MEDZINÁRODNÉ VZŤAHY
SLOVAK JOURNAL OF INTERNATIONAL RELATIONS
Faculty of International Relations, University of Economics in Bratislava
2020, Volume XVIII., Issue 2, Pages 115 – 133
ISSN 1336-1562 (print), ISSN 1339-2751 (online)
Submitted: 1. 5. 2020 | Accepted: 11. 6. 2020 | Published 15. 6. 2020

ZÁKLADY INVESTIČNÉHO PLÁNOVANIA V ÚZEMNOM ROZVOJI: STRATÉGIA INDEXOVANIA DLHOPISOV

CONCEPTUAL BASES OF INVESTMENT PROJECTION OF TERRITORIAL DEVELOPMENT: BOND INDEXING STRATEGY

Lidiia Karpenko[1]

Článok skúma základy investičneho plánovania v územnom rozvoji s využitím stratégie indexovania dlhopisov v kontexte globalizačných zmien a európskej integrácie. Autor systematizuje inštrumentálnu základňu pre investičné plánovanie a budovanie prognostickej schopnosti medzinárodnej investičnej činnosti na regionálnej úrovni. V práci sú podrobne opísané výhody a nevýhody stratégie indexovania dlhopisov. Na základe vytvorených matematických modelov sa skúma vplyv priamych zahraničných investícií na reálny sektor regionálnej ekonomiky a zisťujú sa charakteristiky tohto vplyvu v podmienkach transformácie a ekonomickej bezpečnosti regiónu. Praktickú stránku práce predstavuje ekonomické a matematické prognózovanie priamych zahraničných investícií v regióne. V práci je uvedený model funkčnej závislosti medzi efektívnym ukazovateľom HRP a priamymi zahraničnými ivesticiami a nezamestnanosťou.
Kľúčové slová: stratégia indexovania dlhopisov, priame investície, ekonomická bezpečnosť, hrubý regionálny produkt, investičné plánovanie

This paper investigates the conceptual bases of investment projection of territorial development with using bond indexing strategy in the process modelling of international strategies in the coordinates of globalization changes and European integration. The author systematizes the instrumental base for investment projection and building the prognostic validity of international investment activity at the regional level. The advantages and disadvantages of bond indexing strategy are described in detail in the work. On the basis of the mathematical models constructed, the effect of foreign direct investment to the real sector of the regional economy is investigated and the features of such influence in the conditions of transformation and economic security of the region are determined. The practical side of the work is expressed by the economic and mathematical forecasting of foreign

[1] Prof. Lidiia Karpenko, DrSc., Odessa Regional Institute for Public Administration of the National Academy for Public Administration under the President of Ukraine, Genueska 22, 65009 Odessa, Ukraine, e-mail: lidiiako888@gmail.com

direct investment in the region. In the work, the model of functional dependence on the effective GRP indicator under the influence of two factors is built − FDI and unemployment rate.
Keywords: bond indexing strategy, direct investment, economic security, gross regional product, investment projection
JEL: M21, M29, O16

1 INTRODUCTION

The investment process is considered as a vector of strategic development and forms the basis for successful socio-economic development of the state and its regions. The revitalization of investment processes and the effective increase of investment volumes are important factors in implementing structural reforms in the economy and in implementing the innovation-investment model of development in targeted country. Implementation of current and long-term objectives of economic and social reforms today requires not only a well-balanced and sound investment policy, but also the formation of effective mechanisms for regulating investment processes, taking into account the peculiarities of the current state of economic development.

The existing conditions of world globalization and the specifics of socio-economic development of Ukraine lead to the fact that all internal regional entities are in fierce competition − the regions compete with each other in the production of products of the same industries, attracting investments, redistributing funds within the local budget, and financing development programs. Ensuring a favourable investment climate in the country and its regions remains a matter of strategic importance, the implementation of which depends on overcoming crisis phenomena in the economy, restoring sustainable growth of economic and social indicators for the development of the region, efficient use of all types of resources in the region, and modernizing the national economy (Ilysheva and Krylova, 2014).

Ensuring the stable investment process in the regions is due to both the need for the most efficient use of production factors and the relevance of the structural modernization of the regional economy due to the widespread introduction of innovations. In addition, one of the key problems of ensuring stable and dynamic development of the economic system of the state as a whole is the need to ensure the proportional development of individual territorial units. That is why the problem of imbalances in the economic development of individual regions is one of the most pressing problems of our time. In the process of managing regional development processes, as well as in the formation of regional investment policy, in the formation of managerial decisions, a special role is played by the ability to take into account numerous, often contradictory, factors, as well as to emphasize complex criteria for the effectiveness of ways to achieve the goals of socio-economic development.

2 LITERATURE REVIEW

A wide range of issues related to research in the area of investment activity and attracting foreign investment in order to improve the investment climate are reflected in the works of domestic and foreign scientists and economists. For example, Zhylinska (2018) presents innovative methods for the development of industries. Ilysheva and Krylova (2014) in their work paid attention to accounting, analysis and strategic management of innovation activity. Fabozzi (2008) explores investment management. Elton and Gruber (2014) or Brown and Goezmann (2014) investigate the question of modern portfolio theory and investment analysis. Pearce (2013), for instant, had dedicated his works to strategic management, formulation, implementation, and control. Karpenko (2018) is working on the issues of base alternatives and the paradigm of impact investing development in the context of globalization changes and euro integration. Lipkova (2012) and Navratil (2016) explore development issues of innovation policy of the European Union . Research in the formation of international strategies is incorporated in Lipkova and Bohac (2016).

However, the need for continuous development and the search for alternative ways of effective implementation of the regional investment policy, investment projection of territories, the development of bond indexing strategy makes it necessary to constantly improve existing methods and develop new mechanisms for attracting investment resources to the regional economy. Thus, the chosen research topic is relevant, requiring constant improvement and elaboration of ways to optimize the investment projection of territorial development. The apparatus of mathematical statistics will allow to approach the issues of rationalization of investment decisions.

3 RESEARCH GOAL

The purpose of the paper consists of studding the conceptual bases of investment projection of territorial development with using bond indexing strategy in the process modelling of international strategies in the contextof globalization changes and European integration. The author systematizes the instrumental base for investment projection and building the prognostic validity of international investment activity at the regional level. The advantages and disadvantages of bond indexing strategy are described in detail as well. On the basis of the mathematical models constructed, the effect of foreign direct investment to the real sector of the regional economy is investigated and the features of such influence in the conditions of transformation and economic security of the region are determined.

From the point of view of achieving macroeconomic stability of the Odessa region, estimation of the level of economic security has been calculated and substantiated. The conducted research gives an opportunity to analyze the state and prospects of the development of investment state policy at the regional level, to identify problems and important emphases in order to provide scientific and practical

recommendations on improving the mechanisms of state influence on the investment climate in the region and increase competitiveness. The state of the regional potential of the Odessa region demands a focused attention to the problems of FDI involvement in strategic sectors of the real sector of the Ukrainian economy.

The practical side of the work is expressed by the economic and mathematical forecasting of foreign direct investment in the region. Based on the correlation and determination coefficients, the trend form is substantiated. Author proposes the economic security ball assessment. The model of functional dependence on the effective GRP indicator under the influence of two factors is built – Foreign direct investment (FDI) and unemployment rate. The results confirm the effectiveness of using the bond indexing strategy for the application of investment projection of territorial development. The prospect of further research is a more detailed study of the methodology and mechanism for implementing regional investment policy based on the interaction of regional, municipal authorities and business structures, as well as the systematization of procedures for assessing the effectiveness of regional investment projects.

4 REGIONAL INVESTMENT POLICY AND IMPLEMENTATION OF REGIONAL INVESTMENT PROJECTS

Author has special scientific interest in studding the conceptual bases of regional investment policy. In the context of the interaction of regional, municipal authorities and business structures, the regional investment policy is a system of measures undertaken by regional authorities aimed at attracting and rational use of investment resources of all forms of ownership with a view to sustainable and socially-oriented development of the region. Within the framework of the regional investment policy, the activities of government institutions, as well as non-government entities, can be implemented to introduce a system of measures and mechanisms to stimulate investment activity, create a favourable investment climate and efficient use of investment resources in the region. One of the effective tools for implementing regional investment policy is the implementation of regional investment projects. An integral property of resources, including investment, is their limited nature. That is why often the problem arises of identifying and selecting priorities for regional investment projects. Comprehensive development of the region and an effective solution to the problem of regional investment distribution is possible only if there is a regional investment policy.

Within the framework of the regional investment policy, the activities of government bodies, as well as non-government entities, can be implemented to introduce the system of measures and mechanisms to stimulate investment activity, create a favourable investment climate and efficient use of investment resources in the region. One of the effective tools for the implementation of regional investment policy is the implementation of regional investment projects.

An integral property of resources, including investment, is their limited nature. That is why often the problem arises of identifying and selecting priorities for regional investment projects. Comprehensive development of the region and an effective solution to the problem of regional investment distribution is possible only if there is a regional investment policy. Moreover, the regional investment policy should be determined not only by government, but also take into account the interests of business, as the business community chooses its priorities both in projects and in the areas of their possible and profitable implementation. Due to the coordination of the priorities of regional investments, the manifestation of the interaction of regional, municipal authorities and business structures in the course of regional investment policy is carried out.

Systematization of scientists and economists studies made it possible to highlight the main difficulties in implementing regional investment policies and attracting regional investments, namely:

- relatively low attractiveness of the investment climate in most regions, which is caused by deformations and structural imbalances in regional development;
- lack of a systematic approach to the formation of state regional policy, the imperfection of legal regulation of regional economic development, the insufficient use of instruments of state stimulation of investment development of regions;
- insufficient influence of the system of formation of local budgets and transfers on the economic development of regions;
- outflow of labour and capital from one locality to the benefit of others (young people leave Ukraine and move to Europe);
- low efficiency and effectiveness of supporting regional investment activities through centralized resources, inhibition and opposition to decentralization of the budget process, low level of budget discipline;
- aggravation of investment competition between regions.

Of great importance for the implementation of regional investment policy is the problem of forming investment resources – both at the regional and local levels.

5 BOND INDEXING

Bond indexing means designing a portfolio so that its performance will match the performance of some bond index (Fabozzi, 2008). In indexing, performance is measured in terms of total rate of return achieved (or simply, total return) over some investment horizon. Total return over some investment horizon incorporates all three sources of return from holding a portfolio of bonds.

Several factors explain the recent popularity and phenomenal growth rate of bond indexing. First, the empirical evidence suggests that historically the overall performance of active bond managers has been poor. Second is the reduced advisory management fees charged for an indexed portfolio compared with active management advisory fees. Advisory fees charged by active managers typically range from 15 to 50 basis points. The range for indexed portfolios, in contrast, is 1 to 20 basis points, with the upper range representing the fees for enhanced and customized benchmark funds. Some pension funds have decided to do away with advisory fees and to manage some or all of their funds in-house following an indexing strategy (Casidy, 2014).

Lower non-advisory fees, such as custodial fees, make up the third explanation for the popularity of indexing. Finally, sponsors have greater control over external managers when an indexing strategy is selected. For example, in an actively managed portfolio, a sponsor who specifies a restriction on the portfolio's duration still gives the manager ample leeway to pursue strategies that may significantly underperform the index selected as a benchmark. In contrast, requiring an investment adviser to match an index gives little leeway to the manager and, therefore, should result in performance that does not significantly diverge from a benchmark.

Critics of indexing point out that although an indexing strategy matches the performance of some index, the performance of that index does not necessarily represent optimal performance. Moreover, matching an index does not mean that the manager will satisfy a client's return-requirement objective. For example, if the objective of a life insurance company or a pension fund is to have sufficient funds to satisfy a predetermined liability, indexing only reduces the likelihood that performance will not be materially worse than the index. The index's return is not necessarily related to the sponsor's liability. Finally, matching an index means that a money manager is restricted to the sectors of the bond market that are in the index, even though there may be attractive opportunities in market sectors excluded from the index. While the broad-based bond market indices typically include agency pass-through securities, other mortgage-backed securities such as private-label pass-through and collateralized mortgage obligations are generally not included. Yet it is in these fairly new markets that attractive returns to enhance performance may be available. Table 1 summarizes the advantages and disadvantages of bond indexing.

Table 1: Advantages and disadvantages of bond indexing

Advantages	*Disadvantages*
No dependence on expectations and little risk of underperforming the index	Bond indices do not reflect optimal performance
Reduced advisory and non-advisory fees	A bond index may not match the sponsor's liabilities
Greater sponsor control	Restrictions on fund management ignore opportunities

Source: systematized by author based on Fabozzi, 2008.

5.1 Factors to Consider in Selecting an Index

A money manager who wishes to pursue an indexing strategy must determine which bond index to replicate. There are a number of bond indices from which to select, and several factors influence the decision. The first is the investor's risk tolerance. Selection of an index that includes corporate bonds will expose the investor to credit risk. If this risk is unacceptable, an investor should avoid an index that includes this sector.

The second factor influencing the selection of an index is the investor's objective. For example, although the total return of the various indices tends to be highly positively correlated, the variability of total returns has been quite different. Therefore, an investor whose objective may be to minimize the variability of total returns will be biased toward one that has had, and expects to continue to have, low variability (i. e., a shorter duration relative to other indices). Moreover, variability of total return may not be symmetric in rising and falling markets. Investors who have expectations about the future direction of interest rates will favor the index that is expected to perform better given their expectations (Brown et al., 1987).

5.2 Bond Indexes

The wide range of bond market indices available can be classified as broad-based market indices and specialized market indices. The three broad-based market indices most commonly used by institutional investors are the Lehman Brothers Aggregate Index, the Salomon Brothers Broad Investment-Grade Bond Index, and the Merrill Lynch Domestic Market Index. The bond market sectors covered by these three indices are the Treasury, agency, investment-grade corporate, mortgage-backed, and Yankee markets (Karpenko et al., 2019).

The specialized market indices focus on only one sector of the bond market or a subsector of the bond market. Indices on sectors of the market are published by the three investment banking firms that produce the broad-based market indices. For example, Salomon Brothers publishes both a corporate bond index (a sector index) and a high-grade corporate bond index that includes AAA- and AA-rated corporate bonds (sub index of the corporate bond index). Firms that do not produce one of the three

broad-based market indices may provide specialized indices. Some examples are the Morgan Stanley Actively Traded MBS Index, the Donaldson Lufkin & Jenrette High Yield Index, the First Boston High Yield Index, the Goldman Sachs Convertible 100, and the Ryan Labs Treasury Index.

In recent years, money managers in consultation with their clients have been moving in the direction of customized benchmarks**.** A customized benchmark is a benchmark that is designed to meet a client's requirements and long-term objectives. For example, in December 1986, Salomon Brothers Inc. introduced its Large Pension Fund Baseline Bond Index as a standardized customized benchmark for large pension funds seeking to establish long-term core portfolios that more closely match the longer durations of their nominal dollar liabilities.

Why have broker or dealer firms developed and aggressively marketed their bond indexes? Enhancing the firm's image is only a minor reason. The key motivation lies in the potential profit that the firm will make by executing trades to set up an indexed portfolio and rebalance it. Typically, a broker or dealer charges a money manager who wants to set up or rebalance an index a nominal amount for providing the necessary data, but expects that the bulk of the trades will be executed through its trading desks. Also, by keeping the makeup of the index proprietary, those firms attempt to lock in customers to using their index.

5.3 Indexing Methodology

Once a money manager has decided to pursue an indexing strategy and has selected an index (broad-based bond market index, specialized market index, or customized benchmark), the next step is to construct a portfolio that will track the index. As with equity indexing, any discrepancy between the performance of the indexed portfolio and the index (whether positive or negative) is referred to as tracking error. Tracking error has three sources:

- transaction costs in constructing the indexed portfolio;
- differences in the composition of the indexed portfolio and the index itself;
- discrepancies between prices used by the organization constructing the index and transaction prices paid by the indexer (Karpenko and Voronzhak, 2018).

One approach in constructing the indexed portfolio is for the money manager to purchase, all the issues in the index according to their weight in the benchmark index. However, substantial tracking error will result from the transaction costs (and other fees) associated with purchasing all the issues and reinvesting cash flow (maturing principal and coupon interest). A broad-based market index could include over 5000 issues, so large transaction costs may make this approach impractical. In

addition, some issues in the index may not be available at the prices used in constructing the index. Instead of purchasing all issues in the index, the money manager may purchase just a sample of issues. While this approach reduces tracking error resulting from high transaction costs, it increases tracking error resulting from the mismatch of the indexed portfolio and the index.

Generally speaking, the fewer the number of issues used to replicate the index, the smaller the tracking error due to transaction costs, but the greater the tracking error risk due to the mismatch of the characteristics of the indexed portfolio and the index. In contrast, the more issues purchased to replicate the index, the greater the tracking error due to transaction costs, and the smaller the tracking error risk due to the mismatch of the indexed portfolio and the index. Obviously, then, there is a trade-off between tracking error and the number of issues used to construct the indexed portfolio.

There are three methodologies for designing a portfolio to replicate an index:

- the stratified sampling or cell approach;
- the optimization approach;
- the variance minimization approach.

For each of these approaches, the initial question that the indexer must ask is, what are the factors that affect a bond index's performance? Each approach assumes that the performance of an individual bond depends on a number of systematic factors that affect the performance of all bonds, and on a factor unique to the individual issue. This last risk is diversifiable risk. The objective of the three approaches is to construct an indexed portfolio that eliminates this diversifiable risk (Karpenko and Pashko, 2019).

The next, author is going to investigate *the Stratified Sampling or Cell Approach.* Under the stratified sampling approach to indexing**,** the index is divided into cells, each cell representing a different characteristic of the index. The most common characteristics used to break down an index are: (1) duration, (2) coupon, (3) maturity, (4) market sectors (Treasury, corporate, mortgage-backed), (5) credit rating, (6) call factors, and (7) sinking-fund featurei. The last two factors are particularly important because the call and sinking-fur c features of an issue will impact its performance (Elton and Gruber, 2014).

The next, author is going to investigate *the optimization approach.* In the optimization approach to indexing**,** the money manager seeks to design an indexed portfolio that will match the cell breakdown just as described and satisfy other constraints, but also optimize some objective. An objective might be to maximize the portfolio yield, to maximize convexity, or to maximize expected total returns. Constraints other than matching the cell breakdown might include not purchasing more

than a specified amount of one issuer or group of issuers, or overweighting certain sectors for enhanced indexing (Navratil, 2016).

The computational technique used to derive the optimal solution to the indexing problem in this approach is mathematical programming. When the objective function that the indexer seeks to optimize is a linear function, linear programming (a specific form of mathematical programming) is used. If the objective function is quadratic, then the particular mathematical programming technique used is quadratic programming.

The next direction is *variance minimization approach*. The variance minimization approach to indexing is by far the most complex. This approach requires using historical data to estimate the variance of the tracking error. This is done by estimating a price function for every issue in the index. The price function is estimated on the basis of two sets of factors: (1) the cash flows from the issue discounted at the theoretical spot rates and (2) other factors such as the duration or sector characteristics discussed earlier. The price function is estimated, using a large universe of issues and statistical techniques, from historical data. Once the price function for each issue is obtained, a variance equation for the tracking error can be constructed. The objective then is to minimize the variance of the tracking error in constructing the indexed portfolio. Because the variance is a quadratic function (the difference between the benchmark return and the indexed portfolio's return, squared), quadratic programming is used to find the optimal indexed portfolio in terms of minimized tracking error. The biggest problem with this approach is that estimating the price function from historical data is very difficult in the Treasury market, let alone the corporate market or the new-issue market. Also, the price function may not be stable.

Although the stratified sampling (or cell) approach seems to be the easiest to use, it is extremely difficult to implement when large, diversified portfolios are taken as the benchmark. In this case, many cells are required, and the problem becomes complex. Also, because the handpicking of issues to match each cell is subjective, tracking error may result. Mathematical programming reduces the complexity of the problem when well-defined constraints are employed, allowing the indexer to analyze large quantities of data optimally (Navratil, 2019).

5 RESULTS

The practical part of the work encompass the economic and statistical analysis of the impact of foreign direct investment on the development of the Odessa region. We analyse the foreign direct investment (FDI) in the Odessa region and the impact of Gross regional product (GRP) during the period of 2009-2019 (Table 2).

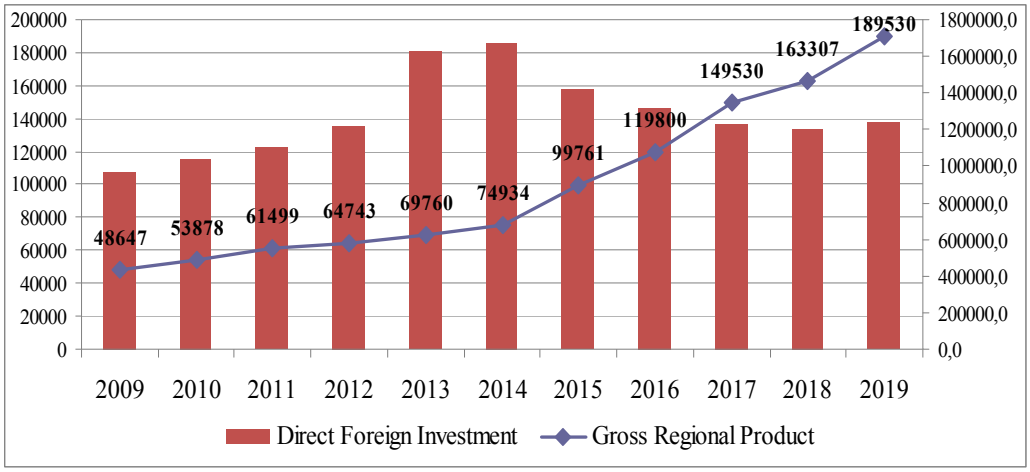
Table 2: Dynamics of FDI, GRP and Unemployment in 2009-2019 in Odessa region

Year	*Gross regional product (GRP)*		*Foreign direct investment (FDI)*		*Unemployment*	
	million UAH	growth rate (decrease), %	thousand USD	growth rate (decrease), %	%	absolute deviation, percentage points
2009	48647	…	970152.5	…	6.7	…
2010	53878	10,75	1041987.7	7.40	6.3	-0.4
2011	61499	14,14	1107326.6	6.27	6.4	0.1
2012	64743	5.27	1220519.4	10.22	6.4	0.0
2013	69760	7.75	1629074.2	33.47	6.1	-0.3
2014	74934	7.42	1671661.5	2.61	6.5	0.4
2015	99761	33.13	1423290.8	-14.86	6.7	0.2
2016	119800	20.09	1320345.6	-7.23	6.5	-0.2
2017	149530	24.82	1228752.8	-6.94	6.8	0.3
2018	163307	9.21	1202594.7	-2.13	7.1	0.3
2019	189530	16.06	1237202.8	2.88	6.4	-0.7

Source: calculated by author on the base of Ukrstat, 2020.

Figure 1 presents the dependence of macroeconomic indicators − Foreign direct investment and Gross regional product.

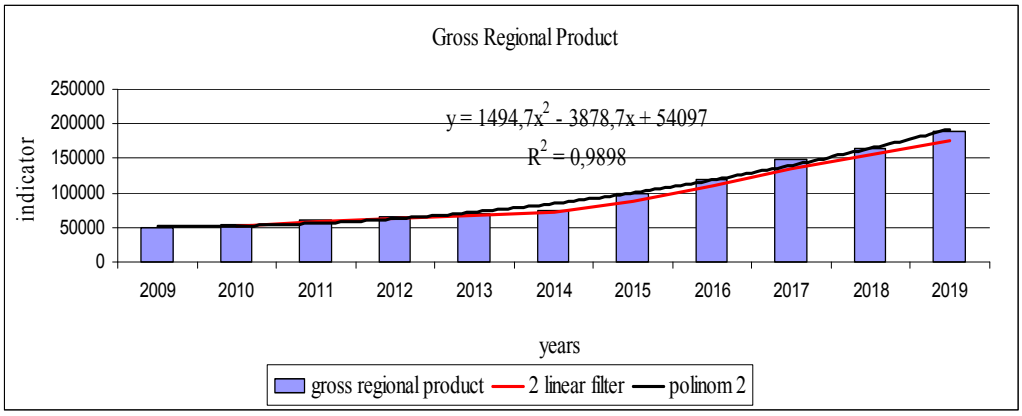
Figure 1: Dynamic of FDI and GRP in Odessa region in 2009-2019



Source: processed by author.

Figures 1 and 2 present the analytical alignment of the studied indicators made by the trend extrapolation method.

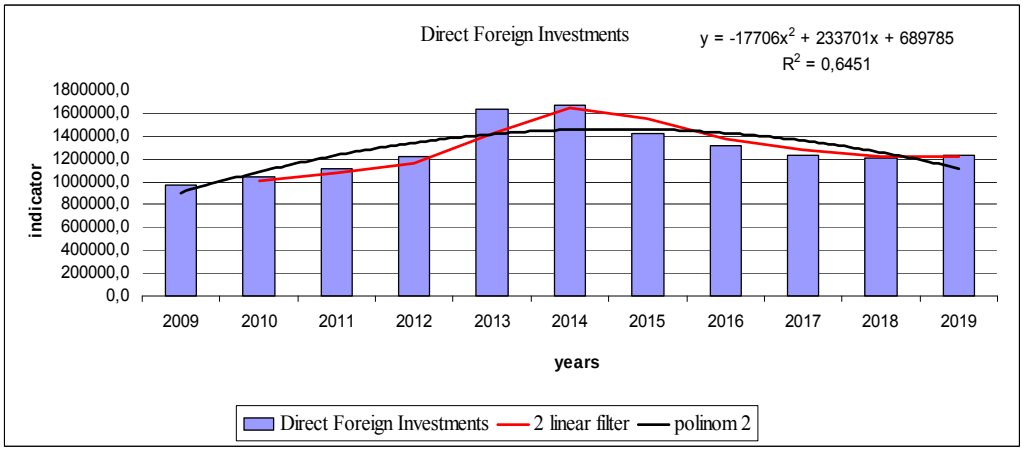
Figure 2: The analysis of the GRP dynamic with using method of extrapolation trend in 2009-2019



Source: precessed by author.

As can be seen from the Table 1 the growth of FDI in the Odessa region was gradually followed from 2009 2014, followed by a sharp decline until 2018 and positive dynamics in 2019, which is largely due to the conflict in the East and the annexation of the Autonomous Republic of Crimea. However, it should be noted that the fall in FDI since 2014 did not affect GRP growth; there was a positive upward trend. The of approximation confidence coefficient R = 0.99, indicating that the future forecast and model acceptance are significant.

Figure 3: The analysis of the FDI dynamic with using method of extrapolation trend in 2009-2019



Source: processed by author.

FDI attraction and socio-economic development of the region are interrelated processes. Let us evaluate the impact of FDI revenues as a factor trait to the number of productive indicators of socio-economic development of the Odessa region. The

financial component covers two dependent variables: foreign direct investment and unemployment in the region. In order to avoid the phenomenon of multicollinearity, all other factors with low impact to GRP were excluded from the regression model.

The differentiation of these factors makes it possible to study the degree of influence of each of them to the dynamics of GRP, as well as the time lag during which their effect is manifested on the basis of the use of correlation-regression analysis and the method of statistical equations.

The method of statistical equations of dependencies allows solving the following problems: identification of the main direction of development (trend); justification of forecast levels of economic phenomena; estimation of intensity of use of the factors that shape the development of economic phenomenon in dynamics (Karpenko and Fylippova, 2016).

The correlation coefficient (R) gets from –1 to +1. If $| R | < 0.30$, the association between the signs is weak; $0.30 \leq | r | \leq 0.70$ means moderate association; $r | > 0.70$ means strong relationship. When $| r | = 1$ – means functional communication.

The regression equation parameters were calculated using the Microsoft Office Excel 2010 analysis suite. The high value of the correlation and determination coefficients indicates that this dependence is quite regular. Significance F indicates that the evaluation results are sufficiently reliable. It is worth paying attention to the variance and F-statistics, their high value indicates the variation of the dependent and independent variables, so the regression equation is significant. Initial regression information and model quality analysis are given in the Table 3.

The magnitude of the multiple correlation coefficients R characterizes the quality of the model obtained. According to the calculations, this coefficient is 0.27, which indicates that there is a low correlation model. The value of R^2, that is, the coefficient of determination, indicates the correspondence of the original data and the regression model, since its value is as close as possible to 1 and is 0.74, which means the correctness (possibility) of choosing factors in the case of a systematic approach in the analysis of the obtained model with statistics.

Table 3: Communication tightness ratios

Regression statistics	
Regression statistics	0.27
Multiple R	0.74
Normalized R-square	-0.15
Standard error	42962
Observations	11

Source: processed by author.

A model of the following form was obtained:

$$Y = -92729.91 + 0.05\,x_1 + 15117.94\,x^2 \quad (1)$$

where Y is the Gross regional product of the Odessa region (million UAH), x_1 and x_2 are volume of foreign direct investments into the fixed capital of the Odessa region (million USD) and unemployment rate (%) repectively.

It is also necessary to graphically compare the results of the simulation by the obtained regression equation with the values of the statistical sample in order to visually evaluate the simulation error. Using a polynomial function, you can make a graphical prediction of the prediction of such models. Based on the obtained equation of dependence of GRP on the indicator of FDI in the Odessa region and the unemployment rate, we can conclude that FDI does not have a significant impact on GRP, however, reducing the unemployment rate significantly affects the growth of GRP, in particular, increasing unemployment by 1% reduces GRP by 15117.94 UAH.

On the basis of the generated statistics, we will evaluate the complex economic security of the Odessa region by the method of scoring on the selected components. Limit values of indicators for determining the level of economic security of the regions are presented in the Table 4.

Table 4: Limit values of indicators for determining the level of economic security of the Odessa region

Indicator	***Class I***	***Class II***	***Class III***
GRP per capita, UAH	33000-50000	32000-33000	15000-32000
Unemployment rate, %	< 7.6	7.6-8	> 8
Import coverage ratio	> 1	1	< 1
Part of the sold industrial products in the foreign country, %	> 1	1 – 2.9	<1

Source: processed by author.

For each of the components one indicator is selected: financial and economic component (GRP per capita); social component (unemployment rate); foreign economic component (ratio of exports by imports) (Lipkova, 2012); innovation-investment component (share of realized innovative products in the total volume of industrial products sold) (Pearce, 2013).

Given the overall rating of the indicators, it is advisable to apply the following gradation of security levels (total score is determined by multiplying the grade by its rating):

- Class I of security − high level of security (100-150 points);
- Class II of security − normal level (151-230 points);
- Class III of security − pre-crisis level (231-250 points).

Table 4: Limit values of economic security indicators

Indicator	***2018***
GRP per capita UAH	62701
Unemployment rate, %	6.4
Import coverage ratio	1.06
Part of the sold industrial products in the foreign country, %	1.1

Source: calculated by author

The parameters were calculated with the help of Microsoft Office Excel 2010 analysis package, the following indicators were calculated and obtained for the Odessa region by static indicators of 2018.

Table 5: Economic Security Ball Assessment in 2018

Region	***2018***				
	GRP per capita UAH / one person	***Unemployment rate***	***Import coverage ratio***	***Part of the sold industrial products in the foreign country, %***	***Σ***
Odessa region	75	25	25	50	175

Source: calculated by author

The economic security ball assessment is 175 points, which indicates the normal level of security in the Odessa region. Checking the adequacy of the model in the light of statistical characteristics makes it possible to conclude that the model of expert judgment is acceptable.

6 CONCLUSIONS

The paper proposes the bond indexing strategy for the application of investment design of territorial development. Active bond portfolio strategies seek to capitalize on expectations about changes in factors that will affect the price and, therefore, the performance of an issue over some investment horizon. The factors that affect a portfolio's return are (1) changes in the level of interest rates, (2) changes in the shape of the yield curve, (3) changes in yield spreads among bond sectors, and (4) changes in the yield spread for a particular bond. The total return framework should be

used to assess how changes in these factors will affect the performance of a strategy over some investment horizon.

Indexing a portfolio means designing a portfolio so that its total return will match the performance of some predetermined index. Indexing requires selecting a bond index to be replicated and constructing a portfolio so as to minimize tracking error. The methodologies used to construct an indexed portfolio include the stratified sampling or cell approach; the optimization approach; and the variance minimization approach. In an enhanced indexing strategy, the performance of the index becomes the minimum return objective that the portfolio manager attempts to achieve. A money manager can lever a position by borrowing funds in the repo market. When used for financing a position, a repo agreement is a collateralized borrowing. The advantage of leveraging is that it magnifies positive returns relative to an unlevered position; the disadvantage is that it magnifies negative returns.

The key goal of the regional investment policy should be the stable socio-economic development of the region based on the optimal use of investment resources. Achieving this goal requires not only increasing investment resources, but also increasing the economic and social efficiency of their use by directing financing to innovative development of production, creation of high-performance jobs, and development of the infrastructure environment. The financial support of investment activity at the regional level largely depends on the state and characteristics of the development of financial markets, among which the bank lending market and the stock market play a key role. Efficient financial markets provide access for corporate sector entities (corporate structures) to long-term resources, which makes capital-intensive investment possible. This reduces transaction costs, helps to increase the efficiency of regional investments and increase indicators of capital mobility.

Thus, the regional investment policy should be implemented, first of all, through the development and implementation of investment projects, grouped into a system of investment programs, formed on the basis of priority areas of socio-economic development of the region, taking into account the possible size of the financial base for the implementation of investment projects.

It should be noted that the effectiveness of the regional investment policy depends on the investment climate, which affects the intensity of the investment process, the volume of investments and determines the investment attractiveness of the region. Attracting investment based on the interaction of regional, municipal authorities and business structures is a priority for the development of the region's economy. In addition, the ability of the region's infrastructure to absorb and efficiently use investment funds is essential. In this sense, it is important to formalize approaches to determining the investment attractiveness of the region, since its positioning in this aspect allows attracting potential investors for the implementation of regional investment projects .

The state of the regional potential of the Odessa region demands a focused attention to the problems of FDI involvement in strategic sectors of the real sector of the Ukrainian economy. According to the conducted research (analysis of the region's potential), the regional investment policy should be aimed at the development of such sectors as agriculture, food and processing industry, energy, tourism, as these are areas where the Odessa region has advantages over other regions and investment potential. Increasing the competitiveness of the region's economy can be facilitated by the transition of the region to the digital economy model (including the exchange of tax information, etc.) and the increase in the flow of FDI from European Union countries into the economy of the Odessa region.

From the presented and calculated statistics and the obtained equations of mathematical analysis, it can be said that the share of offshore accounts for almost a third of all investments that have been invested in the economy of the Odessa region during the last 10 years. Considering the fact that they are mostly investments of Ukrainian companies, which are made in order to minimize taxation, such investments should not be considered as classic FDI, the main characteristic of which is the introduction of additional external resources into the economy of the state, region. Thus, it can be assumed that the volume of real FDI in the Odessa region during 2009-2019 and, accordingly, the real FDI per capita is significantly lower than the official data, which is also confirmed by the indicators of business activity in the region. From the point of view of achieving macroeconomic stabilization of the Odessa region, a point estimate of the level of economic security is 175 points, which confirms the normal level of security of the Odessa region. Considering that the institutional system of conditions of investment activity is not stable and is adjusted depending on the economic policy of the state in each specific period, the degree of investment activity of economic entities calculated and proved on the example of mathematical and statistical models, in particular, FDI do not have a significant impact on GRP, however, reducing the unemployment rate has a significant impact on GRP growth, in particular, increasing unemployment by 1% reduces GRP by 15117.94 UAH.

The results presented in the work confirm the effectiveness of using the bond indexing strategy for the application of investment projection of territorial development. The prospect of further research is a more detailed study of the methodology and mechanism for implementing regional investment policy based on the interaction of regional, municipal authorities and business structures, as well as the systematization of procedures for assessing the effectiveness of regional investment projects. In development of the work, it is planned to evaluate the effectiveness of the investment modelling for the tasks of macroeconomic development and macroeconomic stabilization policy.

REFERENCES:

1. BROWN, L. − HAGERMAN, R. − GRIFFIN, P. − ZMIJEWSKI, M. (1987): Security Analyst Superiority Relative to Univariate Time-Series Models in Forecasting Quarterly Earnings. In: *Journal of Accounting and Economics,* 1987, pp. 61-87.
2. CASIDY R. (2014): Linking Brand Orientation with Service Quality, Satisfaction, and Positive Word-of-Mouth: Evidence from the Higher Education Sector In: *Journal of Nonprofit and Public Sector Marketin,* 2014, 26, 2, pp. 142-161.
3. ELTON, E. J. – GRUBER, M. J. (2014): *Modern Portfolio Theory and Investment Analysis*. 7-th ed. New York: New York University, 2014. 728 p. ISBN-13 978-0470-05082-8.
   en_bal/arh_2012.htm>.
4. FABOZZI, F. J. (2008): *Investment management.* New Jersey: Prentice Hall, 2008. 837 p. ISBN 0-13-889155-9.
5. ILYSHEVA, N. – KRYLOVA, S. (2014): *Accounting, Analysis and Strategic Management of Innovation Activity.* Moscow: Finances & Statistics, 2014. 216 p. ISBN 978-5-279-03542-7.
6. KARPENKO, L. – VORONZHAK, P. (2018): Base alternatives and the paradigm of impact investing development in the coordinates of globalization changes and euro integration. In: *Proceedings of the 4th International Conference on European Integration 2018*. Ostrava: VSB - Technical University of Ostrava, 2018, pp.659-668. ISBN 978-80-248-4169-4.
7. KARPENKO, L. (2019): Innovative Trends in the Process Modeling of International Strategies: Systematic of Fundamental Factor Models. In: *Proceedings of the 6th International Conference on Strategies, Models and Technologies of Economic Systems Management,* 2019. Pp. 349-354. ISBN 978-94-6252-790-4.
8. KARPENKO, L. − PASHKO P. (2019): Formation of the system of fair businesspractice of the company under conditions of corporate responsibility. In: *Academy of Strategic Management Journal,* 2019, 18, 2, pp.1-8.
9. KARPENKO, L. et al. (2019): Strategic management of entrepreneurship based on smart technologies. [Online.] In: *Journal of Entrepreneurship Education*, 2019. [Cited 24.02.2020.] Available online: <https://www.abacademies.org/articles/Strategic-management-of-entrepreneurship-based-1528-2651-22-5-458.pdf>.
10. KARPENKO, L. M. – FILYPPOVA, S. V. (2016): Strategic competitive analysis of innovative enterprises development: predictive validity. In: *Actual problems of the economy*, 2016, 180, 6, pp. 392-404.

11. LIPKOVA, L. – BOHAC, R. (2016): Cataracts of globalization and the economic diplomacy of small states. In: *Research Journal of Economic Annals-XXI*, 2016, 159, 5-6, pp. 16-19.
12. LIPKOVA, L. – HOVORKOVA, K (2018): Economic situation in Norway after the outbreak of the global financial and oil crises in the context of EU integration trends. In: *Research Journal of Economic Annals-XXI*, 2018, 169, 1-2, pp. 12-14.
13. LIPKOVA, L. (2012): Innovation Policy of the European Union. In: *Proceeding of the 1st International Conference on European Integration 2012.* Ostrava: VSB - Technical University of Ostrava, 2012, pp. 171-178. ISBN 978-80-248-2685-1.
14. NAVRATIL, B. (2016): Ever-Coser or Multi-Speed Union. In: *Proceeding of the 3st International Conference on European Intergration 2016.* Ostrava: VSB - Technical University of Ostrava, 2016, pp. 649-655. ISBN 978-80-248-3911-0.
15. PEARCE, J.A. (2013): S*trategic management: formulation, implementation and control.* 8th ed. Publications Office of the McGraw-Hill Companies. ISBN 0-07-248846-8.
16. STANICKOVA, M. (2012): Assessment of Efficiency in Selected EU Member States by Data Envelopment Analysis Models. In: *Proceeding of the 1st International Conference on European Integration 2012*. Ostrava: VSB - Technical University of Ostrava, 2012, pp. 303-314. ISBN 978-80-248-2685-1.
17. UKRSTAT (2020): *Statistics.* [Online.] In: *Ukrstat*, 2020. [Cited 24.02.2020.]. Available online: <http://www.ukrstat.gov.ua/operativ/operativ2012/energ/