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Article

Development of Tools for Synergy of Social Functions of the State and Housing Mortgage Loans in Russia: Regional Analysis of the Central, Southern and Volga Federal Districts

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Abstract: The article researches the features of the synergy of the social functions of the state and the housing mortgage loan (HML) in order to develop a tool that allows determining guidelines and directions for strengthening the effectiveness of collaboration between the state and the private sector represented by commercial banks in solving the most important social problem—providing housing to the population. The authors show that the use of the proposed assessment tool by state structures and commercial banks increases the effectiveness of solutions to the housing problem in the country and enhances the synergetic effect of a comprehensive increase in the standard of living of the population when synchronizing actions. The main purpose of the research was to develop an algorithm that determines the key factors influencing the number of issued HML. The object of the study is the Russian HML market on the example of three federal districts. The developed algorithm is based on the use of statistical analysis methods ANOVA, mutual regression and recursive feature elimination. The approbation of the results obtained on three subjects of the Russian Federation allowed us to obtain a set of significant factors of influence, taking into account regional peculiarities.

Keywords: social state; social function; housing mortgage loan; influencing factors the mortgage market; regional peculiarities Russian districts; quality of life of the people



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1. Introduction

Currently, the problem of providing people with residential real estate remains relevant, and there is no doubt that it is necessary to solve it. At the same time, the methods, tools, algorithms and priorities of actions of participants in the residential real estate market are not so unambiguous, and they are the object of acute discussions among researchers, both science and practice. The dynamically changing socio-economic situation in the country requires systematic updating of existing and creating new approaches for solving these problems.

The working hypothesis is that the housing mortgage lending market of the Russian Federation is influenced not only by economic but also social factors. At the same time, the main factors are common, but the regions have their own significant features.

The effectiveness of the tools used by state organizations to solve social problems has a direct and indirect impact on all spheres of life of the people and may differ in the strength of the impact. The consequences of the actions taken are related to the level of synergy between state structures and real estate market entities, synchronization of their goals, and a shift in focus to the social aspect of the aim. It is important that the individual goals of each market participant are respected, and there is no infringement of the interests and rights of any of them.

In this context, “banking services are increasingly becoming socially oriented, so one of the priorities of modern banks is the creation of socially significant financial products and services” (Sviridov 2015) which fully applies to housing mortgage lending (HML).

It is necessary to rethink the social function of the housing and communal services and develop tools to strengthen this function to solve new challenges. Moreover, the social function of the HML and development of tools becomes the main along with the universal functions inherent in this type of credit and increases its significance at the level of the entire country, its individual subjects and each person. It can be fully implemented only on the basis of synergy between commercial banks and state institutions of management and forecasting.

The proposed model aims to determine the main factors affecting the development of the HML market in each individual district of the Russian Federation. By taking into account the limited resources both at the level of the subject of the Russian Federation and a separate commercial bank, it is crucial to increase the effectiveness of the measures carried out by determining the areas of influence that have the maximum effect on the HML market. It is also important to determine the causality of the relationship between the identified factors and the indicators of HML—the number of given HML.

The main goal is to develop a tool that allows identifying the main factors influencing the count of issued HML and testing on the regions of Russia. Objective restrictions are imposed by the availability of information with the necessary detail only in Russia. The proposed tool should be adapted for other countries by taking into account regional peculiarities. The research of other countries goes beyond the boundaries of this article.

2. Literature Review

In the Deloitte Access Economics report ([Deloitte Access Economics 2018](#)) there is a separate section that highlights “Social benefits from an increase in the number of homeowners” and indicates that increasing the availability of purchasing your own residential real estate has a greater social value compared to renting housing:

- Communities with a higher proportion of people who own residential real estate are stronger because the value of housing is related to the quality of society. In addition, housing ownership gives people more incentives to be involved in political life and contributes to the long-term health of society;
- The children of homeowners are more likely to finish school than the children of real estate renters, especially in low-income families. They are 9% less likely to drop out of school than the children of tenants;
- Owning a home allows you to take better care of the older generation. The health benefits of home care compared to care in budgetary institutions are well known and recognized.

The development and improvement of forecasting tools, decision support in managing the economy in general, and the regions of the Russian Federation, in particular, is the subject of research by many scientists, among whom it is necessary to highlight L. R. Chernyakhovskaya, M. M. Nizamutdinova, V. V. Oreshnikov, A. R. Atnabayeva ([Chernyakhovskaya et al. 2019](#)), A. R. Bakhtizin ([Bakhtizin 2008](#)), N. V. Bakhtizin, V. L. Makarov ([Makarov 2005](#)) and many others.

AS. Sviridov, T. N. Gogoleva and Yu. I. Treshchevsky proposed a method for quantifying the social functions of business ([Sviridov 2015](#)) on the territory of conventionally designated clusters, where a set of 25 characteristics is used as a basis. This issue confirms the relevance and importance of assessing the social behavior of business but does not reflect the social significance of unique products and services.

In her work on the study of approaches to assessing the quality of life of people, M. L. Vartanova pointed out that the problem is complex and includes many metrics. Among them, “housing security” is included in the list of priorities ([Vartanova 2021](#)).

Separately, it is necessary to note the works of the Nobel Prize laureates in the field of research of cause and effect relationships in macroeconomics, assessment of the impact of decisions made by state bodies on industries, organizations and individual households—Thomas Sargent and Christopher Sims. One of the objects of the research was central banks,

as a subject of influence on the economy ([Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2011](#)).

In their work, they used adaptive simulation models, neural networks, technologies for restoring NULL or missing data based on the logical inference mechanism, and processing unstructured data as tools.

The above-mentioned studies focused on the use of regional state structures for the development of strategies, plans and measures for the development of regions with the possibility of subsequent assessment of their effectiveness and management during implementation. In particular, the CGE model was tested on the assessment of the impact of tax rates on the key macroeconomic characteristics of the Russian economy.

The above developments were the basis for the study of the implementation of the social function in the context of HML, as well as the development of a practical tool adapted to regional peculiarities.

According to paragraph 1, Article 7 of the Constitution of the Russian Federation, our country is defined as a social state whose policy is aimed at creating conditions that ensure a decent life and free human development. The existing theoretical approaches considering the welfare state agree in the opinion of the unity of economic and social goals of representatives of business and the country.

It should be agreed with V. A. Malgin that “in the development of corporate social responsibility in Russia, it should be borne in mind that the leading role here certainly belongs to the state” ([Malgin 2015](#)). At the same time, we propose to consider the social function of HML as a meta-function, which is a synthesis of the functions implemented by the loan, which is manifested in stimulating the achievement of social goals of the state through meeting the needs of individuals in their own residential real estate. The peculiarity of the social function is that, as it is a metacategory, it does not depend on the structure, sequence and strength of each individual function since it manifests itself regardless of these factors.

The trends in the development of causality models of social-economic processes identified and formulated by D. M. Nazarov confirm the validity of the use of these tools: “the third trend is related to machine learning algorithms and methods. Thanks to the flexibility of settings and instrumental support, these algorithms allow us to develop new methods and technologies for evaluating causal connections in social-economic processes within any of the approaches discussed above” ([Nazarov 2020](#)).

In addition, the need for effective mechanisms to support the purchase of housing, such as mortgages, is confirmed. It is important that the value of these mechanisms is significant for both adults and young adults ([Bryx et al. 2021](#)).

In this article, we focused on the housing mortgage lending market and its regional aspects without interconnection with the markets of other countries. It is due to the essential differences in the functioning of the markets. For example, “mortgage interest rates consist of base interest and spread” ([Baek et al. 2021](#)), and “in general, the base percentage is adjusted by the government to ensure the sustainability of the housing market” ([Baek et al. 2021](#)) is not relevant for Russia.

The high role and necessity of the state’s participation in the implementation of the social function are confirmed by the experience of China, which implemented rural public health insurance, which was called the New Rural Cooperative Medical Scheme (NRCMS), contributed to the development of the HLM market ([Yang et al. 2020](#)).

The need for active participation of political authorities in the regulation of the housing and communal services market is shown in researches on the development of Mortgage banking in Slovakia over a 20-year period ([Horvatova 2020](#)) and the Mortgage market in Azerbaijan ([Ganbarov et al. 2020](#)).

3. Materials and Methods

The social function of HML is realized for the people through the prism of the needs of each of its representatives and changes continuously simultaneously with the human

value system. At the same time, the issues of changing the essence of the social function of the HML, its effectiveness, assessing the demand for HML and the sufficiency of the relevant products offered by commercial banks remain open.

Given this specificity of the social function of the HML, it is necessary to take into account external factors affecting its implementation, namely the number of given HML.

The existing statistical data do not allow us to uniquely identify the number of households that own real estate. Even with these data, it is impossible to solve the problem of owning residential real estate “de facto”, and “not de jure”. For example, parents own several apartments, one of which is occupied by a son or daughter who is the owner but does not have the right in accordance with current legislation.

The data source is the official data of the state statistical organizations of Russia. It makes it possible to ensure comparability and reliability of the information, as well as methodological transparency of social and economic indicators.

In our research, we tried to maximize the count of social and economic features we could obtain.

We proceed from the fact that each individual person or household, as a consumer of a product or service, does not always act on the basis of absolute rationality, necessity and utility. Moreover, they are not always based on the possibility of using all the alternatives due to ignorance. Moreover, regional features of the economy and social situation have a direct impact on residents and may differ from each other, but they are conditionally permanent within the same territory due to the inertia of cultural and social preferences.

Based on the conditional rationality of human behavior and the presence of regional differences, it becomes necessary to develop a model for each individual region. In addition, this thesis imposes a number of restrictions, in particular, the impossibility of using only optimization methods or decision support systems. On the other hand, this approach is the basis for forming a model using separately such tools as regression models, including logistic ones, the support vector method, extreme gradient increase (XGBoost), etc.

It should be noted that, due to the complexity of housing mortgage lending as a phenomenon and process, as well as the multifactorial influence on the decision-making of people on the purchase of real estate and taking HML, it is impossible to rely only on expert opinion in determining the factors of influence. In this regard, the model used the maximum available data in open sources on social and economic indicators in the context of each region of the Russian Federation. The openness of information provides the possibility of reproducibility of the experiment and calculations, and annual updates of statistical data allow updating the conclusions.

Data for 2012–2020 were used to form the initial dataframe, and the missing values were filled in with averages because they are necessary for building the model and, at the same time, do not have a significant impact and do not distort the result. The degree of significance of these indicators for the number of issued AHML was determined using three different methodologies. These methods are implemented using Python and the scikit-learn library.

At the first stage, the evaluation of the significance of the features (calculation of the f significance metric) in relation to the target “number of issued HLS” was carried out in accordance with the ANOVA variance analysis. Using ANOVA is based on the need for multiple pairwise comparisons, and the Student’s criterion is not suitable for these purposes because we have more than two groups.

The analysis of variance created by Ronald Fischer was used for analyzing the results of experimental studies. The essence of this method is to determine the ratio of the inter-group and intra-group variance of the analyzed data. The indicator of variability is the sum of the squared deviations of the parameter from the average value, calculated separately for intra-group and inter-group datasets:

$$SS_T = SS_b + SS_w = \sum (X_{ij} - \bar{X}_G)^2 \quad (1)$$

On the basis of F-distribution, we then calculated the p -value that was carried out with the exception of features with a p -value above 0.05. The remaining features are ranked from the minimum p -value.

At the second stage, the degree of significance of descriptive characteristics was calculated based on mutual_info_regression [<https://scikit-learn.org>, 6 January 2021]¹. The idea is that the information gain (usually used in the construction of decision trees) is applied to perform the selection of features. Mutual information is calculated between two variables and measured as a decrease in uncertainty for one variable with a known value of the other variable. Mutual information takes the value 0 when the random variables are independent, and when the value increases, the relationship increases. The calculation function is based on the estimation of entropy by the distances of k -nearest neighbors. Compared to the classical correlation analysis, when using mutual_info_regression, there is a probability of increasing the number of features evaluated as relevant, which may be due to statistical noise in the original dataframe. This feature is taken into account by setting a limit of a number of selected variables. Only four variables with the maximum value are selected.

At the third stage, the selection of significant features took place on the basis of recursive feature elimination (recursive exclusion of features). The role of the estimator was determined by logistic regression. After the evaluator was trained, based on the generated initial dataset, a recursive consideration of a sequentially smaller set of features was carried out and cut off until the target value was reached. For the purpose of comparability and uniformity, the target number of variables was four [<https://scikit-learn.org>, 6 January 2021]².

Using only one method of selecting significant descriptive variables has a high probability of error. In order to reduce this probability, a stack of methods was used with subsequent averaging of the results. The metric of evaluation is the number of occurrences of the selected indicator because it is necessary to determine exactly the list of significant variables without quantifying them.

4. Results

Using these tools allowed us to obtain a set of 12 most significant influencing variables for each district of the Russian Federation. Then the number of occurrences for all regions of each federal district was calculated, and the ranking was carried out. As an illustration, we applied the described method to the analysis of three Federal Districts: the Central Federal District (CFD), the Southern Federal District (SFD) and the Volga Federal District (VFD).

A comparison of the results revealed that three indicators were included in the TOP five most important factors of influence in all three federal districts (Table 1):

- (1) Actual final consumption per capita—rubles per month per person;
- (2) Average income per capita—calculated using the value of the macroeconomic indicator of the average per capita monetary income of the population, determined in accordance with the Methodological Provisions for calculating the indicators of monetary income and expenditure of the population (Rosstat Order No. 465 of 2 July 2014, with changes on 20 November 2018);
- (3) Average salary—the following payments are not included in the salary: remuneration based on the results of work for a year, for years of service, paid once a year, one-time bonuses and incentives, including the cost of gifts, financial assistance for vacation and other payments that are of a one-time nature, regardless of whether they were provided to individual employees or to all employees.

These factors reflect the state of effective demand of consumers of residential mortgage loans (HML) and are common for the analyzed territories. The results obtained were confirmed by the logic of decision-making by commercial banks on the issuance of HML based on the analysis of the income level of the individual who applied for a loan.

It should be noted that at the same time in the Central Federal District and the Volga Federal District, the regional living wage was included in the list of factors, which suggests

the need for its revision in these regions individually, based on the possibilities of budgets and goals for the development of the HML market.

It is important to note that current federal districts have their own characteristics.

Table 1. TOP-5 factors of influence on the regional housing and communal services in the Southern Federal District, Central Federal District and Volga Federal District.

No.	Factor/Federal District	SFD	CFD	VFD
1	Actual final consumption per capita	+	+	+
2	Average income per capita	+	+	+
3	Average salary	+	+	+
4	GRP per capita	+		
5	Citizens' assessment of the executive power	+		
6	Regional living wage		+	+
7	The difficulty of obtaining a construction permit		+	
8	Median income per capita			+

The list of key influence factors for the Southern Federal District includes the following (Figure 1):

1. GRP per capita before 2004; GRP per capita after 2004—nominal value (population) × GDP deflator ÷ 12;
2. Citizens' assessment of the executive power—the percentage of citizens who positively assess the activities of the regional executive power according to the FSO.

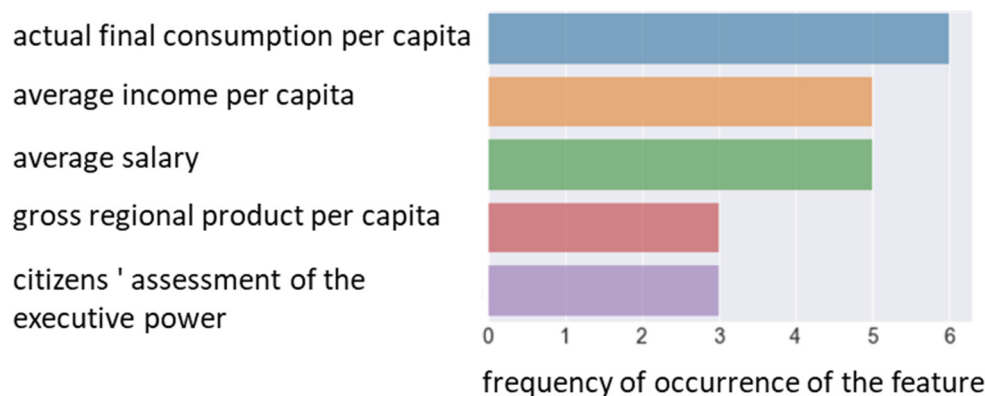


Figure 1. TOP 5 most common factors in the Southern Federal District.

These factors show that there is a potential for improving the efficiency of the regional economy in this territory and the need for an additional communication policy between the executive power and the population.

The Southern Federal District is characterized not only by differences in the conditions and types of economic activity of the population (from the regions of the Chernozem region to the high-altitude areas and resorts of the North Caucasus) but also by differences in the national way of life (due to the multinational population of the inhabitants of this district). The key factor is the “assessment by citizens of executive power” along with the “GRP per capita” factor. This allows us to assert that the stability of the HML market in this territory can be ensured with optimal communication policy of the executive power in relation to the population behaves.

Distinctive for the Central Federal District is the indicator “Complexity of obtaining a construction permit”, determined by the number of procedures calculated from the date of application of an economic entity to an organization that has the admission of self-regulating organizations in the field of construction to conduct geodetic works for topographic survey of a land plot until the day of obtaining a construction permit. (Figure 2).

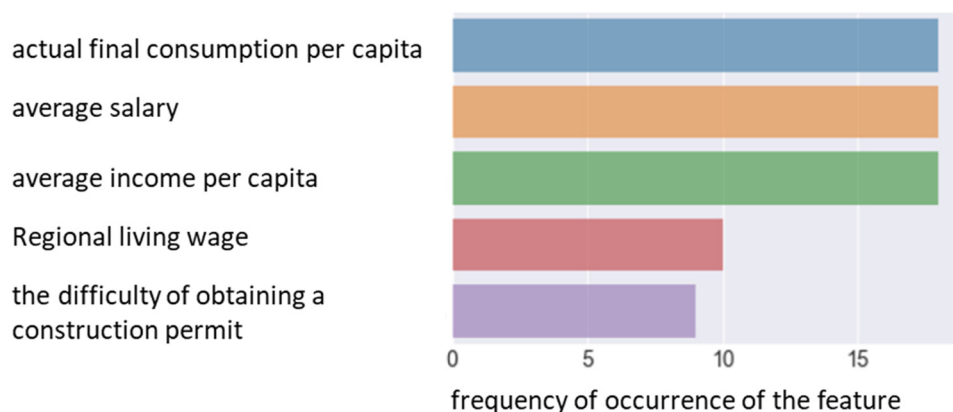


Figure 2. TOP 5 most common factors in the Central Federal District.

For the Central Federal District region, the key factor is the “difficulty in obtaining a construction permit”. The content of this factor is related to a number of procedures from the moment an economic entity applies to an organization that provides permission to organizations in the field of construction to carry out design and survey (including geodetic) works and so on until the day of obtaining permission to start construction work. The significance of this factor is determined by the main “capital” value of this region in the economic structure of the country.

For the Volga Federal District, the distinguishing factor is the median income per capita. It reflects not only an economic characteristic but also a social one: How significant is the stratification of society in the territory by income level (Figure 3)?

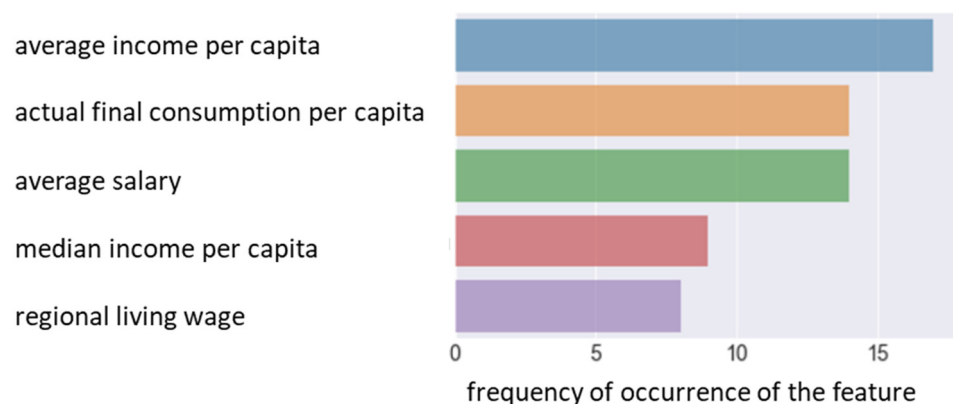


Figure 3. TOP 5 most common factors in the Volga Federal District.

For the VFD, the key factor is the median income per capita. This highlights the social peculiarity of this region, characterized by a noticeable social heterogeneity of the population in terms of income. This factor indicates the need for the executive branch to conduct a more active social policy in the region, for example, the use of special regional preferential programs in the field of banking housing and communal services.

The results obtained allow us to conclude that the most important factors affecting the number of issued HML are indicators that primarily characterize the level of income of the population.

It should be noted that not only the level of income of the country’s residents is important but also its distribution among the population strata. This conclusion is based on the importance of the “median income per capita”. Therefore, it is important not so much to increase the average income but to ensure the growth of the median one.

The indicator “GRP per capita” is a certain indicator that characterizes the efficiency of the national economy, which confirms not only the mathematical but also the logical and analytical relationship with HML.

The complexity of obtaining a construction permit shows the level of competition in the real estate construction market, which is directly related to the number of offers on the market.

5. Discussion

The conducted research allows us to substantiate the conclusion that there is a need for joint actions of the state and commercial banks to develop the housing mortgage loan market, which should be based not only on common national trends but also takes into account the peculiarities of each region separately. The proposed tool determines the most significant factors influencing an increase in the number of mortgage housing loans issued in a particular region.

This allows state structures to develop new and adjust existing measures to support people when applying to mortgage lending through the prism of the interconnection and inseparable practical implementation of the social function of the HML aimed at a qualitative change in the life of the people through meeting the fundamental human need for housing.

Commercial banks, in turn, receive tools for improving and adapting the economic and qualitative parameters of bank mortgage products. In general, this approach allows us to form strategies and plans for the development of regions taking into account the implementation of social goals of economic adaptation and the interests of banks in increasing the number of HML in conditions of limited resources.

At the same time, the developed tool is self-learning and can be used by commercial banks and state legislative and executive authorities in the future when more new data become available or if it is necessary to conduct a cluster analysis based on the selected criterion.

6. Conclusions

The results allow us to make the following conclusions:

1. The development of the HML market is an essential element of ensuring the social component of the sustainable development of the country's economy and the factor of ensuring social stability. The social function and residential complex as a metafunction synthesizes the implementation of a set of classical functions of credit and manifests itself in stimulating the achievement of both the social goals of the state and the satisfaction of the needs of individuals in their own residential real estate;
2. The need for a regional approach to the creation of tools for regulating the HML market is due to the fact that a separate participant in the relationship—an individual is subject to the irrationality of behavior due to ignorance of alternatives to choice and behavior. The scale of Russia determines both economic and social differences among residents of territories that are quite stable in the long term. This is shown in the model and allows us to identify regional features that restrain the further growth of the housing and communal services market;
3. The results of the research allow us to conclude that factors characterizing the level of income of the population are fundamental in the development of the housing and communal services market and the number of mortgage bank loans issued. At the same time, it is important not only the amount of income but also their distribution among different groups of the population. This is evidenced by such a factor as “median income per capita”. Therefore, the state policy in the field of development of the housing and communal services market should be based on the goal of increasing the median income, but not only average.

The analysis of the factors of the HML market showed that not only economic but also social factors have a significant impact on the development of the HML market:

1. For all districts of the Russian Federation selected for the testing with the model, the fundamental factor is the “GRP per capita”, which characterizes both the overall efficiency of the national economy and the logic-analytical relationship of this indicator and the housing and communal services. However, the key factors are varied;

2. Thus, qualitative and quantitative changes in the housing and communal services market are possible only with the joint actions of the welfare state and commercial banks. The demand for HML banking products largely depends on social factors and government support. Only the complex use of various statistical methods ensures the reliability of the estimates obtained in the study of the HLM market.

The usefulness of results is in the possibility of determining the main factors of influence on the market of housing and communal services of the regions of the Russian Federation with subsequent use for making correct management decisions.

We suppose the further directions of research are in correlation with limits.

1. The power of influence of the factors;
2. Adopting this model to other countries;
3. Validating results with a social survey of various HML market participants.

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Notes

- ¹ Available online: https://scikit-learn.org/stable/modules/generated/sklearn.feature_selection.mutual_info_regression.html (accessed on 6 January 2021).
- ² Available online: https://scikit-learn.org/stable/modules/generated/sklearn.feature_selection.RFE.html (accessed on 6 January 2021).

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