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Economic Activities Structure and Development: Evidence From Serbia

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Differences in the level of economic achievement in different countries are determined by the availability of resources and economic policies. Economic development could be influenced by the structure of economic activities. The paper brings the analysis of Serbian economic activities structure and its influence on the level of development during the period 2008-2011. The optimization model has been used to show economic activities to be invested in in order to achieve development. The results show that the most important economic activities in enhancing development are information and communication; finance and insurance; water supply, sewerage, waste management and remediation activities.

Keywords: economic activities, structure, economic development, Serbia, optimization

1. Introduction

Economies undergo certain reforms in order to increase economic growth and development. In order to achieve the set goals, governments use different tools and mechanisms to make structural and institutional changes. The role of government is to coordinate and make decisions for the economy transformation and achieve the best possible economic performances. Economic development demands the growth in production, employment and income. Productivity increase and better distribution of natural resources and physical and human capital contribute fastest to achieving economic growth and development (Cypher and Dietz, 2009). Due to different levels of development, different economies should combine various relevant concepts and theories of the classical economic analysis with the new models that provide wider approaches. Moreover, depending on the available resources, the government has to invest in the activities that contribute to the rise of the gross domestic product.

The aim of this paper is to analyse the influence of economic activities structure on the Serbian economic development. The purpose of this paper is the analysis and optimization of investment into certain activities that contribute most to achieving economic development. Investment problem is formulated as a portfolio optimization problem based on Markowitz' theory of mean-variance optimization. The rest of this paper is structured as follows: characteristics of sectors' structure during economic development are presented in Section 2. The overview of the Serbian economic growth and the development strategies is given in Section 3. In the Methodology section the optimization model is introduced. The following section illustrates the application of the proposed model on the real data for the period 2008 - 2011. Finally, concluding remarks are presented in the last section.

2. Sectors' structure during economic development

Different economic activities enable development. Investments, productivity and competitiveness increase the income. Depending on the available resources, certain economic activities are being developed that represent target activities for development. There are various models and strategies of growth and development. Many economic models of growth and development are based on the analyses of efficient allocations of the available resources in a given economy, along with the change of institutional structure. For

example, classical theories of economic development are: 1) Rostow stages of growth, 2) market based, 3) international dependence and 4) structural change (Todoro & Smith, 2003). Structural changes that are important and necessary for achieving growth and development are: decreased agriculture share in production, increase in industry production, changes in export structure, increased level of knowledge application and undergoing fundamental institutional changes. When transitional countries are observed, the structural change that occurred in production patterns is the reallocation of physical capital from inefficient to efficient sectors and the emergence of a new, competitive economic system (Pintea).Transitional countries need to make both structural changes and establishk a market based economy. Those models are connected due to establishing market based economy that demands structural changes and vice versa. This is emphased by the obligations to fulfill the EU requirements.

Developing countries base growth upon agriculture. However, along with economic growth come the changes in the sectors` structure that economic growth is based upon. Economic development is related to increasing the share of industrial sector, and decreasing the share of agriculture in the GDP (Punnyasavatsut & Coxhead, 2002; Arandjelovic et al., 2013, Savic, 2014). Thus the development of industrial sector influences the service sector to gain more importance. Owing to a wider usage of technology, the industrial sector becomes more profitable than agriculture. The usage of technologies, knowledge, human and physical capital helps establishing a more efficient industrial sector that increases the level of production. Furthermore, the development of industrial sector causes changes in the export structure. The development of industry sector enables exports of industrial, knowledge and technology supported products.

However, for achieving a higher level of development, institutional changes are necessary. New institutions and infrastructure lead towards modernisation and economy development. Some economies apply traditional ways of achieving economic growth and development (capital, work), while the others manage their development by applying and implementing new factors, such as knowledge, new technologies and innovations. In order to speed up the development of an economy, there is a need for synergy, cooperation, and coordination of knowledge, innovation, and advanced technologies. New knowledge creates innovation, which has its applications in the manufacturing and services industry sectors (Jednak, 2012). Nowadays, the most developed countries and countries with high competitiveness have their economic growth and development based on the knowledge-based industries - telecommunication, software, research and certain public sector activities (health care, social work activities and education). Due to this fact, some of the transitional economies invest and enhance growth in those industries (Jednak and Mijatovic, 2012).

The question of which economic activities should be the basis of the Serbian economic development are explained in this paper by applying Markowitz' theory of mean-variance optimization.

3. Overview of Serbian economic growth and development strategies

The government should do the analysis of all the available capital resources and provide a long-term economic growth and development by carrying out the appropriate economic policy (Stigliz, 2006). The government can borrow or create the environment that would attract foreign investments in order to achieve a high GDP rate in a short run time. A country debt is usually considered to be foreign capital inflow, mostly provided by international institutions. On one hand, capital inflow can also influence export funding, customer loyalty increase, inflation decrease and appreciation of exchange rate, while on the other, it can increase the risk of the future decrease in capital inflow due to variations in exchange and interest rates. As for the Serbian economy, besides borrowing, foreign direct investments are considered to be the significant source of economic growth and development. However, in the period after the economic crisis it is hard to attract foreign investors. An underdeveloped financial market, an unfavourable economic situation and economic performances make it harder and slower. There has been a drop in demand, and at the same time the investments decline. The foreign capital inflow decreased from 14.3% to 5.6% GDP (in 2009) and the slower pace of credit activities has resulted in a drop in production, income, personal consumption, and consequently in the drop in domestic demand (about 7%). For all these reasons, the Government of Serbia has changed its strategies for economic growth and development (Jednak et al., 2013).

The conomic growth and development of Serbia rested on a large-scale domestic demand, import and the need for foreign funds. In the period 2001-2008, the economic growth was achieved (annual average of 4.9%) (Report on the development of Serbia / Izvestaj o razvoju Srbije, 2010) as a consequence of the un-

dergone institutional reforms, economic and social policy and permissive environment in the international capital market (Djordjevic and Veselinovic, 2010). At the time, Serbia was following the strategy of economic growth and development (2001-2008) that rested on the investment in the following sectors: 1) traffic, storage and connections, 2) trade and 3) financial brokerage. These economic activities were the basic components of the economic growth and amounted to 30% GDP. In the year 2001 agriculture, hunting, forestry, fishery and manufacturing comprised 32 % GDP, but their share decreased in 2008 to 24% GDP (The Post-crisis model of economic growth and development of Serbia / Postkrizni model ekonomskog rasta i razvoja Srbije 2011-2020). The influence of the economic crisis was reflected on the economic activities as well. The production growth in manufacturing achieved for the period 2001-2009 (18.6%) was annulled by the production drop of 8.7% in 2009. The number of employees decreased by 4.7%. However, in 2010 the manufacturing achieved a growth of 3.9%, while the export of goods recorded a growth of 24% and investments 5% (Report on the development of Serbia / Izvestaj o razvoju Srbije, 2010).

However, when the "Europe 2020" strategy was adopted, Serbia worked out a new model of growth for Serbia 2020. The new growth model was changed from consumer-oriented to pro-investment and export-oriented economic growth. The growth according to this new strategy is based on the reform of the public sector, economy restructuring and infrastructure development. The main objectives of this model are – increase in the number of employees, human capital improvement, investing in knowledge and technology, export-based growth, rational energy use and poverty decrease. Accomplishing such objectives depends on: fixed investment increase, reducing the share of public consumption in GDP, raising the share of exports in GDP and reducing the current account deficit. Furthermore, according to the EBRD, Serbian strategic priorities are corporate and financial sectors and infrastructure. In the corporate sector, financing will be provided for privatisation and post-privatisation restructuring to both local and foreign corporations, while in supporting the financial sector, it will look for opportunities to develop new products. The EBRD, together with its partner IFIs, has a role in developing transport, energy and infrastructure.

The fiscal policy of Serbia for 2013, with projections for 2014 and 2015 (The Draft of the fiscal strategy for 2013 with projections for 2014 and 2015 / Nacrt fiskalne strategije za 2013. godinu sa projekcijama za 2014. i 2015.godinu), envisages the following economic acitivites to be the basic ones for economic growth and development: agriculture, mining and power industry, transport, telecommunications, tourism, health care, education and science. According to the Statistical Office of the Republic of Serbia report of Serbian economic activity for 2012, the highest growth of GDP was recorded for the following economic activities: information and communication, professional, scientific, innovation, technical, administrative and service industries. On the other hand, the greatest production reduction was in the sectors of agriculture, forestry and fishery, other service industries and in the sectors of accommodation and food services. The drop in industrial production was 3.4%. This fall was mostly influenced by the decrease in production in the sectors of power, gas and steam. Agricultural production also declined by 17.5%. Furthermore, there was a decrease in construction, retail, transport and storage activities, while the telecommunication and wholesale activities recorded growth.

4. Metodology

The mean–variance model, proposed by Markowitz (1952), represents the basis for the modern financial portfolio theory. It is based on two conflicting criteria: the risk of a portfolio which should be minimised and the expected return on the portfolio which should be maximised. The return represents the performance of an investment while the risk of a portfolio is measured by the variance of return (Cornuejols, 2011).

Although this approach has been originally developed for financial portfolios, it was applied in other areas. The problem of resource allocation between different regions within a state was observed as a portfolio optimization problem since the 1970s. The analogy between a regional economy and a stock portfolio was established by Conroy (1974). This analogy is based on the statement that real resources which a region invests in any industry generate a variety of returns (employment, wage income, nonwage income or their weighted subsets) which are essentially stochastic. Several years later, based on this concept, industrial diversification of nine regions in Canada is measured using Markowitz' portfolio concept in order to compare the existing industrial portfolio with an efficient potential portfolio (Louis, 1980). By analyzing the same approach on the case of US countries, Brown, D. J., Pheasant, J. (1985) proved that interindustry covariances are not uniform nationwide and that other data sets in addition to employment data should be investigated.

A portfolio management framework as a basis for developing regional economic strategies is also given in (Lande, 1994). The authors propose the US employment portfolio by considering employment growth rates and employment volatility. Starting with the assumption that the regional (urban) economy has a lot in common with an investment portfolio, Spelman (2006) applied the portfolio theory to the data on the economies of the 316 US metropolitan areas. The goal was to improve local economic development policy which includes both stability and growth.

The portfolio optimization concept is widely applied on the individual industrial sector. Junning and Leung (2006) observe the Hawaii's agricultural sector as a portfolio composed of a variety of individual agricultural industries. Using the data about the production value as a measure of the general performance of the agricultural sector, the authors applied portfolio analysis to assess the growth and stability of the agricultural industries. Recently, a large number of research concerns the application of portfolio optimization in the energy sector. Rodoulis (2010) uses the optimization portfolio theory to evaluate the planned electricity generation mix consisting of oil, natural gas, wind, and coal energy for the country of Cyprus. The similar research was done by Cucchiella et. al (2012) in the case of investment in Italian renewable energies: biomass, wind, hydro and photovoltaic. As in the previous research, the goal was to minimize energy risk and energy dependency. Westner and Madlener applied a mean-variance portfolio analysis on the combined heat and power (CHP) portfolio in the case of four European countries: Germany, France, Italy and the UK (2010), where regional diversification was investigated as well as in the case of Germany (2011), where different CHP technologies and the expected development of CHP generation in Germany where considered.

The basic portfolio optimization model considers an initial sum for investment and *n* securities with random returns. The goal is to determine an investment proportion vector x = (x_1,…, x_n), also called a portfolio, which specifies the proportions of the initial sum to be invested in the *n* securities. The natural condition relating to x is:

$$\sum_{i=1}^{n} x_i = 1 \tag{1}$$

We can now introduce S, the set of all feasible investment proportion vectors:

$$S = \{x_i \mid \sum_{i=1}^{n} x_i = 1, \alpha_i \le x_i \le \omega_i,\ i = 1,...,n\} \tag{2}$$

where the α_i and ω_i are lower and upper bounds on the x_i.

Let vector μ = (μ_1,…, μ_n) specify the expected returns of the *n* securities to be realised at the end of the observing period. The portfolio return can be expressed as:

$$E[x] = \sum_{i=1}^{n} \mu_i x_i \tag{3}$$

The overall risk of the portfolio is then defined as a quadratic combination of the covariance of the securities included in it:

$$V[x] = \sum_{i=1}^{n} \sum_{j=1}^{n} x_i \sigma_{ij} x_j \tag{4}$$

Two optimization models can be formulated: the maximum return for a given level of risk (5), or the minimum risk for a given level of return (6).

$$\begin{aligned} &\max \sum_{i=1}^{n} \mu_i x_i \\ &\text{s.t.} \\ &\sum_{i=1}^{n} \sum_{j=1}^{n} x_i \sigma_{ij} x_j \le \sigma \\ &x_i \in S,\ i = 1,...,n \end{aligned} \tag{5}$$

$$\begin{aligned} &\min \sum_{i=1}^{n}\sum_{j=1}^{n} x_i \sigma_{ij} x_j \\ &\text{s.t.} \\ &\sum_{i=1}^{n} \mu_i x_i \geq R \\ &x_i \in S,\ i = 1,...,n \end{aligned} \tag{6}$$

where σ and *R* are the target values for the variance and expected portfolio return.

Many authors observe the portfolio selection as the bi-criteria problem with the return (3) and risk (4) as objectives and subject to (2). (Ehrgott *et al.*, 2004) However, incorporation of additional criteria and/or constraints into the model can be rarely found in literature. Anagnostopoulos and Mamanis (2010) formulated the portfolio selection as a three-objective optimization problem with risk, return and the number of securities included in the portfolio as objectives. Steuer *et al*. (2006) give the example consisting of five different objectives (dividends, growth in sales, amount invested in R&D, social responsibility and liquidity) and even twelve in (Steuer *et al*., 2005) which can be appended to portfolio return.

In this paper, we investigate the problem of investment in different economic activities, taking into account two increases: employment and gross value added (GVA). For this purpose we introduce the following notation:

μ_i^e - expected increase of employment of the *i*-th activity, $i=1,...,n$;

μ_i^g - expected increase of GVA of the *i*-th activity, $i=1,...,n$.

Based on the given increases, the corresponding covariance σ_{ij}^e and σ_{ij}^g ($i, j=1,...,n$) can be obtained. The mathematical model for Serbian economic activities portfolio optimization:

$$\begin{aligned} &\max \sum_{i=1}^{n} \mu_i^g x_i \\ &\text{s.t.} \\ &\sum_{i=1}^{n} \mu_i^e x_i \geq R^e \\ &\sum_{i=1}^{n}\sum_{j=1}^{n} x_i \sigma_{ij}^g x_j \leq \sigma^g \\ &\sum_{i=1}^{n}\sum_{j=1}^{n} x_i \sigma_{ij}^e x_j \leq \sigma^e \\ &x_i \in S,\ i = 1,...,n \end{aligned} \tag{7}$$

Since greater importance is given to the GVA increasing, the objective function in model (7) is the expected GVA growth, which should be maximised. The first constraint refers to the expected employment increase, which should be at least R^e. Parameter R^e can be estimated based on the optimal value of model (5) for portfolio optimization based only on employment increase. The second and third constraints are related to the risk of GVA and employment increase, respectively. The set *S* is as defined in (2). The values of lower and upper bounds on the x_i will be as follows. Let $x_i^g,\ x_i^e,\ i = 1,...,n$ be the optimal values of x_i in model (5) based on GVA and employment increase, respectively. Then, the lower bound of on the x_i in model (7) will be $\alpha_i \in [0, a_i],\ i = 1,...,n$, where $a_i = \min\{x_i^g, x_i^e\}$. Analogously, the upper bound of on the x_i in model (7) will be $\omega_i \in [c_i, 1],\ i = 1,...,n$, where $b_i = \max\{x_i^g, x_i^e\}$.

5. Results and discussion

Data are used from the Statistical Yearbook of Serbia for 2012. The data presented here are given at the level of the macroeconomic indicators (employment and GVA) for the period after the economic crisis (2008-2011). Table 1 shows the GVA in current prices in mill RSD, while Table 2 represents employment in different activities of the Serbian economy. Based on GVAs in Table 1, a GVA rate for each economic activities and each year is determined, and the expected GVA growth rate ^{g} is calculated as its average.

Table 1: GDP in different activities of Serbian economy

Activities	GVA, mil RSD in current prices				μ^g
	2008	2009	2010	2011	
Agriculture, forestry and fishery	237474	218005	245127	284234	0.0673
Manufacturing	373645	370264	389942	437953	0.0557
Electricity, gas, steam and air conditioning supply	69284	86388	90119	101238	0.1378
Water supply; sewerage, waste management and remediation activities	26754	28897	33736	38089	0.1255
Construction	125692	111747	114513	127797	0.0099
Wholesale and retail trade;	277794	258486	267969	292275	0.0193
Transportation and storage	122502	126593	132582	141909	0.0503
Accommodation and food service activities	25612	27693	27507	29768	0.0522
Information and communication	106128	114393	123813	135778	0.0856
Financial and insurance activities	77917	85076	94803	106502	0.1099
Professional, scientific and technical activities	112861	97084	97926	118193	0.0253
Public administration and defence; compulsory social security	91633	90452	100137	104203	0.0449
Education	114757	119411	121467	134655	0.0554
Human health and social work activities	144343	150012	151009	169188	0.0554

Analogously to the previous case, based on the number of employers in Table 2, the employment rate for each activity and each year is determined, and the expected employment growth rate ^{e} is calculated as its average.

Table 2: Employment in different activities of Serbian economy

Activities	Employment			μ^e
	2009	2010	2011	
Agriculture, forestry and fishery	40238	37392	34815	-0,0698
Manufacturing	329491	301452	295363	-0,0526
Electricity, gas, steam and air conditioning supply	28099	27854	27996	-0,0018
Water supply; sewerage, waste management and remediation activities	32279	32240	32427	0,0023
Construction	82032	74506	72405	-0,0600
Wholesale and retail trade	190689	186748	183326	-0,0195
Transportation and storage	91223	89003	86265	-0,0275
Accommodation and food service activities	22520	20863	20392	-0,0481
Information and communication	36646	36504	37738	0,0150
Financial and insurance activities	38812	39305	39025	0,0028
Professional, scientific and technical activities	50415	51758	52251	0,0181
Public administration and defence; compulsory social security	71222	69897	70479	-0,0051
Education	134795	136179	138391	0,0133
Human health and social work activities	158740	159449	161016	0,0071

First, the mathematical model (5) for GVA increase is solved. The obtained optimal values are given in the column "GVA (5)" in Table 3. This solution implies that 41.69% of investment funds should be invested in electricity, gas, steam and air conditioning supply and 58.31% in water supply; sewerage, waste management and remediation activities. The expected GVA increase in these activities is 13.06%. Then, the mathematical model (5) for employment increase is solved, whose optimal values are given in the column "Employment (5)" in Table 3. If employment is the only criterion for investment, optimal portfolio includes 85.05% investment in professional, scientific and technical activities and 14.95% in information and communication. The expected employment increase in these activities is 1.76%.

Finally, model (7), which includes the entire observed problem, is solved. Due to the feasibility of the solution, the parameter R^e in the first constraint must be set to 50% of the optimal value obtained by solving the mathematical model "Employment (5)". The risk levels expressed by σ^g and σ^e have the same values as in corresponding models (5). The optimal solution of the mathematical model (7) is given in the column "Optimal portfolio (7)" in Table 3. Optimal portfolio suggests the following investment plan: 49.48% of investment funds should be invested in information and communication, 49.34% in financial and insurance activities, and 1.18% in water supply; sewerage, waste management and remediation activities. The expected GVA increase in these activities is 9.81% while the expected increase in employment is 0.88%.

Table 3 Optimization results

Activities	GVA (5)	Employment (5)	Optimal portfolio (7)
Agriculture, forestry and fishery	0	0	0
Manufacturing	0	0	0
Electricity, gas, steam and air conditioning supply	0.4169	0	0
Water supply; sewerage, waste management and remediationactivities	0.5831	0	0.0118
Construction	0	0	0
Wholesale and retail trade;	0	0	0
Transportation and storage	0	0	0
Accommodation and food service activities	0	0	0
Information and communication	0	0.1495	0.4948
Financial and insurance activities	0	0	0.4934
Professional, scientific and technical activities	0	0.8505	0
Public administration and defence; compulsory social security	0	0	0
Education	0	0	0
Human health and social work activities	0	0	0

Both domestic and foreign organisations mention in their reports and development strategies for the Serbian economy that economic growth can be achieved by investing in infrastructure, the power sector, the ICT sector, education, the financial sector and the agricultural sector. The results achieved by the analysis of the selected economic activities and indicators for the observed period of time show that investments should be directed towards the sectors of information and communication and financial and insurance activities, because they provide a balance between growth and security regarding GVA and employment in Serbian economic activities.

Conclusion

Adequate economic policies, development strategies and an active role of the government are important for obtaining economic development. The appropriate economic policy targets economic activities that could be significant for development. The government could apply different models and strategies of economic development. The main question is which economic activities should be invested into. Priority should be given to the economic activities that contribute most to economic growth. However, there are some limitations. Firstly, it depends on the available resources. Secondly, the outcomes of investing in certain activities are not the same. Thirdly, the results is not visible simultaneously. For example, the growth in some manufacturing economic activities can be achieved fast, while in some other activities such as power supply, automotive and construction industry it is slower. Finally, the source of finance can influence the investments to be directed to particular activities. Many international institutions that provide capital (credits, loans, aids and other source of finance) may require the fulfillment of certain conditions and capital allocation in certain economic activities. Along with the requirements Serbia has to establish its strategic priorities - energy, agriculture, ICT, education, financial sectors and infrastructure. Due to strategies, Serbian economic policies direct both domestic and international capital towards the target activities for achieving economic development. Those activites are mostly in the service sector which has a large share in obtaining economic growth. The results of this paper show that the most important economic activities for enhancing development are information and communication; financial sector and insurance; followed by water supply, sewerage, waste management and remediation activities. These results indicate that the sectors` structure changed. Moreover, the service sector and infrastructure contribute significantly to Serbian economic growth and development. For the period after economic crisis, the best incentives for the economic growth in Serbia are investments into service sectors. However, electricity, gas, steam and air conducting supply as well as professional, scientific and technical activities could also contribute to economic growth and development.

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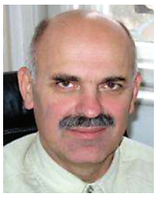

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