Innovation Management, Development Sustainability, and Competitive Economic Growth, 1218-1225.
8. Babkin, A.V., Karlina, E.P., Epifanova, N.Sh. Neural networks as a tool of forecasting of socioeconomic systems strategic development (2016) Proceedings of the 28th International Business Information Management Association Conference - Vision 2020: Innovation Management, Development Sustainability, and Competitive Economic Growth, 11-17.
9. Ivanova, M., Degtereva, V., Gorovoy, A. Ex ante and ex post regulatory impact assessment in Russia: framework and practice (2017) Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 - Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth, 2017-January, 1262-1266.
10. Rudskaya, I., Rodionov, D. Econometric modeling as a tool for evaluating the performance of regional innovation systems (with regions of the Russian Federation as the example) (2017) Academy of Strategic Management Journal, 16 (Special issue 2).

11. Sokolitsyn, A.S., Ivanov, M.V., Sokolitsyna, N.A. Statistic modeling industrial enterprises production process parameters (2017) Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 - Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth, 2017-January, 1041-1052.

12. Shabunina, T.V., Shchelkina, S.P., Rodionov, D.G. An innovative approach to the transformation of eco-economic space of a region based on the green economy principles (2017) Academy of Strategic Management Journal, 16 (Special issue 1), 176-185.

13. Rudskaya, I. A regional innovation system: Formation features and growth areas (case study: St. Petersburg) (2017) Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 - Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth, 2017-January, 541-547.

14. Rodionov, D., Rudskaya, I., Degtereva, V. Regional foresight as a technology for development of the regional innovation system (2017) Proceedings of the 29th International Business Information Management Association Conference - Education Excellence and Innovation Management through Vision 2020: From Regional Development Sustainability to Global Economic Growth, 2699-2705.

15. Rudskaya, I. Regional innovation foresights: drivers and barriers for development (2017) Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 - Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth, 2017-January, 889-903.

16. Farvaque, E; Mihailov, A; Naghavi, A The Grand Experiment of Com-munism: Discovering the Trade-Off between Equality and Efficiency // Journal of institutional and theoretical economics-zeitschrift fur die gesamte staatswissenschaft № 3 707-742. [web site] URL: https://apps.webofknowledge.com/full_record.do?product=WOS&search_mode=GeneralSearch&qid=2&SID=E1HsxnkJMk82sDzO5n&page=1&doc=5&cacheurlFromRightClick=no (Date of the application 08.07.2019).

17. Stroeva, O.A., Mironenko, N.V., Lyapina, I.R., Petrukhina, E.V. Peculiarities of formation of socially oriented strategy of economic growth of national economy (2016) European Research Studies Journal, 19 (2 Special Issue), 161-170.

18. Bataev, A.V., Plotnikova, E.V. Assessment of digital banks' performance Espacios (2019) [web site] URL: https://www.scopus.com/record/display.url?eid=2-s2.0-85067685609&origin=list (Date of the application 12.08.2019).

19. Demidenko, D.S., Kulibanova, V.V., Maruta, V.G. Using the principles of "digital economy" in assessing the company's capitalization Proceedings of the 31st International Business Information Management Association Conference (2018) 6087-6091.

20. Gromova, E.A. Digital economy development with an emphasis on automotive industry in Russia Espacios (2019) [web site] URL: https://www.scopus.com/record/display.url?eid=2-s2.0-85061654343&origin=list (Date of the application 12.08.2019).

21. Milenka Villca-Pozo, Juan Pablo Gonzales-Bustos Tax incentives to modernize the energy efficiency of the housing in Spain, Energy Policy, Volume 128, 2019, 530-538 [web site] URL: http://www.sciencedirect.com/science/article/pii/S0301421519300370 (Date of the application 12.09.2019).

22. Nasir Javed, Ehsan Saqib, Abdul Razaq, Urooj Saeed. 3.16 - Revamping Urban Immovable Property Tax System by Using GIS and MIS: A Case Study of Reforming Urban Taxation Systems Using Spatial Tools and Technology, Editor(s): Bo Huang, Comprehensive Geographic Information Systems, Elsevier, 2018, 272-296, [web site] URL: http://www.sciencedirect.com/science/article/pii/B9780124095489096913 (Date of the application 13.09.2019).

23. Bernardo D. Olivares Olivares, Technological innovation within the Spanish tax administration and data subjects' right to access: An opportunity knocks, Computer Law & Security Review, Volume 34, Issue 3, 2018, 628-639, [web site] URL: http://www.sciencedirect.com/science/article/pii/S0267364917303825 (Date of the application 13.09.2019).

24. Eugenia Politou, Efthimios Alepis, Constantinos Patsakis, Profiling tax and financial behaviour with big data under the GDPR, Computer Law & Security Review, Volume 35, Issue 3, 2019, 306-329.

25. Muhammad Shakaib Akram, Aneela Malik, Mahmud Akhter Shareef, M. Aways Shakir Goraya, Exploring the interrelationships between technological predictors and behavioral mediators in online tax filing: The moderating role of perceived risk, Government Information Quarterly, Volume 36, Issue 2, 2019, 237-251.
26. Walter Didimo, Luca Giamminonni, Giuseppe Liotta, Fabrizio Montecchiani, Daniele Pagliuca, A visual analytics system to support tax evasion discovery, Decision Support Systems, Volume 110, 2018, 71-83.

27. Goncharova, N., Degtereva, V. Expansive Use of Planning and Finance Mechanisms as a Factor Increasing the Living Standard of Elderly People (2017) Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 - Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth, 2017-January, 1175-1183.

28. Administration for Statistics of St. Petersburg City and Leningrad Region [web site] URL: http://petrostat.gks.ru/ (Date of the application 21.08.2018).

29. Volume 3. Education, Russian census [web site] URL: http://www.gks.ru/free_doc/new_site/perepis2010/croc/perepis_itogi1612.htm (Date of the application 21.08.2018).

30. Tax Code of the Russian Federation of July 31, 1998 No. 146-FZ // SPS Consultant Plus [web site] URL: http://www.consultant.ru/document/cons_doc_LAW_19671/ (Date of the application 12.08.2019).

31. Apartment sale and rental prices – St. Petersburg // Property sale and rental web site Domofond.ru OOO "KEX eCommerce" [web site] URL: https://www.domofond.ru/tseny-na-nedvizhimost/leningradskaya_oblast/sankt_peterburg-c3414 (Date of the application 26.07.2019).