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THE IMPLEMENTATION OF REGRESSION CROSS-SECTORAL ANALYSIS IN PORTFOLIO MANAGEMENT

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Abstract: The most important role of the financial system of a national economy is to ensure the smooth flow of funds between the groups of entities that operate within each national economy. These are, on the one hand, entities that have surplus financial resources and entities that lack those resources.

In the last few decades, in all developed economic systems, the management of investment activities is mostly realized through portfolio management.

The modern theory of portfolio management, unlike the traditional one which selected securities that best suit the profiles and wishes of investors, emphasizes the assessment of risk and return as well as the investor's inclination towards risk.

The development of information and telecommunication technology has greatly facilitated the management of the securities portfolio by increasing the amount of available information needed for quality decision-making and in order to, to some extent, reduce the level of investment risk.

Regression cross-sectoral analysis, based on an extensive and complex statistical database and elaborate analytical tools and instruments, can greatly help investment decision makers, primarily portfolio managers, and point them in a timely manner, with a certain degree of probability, to possible directions for their future investment activities.

Taking into account the scarce literature in the field of regression cross-sectoral analysis in portfolio management, it can be concluded that the holders of investment activities in making investment decisions rely more on their experience, intuition and theoretical knowledge and less on quantitative indicators and results of modern regression cross-sectoral analysis as well as on probability theories.

The use of the results of regression cross-sectoral analysis in portfolio management should be a priority in future activities of those responsible for implementing an efficient and consistent investment policy, which ultimately necessarily reflects an increase in national wealth and brings higher economic growth.

Keywords: portfolio management, securities, regression cross-sectoral analysis, quantitative indicators, probability theory, national wealth and economic growth.

INTRODUCTION

An elaborate system of input-output tables and their analysis, which represent the basis of regression cross-sectoral analysis, was published by Vasily Leontiev in his article "The Structure of the American Economy 1919-1929". Because of this revolutionary idea, he received the 1969 Nobel Prize in Economics.

The best statistical basis for a complex analysis of the structure of economy and mutual relations of market participants, import-export flows, reproduction processes, investment activities and consumption in the national economy is provided by input-output intersectoral tables on the basis of which the intersectoral analysis model is constructed.

The cross-sectoral model enables an analytical view of the structure and interdependence of individual economic processes, as well as the connections that economic subjects create with each other.

The advantage of applying regression cross-sectoral analysis in many areas of the economy lies in the fact that this type of analysis provides the most detailed and accurate data on the level and type of interconnection of market participants. This analysis is based on original and exact data that the subjects of the national economy submit to the official statistical service in accordance with the law.

Taking into account that the intensity and level of mutual relations between the subjects of the

national economy can be measured and quantified through unput-output tables, it is possible to determine the cause-and-effect relationship of increase in production in one subject towards the increase in production in another economic entity.

Which of the above is important for portfolio management?

The results of regression cross-sectoral analysis represent a good starting point for portfolio management because at any time they can provide investment policy makers with timely information on which participants will be potential issuers of securities and what their most likely investments will be, if investment activities have already taken place regarding a certain investor.

Obtaining timely information on future investment activities of certain market participants gives portfolio managers space for detailed consideration and the possibility of timely selection of securities issuers, which opens the possibility for achieving higher profits, and thus the realization of successful portfolio management.

1. THE PLACE OF PORTFOLIO MANAGEMENT IN THE ECONOMIC SYSTEM

The successful function of portfolio management comes down to defining a system that will enable timely and quality selection of securities, which ultimately leads to higher efficiency of the financial market and ensures that the available financial resources achieve greater efficiency of investments in an economic system.

Thus, with the existing level of capacity, greater economic activity and profitability of the domestic economy can be achieved, as a precondition for a higher level of material well-being. This is particularly important for countries that lack fresh capital, as well as countries that are transitioning from a state of stagnation to a state of accelerated economic growth when there is an increased demand for available capital.

"Portfolio management results in the fact that the shares of companies which, according to investors, have weaker profit prospects, and thus weaker earning power for their owners, will be offered in greater numbers on the financial market."

Higher interest in selling than interest in buying reduces the prices of securities to a lower level, which allows interested investors to take a controlling stake in such companies at favorable prices. Therefore, interested stakeholders come into a position to impose their management and development strategy, thus putting them on the healing track.

Thus spontaneously, ie restructuring of the economy almost uncontrolled by the state, for most small and medium enterprises can be a way out of long-term stagnation or loss-making business."

Active portfolio management leads to profitable companies and projects being transparently legitimized through a continuously stable high level of prices of their securities, with a tendency to grow. This makes it clear to rational investors, who are not looking for short-term speculative profits, where to invest their free and available funds.

In cases when the current situation in the company's business is not good enough, if there is a tendency for its securities to grow, investors will invest their money in that company, due to potential capital gains.

Precisely because of that, at the level of the economy as a whole, money is directed in the direction of profitable companies and projects, which is extremely important for the dynamics of economic development. Portfolio management, figuratively speaking, results in determining the priorities of the financial market to which money and capital are directed.

These priorities will organize efficient capital movement in the national economy, and if the results achieved are sufficiently attractive compared to similar countries, especially in the immediate geographical environment, and accompanied by adequate processing by the national statistical system and regular publication in the country and abroad, sooner or later, will lead to a larger inflow of capital in the form of foreign direct and portfolio investments. This additionally influences the dynamics of the development of the national economy.

We should keep in mind that portfolio investments from abroad react very easily to market instabilities and in case of unexpected risk, they easily withdraw from the host country, thus deepening the crisis due to which foreign portfolio investors decided to sell their shares. Therefore, the beneficial effect of foreign portfolio investments is undoubted, but with the condition of serious and long-term stability of the development economic policy in the country and favorable political conditions in the country and the environment.

"Investment funds as institutions specialized in portfolio management, which can actively involve a large number of small and uninformed investors in transactions on the financial

market, can play a significant role in the privatization process. Investment funds have emerged in the form of privatization investment funds, in most countries in transition where privatization has involved the free or almost free allocation of purchasing power to all citizens or part of it. These funds were created in an organized manner as national state investment funds (such as in Poland) or as spontaneously formed institutions (Slovenia and the Czech Republic) ".

Unlike investment funds in developed market economies, privatization investment funds in transition countries have played more or less a role in the process of corporate control of privatized companies. In that sense, the question arose: if funds manage companies, who manages funds, ie managers?

If the state were to act again as a controller of funds, either directly or through a state bank or other state financial institution, as in some cases in the Czech Republic, we would not have the resolution to the crucial problem of state influence on private decisions, but it would only move the same problem to another level while delaying its resolution with, quite clearly, negative consequences for private life.

2. THE ROLE AND IMPORTANCE OF REGRESSION CROSS-SECTORAL ANALYSIS IN PORTFOLIO MANAGEMENT

In the abstract of this paper, it has already been mentioned that there is a scarce literature in the field of regression cross-sectoral analysis in portfolio management, and that it can be concluded that investment decision makers rely more on their experience, intuition and theoretical knowledge and less on quantitative indicators and results of modern regression cross-sectoral analysis and probability theory.

Investment management has an already developed method of acting on the financial market if problems of an external nature occur on the same. This primarily refers to unforeseen situations which, by their nature, have a periodic and stochastic character. For example, in relatively longer periods of time, economic growth stagnates globally. War conflicts are taking place in certain regions of the world, the price of oil on the world market is cyclical, droughts and floods are becoming more frequent on a global level, earthquakes destroy entire regions.

One of the unforeseen situations in society, which is still ongoing, is the corona virus pandemic, which has greatly affected the current stagnation of economic growth globally and as a consequence the collapse of many companies, which due to their specific market position, failed to adapt to the situation.

All the above mentioned situations greatly affect the movement of securities prices.

During a global crisis and natural disasters, the movement of securities prices is quite clear. All prices have a downward trajectory. The job of the portfolio manager is reduced to the activities of urgent sale of these securities in order to minimize losses or purchase of securities at the moment when they reach the minimum value. It is usually expected that the prices of securities will gain, and then they will be bought as soon as possible.

It can be noticed at the New York Stock Exchange how important the moment of buying securities is in trading, where seconds play an important role, not minutes or hours.

Most transactions are performed under the stress of losses for buyer or seller. It looks, looking from the side, as if it is a 100-meter race, where the start, training and fitness of the competitors are important.

All of the above leads us to the conclusion that potential investors and sellers of securities are always in a state of anticipation of what will happen; they are rarely in a position to be able to predict the occurrence of a certain situation.

The question is whether it is possible to predict at least a part of the stated tendencies and processes. Is it possible to determine a sufficient number of parameters that will indicate the future course and direction of events and with what dose of probability we can determine that?

If portfolio managers acquire such information, we can say that in that case they will be superior to other participants in the transactions in question, and that they will make the greatest possible profit in them.

Having sufficient reliable information on the future course of securities prices, portfolio managers have the opportunity to buy securities whose value will increase, as well as to, in a timely manner, sell shares whose value will decrease in due course.

In these cases, timely information is invaluable and leads to the maximum possible profit.

Assistance in obtaining timely information to portfolio managers with a certain dose of probability of a positive outcome is provided by regression cross-sectoral analysis in cooperation with probability theory.

3. USE OF THE RESULTS OF REGRESSION CROSS-SECTORAL ANALYSIS IN PORTFOLIO MANAGEMENT

The results of regression cross-sectoral analysis should be the starting point for portfolio management because they give a quantified picture of the most likely future investment activities, in detail, for each market participant or group of participants, which creates preconditions for future investors for quality and timely selection of securities." .

The logic of regression cross-sectoral analysis is to monitor the consequent connections through regression inverse coefficients, if there is investment activity in one sector of the national economy.

What is the consequence of this initial investment activity?

The consequence, in the first instance, is a necessary increase in production, and thus increased investment activity, in a proportional amount determined by the size of regression inverse coefficients in all other sectors of the national economy, ie in sectors that have any direct or indirect links with economic activities of the specified sector. The next consequence is the increased demand for raw materials in all sectors, which have increased production, all due to increased deliveries of raw materials in these sectors to the first sector, and so on indefinitely.

We can conclude that the initial increase of investment activity in one sector results in a multiplicative increase of investment activities in all sectors (increase on several occasions) and the totality and size of these investment activities is proportional to the size of the corresponding regression inverse coefficients.

This method can indicate to portfolio managers much earlier who will be potential eminent securities as well as how much their investment activity will be if there is already an investment in a particular market participant. Therefore, the results of regression cross-sectoral analysis enable the successful realization of the planned function of portfolio management.

This type of analysis cannot predict which of the investors will be profitable in the future, but by including other types of economic analysis, the future picture of the economic structure can be projected with a higher probability.

Thus, using the results of the regression cross-sectoral model, it is possible to predict with great certainty the amount and place of the most probable investments if investments have already taken place in one particular sector.

Investing in securities by market participants that have a lower rank compared to their future, potential rank, means for investors lower investments compared to the most likely future investments. This creates the possibility of achieving higher profits, which is the goal of successful portfolio management.

The logic of regression cross-sectoral analysis starts from the fact that market participants in a national economy are connected by flows of reproductive material. One finished product contains a whole series of transactions together with the raw materials of which this product is made.

The finished product in one production sector is a raw material in another sector, which is used in the creation of a new product (coal is a finished product in mining, while it is a raw material in energy), in the next phase the finished product in the second sector is a raw material for production in the third sector (the finished product in the energy sector is electricity, while in the automotive industry it is a raw material), etc.

All transactions of raw materials that occur in the national economy are recorded in intersectoral tables, on the basis of which the construction of a regression intersectoral model is performed. Thus, the construction of a regression cross-sectoral model is based on data from real economic life, so that the results of this type of analysis most closely reflect the production system of the national economy.

The correct approach to regression cross-sectoral analysis enables the perception of the largest number of invisible connections between market participants and is the basis for designing the optimal economic structure.

Since the data in the intersectoral input-output tables are expressed in absolute values for the purposes of a comprehensive economic regression analysis, these data are converted into stable values (relative numbers - coefficients).

The application of regression cross-sectoral analysis in portfolio management comes down to converting absolute values from the second quadrant of input-output tables into technical and inverse regression coefficients.

„Technical coefficients $a_{ij} = x_{ij} X_j$ show how much the production value of the i-th sector is directly dependent on each produced unit of the j-th sector. So the technical coefficient shows us the direct dependence of sector i and sector j. It further tells us which part of the sector's production also directly depends on the size of the total sector's production.

Furthermore, the technical coefficients show the maximum possible production of sector j, given the production possibilities of the i-th sector.

We can say that the maximum production of sector j is determined by the inequality Xjxijaij, which means that for a certain size of the production of sector j, the appropriate size of the products of sector i must be used. "

Unlike the technical coefficients that show the direct dependence of the two sectors of production, the inverse coefficients show the direct and indirect cause-and-effect relationships that exist in the entire production system of the national economy.

We herewith provide a practical use of the results of regression cross-sectoral analysis on one, at the present moment, current example.

The Government of Serbia has decided and entered into a contractual obligation to build several sections of highways in the total value of about 2,000,000,000 dollars.

The problem of determining the necessary investment activities in the entire national economy is posed in order to enable conditions for increased delivery of necessary raw materials to the construction sector by other sectors in the period of realization of the set tasks of construction of civil engineering facilities in the Republic of Serbia.

In addition to the above, it is necessary to provide the necessary data to the portfolio management on the amount of future investments in all economic sectors of the national economy as well as the probability of changes in securities prices in these sectors.

The problem can be resolved through inverse coefficients.

Example 1. - Suppose that the utilization of production capacity is 100%.

Then the amount of required investment funds is defined by the relation k=IjK100
where k is the amount of required investments in the j-th sector, Ij is the inverse coefficient of the j-th sector and K is the amount of total investments in the project implementation, so we get the following:

No	Production sectors	Inverse coefficient	Amount of required investments in USD
1.	Industry and mining	0,47988	959.760.000
2.	Agriculture and fisheries	0,04721	94,420.000
3.	Forestry	0,00525	10.500.000
4.	Water management	0,00119	2.380.000
5.	Construction	0,24898	497960.000
6.	Traffice and transferss	0,02789	55.780.000
7.	Trade	0,05482	109.640.000
8.	Hospitality and tourissm	0,00014	280.000
9.	Craft services and repairs	0,01931	38.620.000
10.	Communal activity	0,01009	20.180.000
11.	Other production services	0,10380	207.600.000
12.	Old material and waste	0,00144	2.880.000
	TOTAL	**1,00000**	**2.000.000.000**

Example 2. - Average actual utilization of production capacities in 2020 is 83,9%

In the first example, the assumption is that the production capacities are fully utilized. This assumption does not correspond to reality, but it is a good basis for understanding the subject matter and indicates the proportions that should be kept in mind when estimating the size of future investments by production sectors, if the investment in construction is made in the amount of 2,000,000,000 USD.

In example 2, the degree of capacity utilization by individual sectors is included in the analysis.

In this case, the proportions determined by the inverse coefficients should be corrected (multiplied) by the percentages of capacity utilization.

k=IjqjK100

where k is the amount of required investments in the j-th sector, Ij is the inverse coefficient of the j-th sector, qj is the degree of utilization of production capacities and K is the amount of total investments in the project implementation

No	Sektori proizvodnje	Inverzni koeficijent	Procenat korišćenja kapaciteta	Iznos potrebnih investicija u USD
1.	Industry and mining	0,47988	79	758.210.400
2.	Agriculture and fisheries	0,04721	82	77.424.400
3.	Forestry	0,00525	80	8.400.000
4.	Water management	0,00119	91	2.164.000
5.	Construction	0,24898	75	373.470.000
6.	Traffice and transferss	0,02789	78	43.508.400
7.	Trade	0,05482	90	98.676.000
8.	Hospitality and tourissm	0,00014	80	224.000
9.	Craft services and repairs	0,01931	87	33.599.700
10.	Communal activity	0,01009	90	18.162.000
11.	Other production services	0,10380	85	176.460.000
12.	Old material and waste	0,00144	90	2.592.000
	TOTAL	1,00000	83,9	1.592.892.400

In this second example, we can see that the realization of the contracted work of the construction sector requires smaller investments in other sectors by 407,107,600 USD because the existing production capacity is not used by 100% but is used on average by 83.9%.

Which of the above may be used by portfolio managers?

Based on the tables and data obtained by the above analysis, the following can be concluded:

The realization of the project for the construction of law-level civil engineering facilities worth 2 billion USD will cause investment activity in all sectors of the national economy in the future, in proportions that depend on the size of inverse coefficients and the current degree of utilization of production capacity.

The amount of expected investments primarily depends on the intensity of the connection of the production sectors with the construction sector, ie on the size of the inverse coefficients.

The largest investment activity will be performed in the Industry and Mining sector in the amount of 758,210,400 USD because its connection with the Construction sector is extremely large, ie the inverse coefficient is 0.47988 and the real utilization of production capacities is 79%.

The second largest will be investment in the Construction sector in the amount of 373,470,000 USD, taking into account the degree of utilization of production capacity of 75% and the size of the inverse coefficient of 0.24898.

In addition to the above, there will realize investments in the Trade sector in the amount of 98,676,000 USD, because its connection with the Construction sector (value of the inverse coefficient) is 0.05482, and the degree of capacity utilization is 90%, while the Other production services sector will have investment activity in the amount of 176,460,000 USD.

Sectors whose inverse coefficient is relatively small will have insignificant investments.

These facts give portfolio managers timely information that in the coming period there will inevitably exist investments and increased production in the sectors of Industry and Mining, Trade as well as in the sector of Other production services.

Due to the increase in production, these sectors will need financial resources to expand production capacity, procure raw materials and finance fixed production costs.

In accordance with the balance sheet in these sectors, part of the securities will be sold and loans will be contracted, or some other form of indebtedness will be realized in order to finance the increased delivery to the Construction sector.

It should be expected that, during the realization of increased deliveries by the mentioned

sectors to the Construction sector, and even later, the value of their securities will grow because they will have increased economic activities in a relatively short period, which entails increasing the attractiveness of investing in their portfolio.

The task of portfolio managers is to try to buy securities of these sectors on the securities market before they enter the investment activity and cooperation with the Construction sector, ie to buy them at a price that will in any case be lower than they would pay in the course of the investment cycle or during the realization of increased deliveries to the Construction sector, which creates space for higher profits.

4. CONCLUSION

Successful portfolio management cannot be realized without the use of modern tools of economic amalysis and reliable and timely data in this area as well as the results of complex regression cross-sectoral analysis.

Portfolio managers who invest financial resources in securities based on intuition, experiential norms and qualitative indicators realize their activities in the zone of increased risk of possible losses, because they are not able to see all aspects of the investment. They are also not able to see all the seemingly invisible connections that have been established in the complex relations between the actors of the national economy.

Furthermore, they are not in a position to predict the future movement of investment activities, but they are always in a situation to have a lack of information and time for the realization of business activities.

Managers who use information extensively in their functional activity and apply cross-sectoral regression analysis methods have a great advantage over others because they expect to make a profit when trading securities with a high dose of certainty (probability).

They are able to buy securities at the right time, which in most cases means their lower price; thus, they make higher profits through the realization of portfolio transactions.

Assuming that there functions an efficient financial market, ie the market in which business information is momentarily reflected in the prices of securities, risk and return on individual securities are directly proportional. In other words, high-yield securities, as a rule, carry a high level of risk.

The risk of securities trading can be reduced if all the necessary information is provided in a timely manner and a thorough and sophisticated regression cross-sectoral analysis and risk analysis is performed, which is impossible to realize without knowledge of complex statistical instruments.

After all, the task of the statistical service is to provide every interested market participant with timely and reliable information.

Given the level of current use of the results of regression cross-sectoral analysis in portfolio management, there is a need for education of this category of financial professionals. This would ultimately increase the efficiency of investing in securities and increase the overall economic growth rate of the economy through given financial funds, thus increasing the certainty of profit as well.

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