"Data analysis and forecasting of tourism development in Ukraine"

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DATA ANALYSIS AND FORECASTING OF TOURISM DEVELOPMENT IN UKRAINE

Abstract

The article contains a thorough study of tourist flows in Ukraine during the last 18 years. The tendencies of the development of international tourism during the last 20 years and their influence on the development of tourism in Ukraine have been explored. Particular attention is paid to the analysis of inbound tourist flows. The negative dynamics of tourist arrivals in Ukraine led to the construction of a forecast model for the development of this component of tourism activity with the aim of an objective assessment of future tourist arrivals and the adoption of effective management decisions on improving the situation of tourism in Ukraine. Tourist destinations today are rigorously competing for consumer interest in tourism products. In view of this, tourist facilities operating in the tourist market place particular emphasis on the elements of tourism marketing (product, price, distribution, advertising, human capital, actual data, processes).

Modern forecasting systems and methods have been used to build a forecast of tourism development in Ukraine and, in particular, arrivals of foreign tourists to Ukraine. An analytical forecasting model was built by the system of CurveExpert in the form of a polynomial function, analytical forecasting models were built by the system of computer algebra Maple in the form of piecewise linear and piecewise polynomial functions. Numerical prediction models in the MathCAD system using different types of spline-interpolation and predictive functions have been constructed. A comparative analysis of the results of forecasting in different systems was carried out. The results of the comparative analysis give confidence in the development of inbound tourism in Ukraine.

INTRODUCTION

Tourism is one of the most important forms of international cooperation, which provides many countries with major budget revenues and employment growth. Successful tourism business needs a brand that focuses on target markets, successfully generates potential customers and maintains their quality, satisfies the customers' requirements, which is extremely important for Ukraine. The formation and development of the tourist market in Ukraine in recent years has been taking place in a context of a sharp decline in the consumption of tourist services, the sharpening of inflationary processes with a corresponding rise in prices, limited demand and a reduction in real cash incomes. The search tools for solving these problems require radical economic transformations and application of innovative means of forecasting by tools of the mathematical and computer modeling for the management of activity of tourist enterprises.

The aim of the article is to research the development of tourism in Ukraine on the basis of analysis of tourist flows data, marketing, building of different types of the forecasting models of development and their comparative analysis.

1. LITERATURE REVIEW

The tourism sector still maintains its ability to be an industry, which is intensively attracted by high developed countries and countries with emerging markets. The most important reason for this is that it is one of the quickly developing sectors in the world. This has highlighted the contribution of the tourism sector to the econom of the countries. With the impact of the World Tourism Organization's prediction (UNWTO, 2018) that the world tourism income will be 2 trillion dollars in 2020, each country has caused their own tourism supply potential to engage in the struggle to get a share of this or to enlarge the share they received.

The tourism industry can act as the locomotive of the country's socio-economic development, as a major "foreign exchange earner" (Ranade, 1998), as a big creator of employment through its labor-demanding nature, including employment for women and minority groups (Cukier, 2002; Gorg, 2000), as a reliable environment for infrastructure development and poverty reduction, as well as a real promoter of multiculturalism and tolerance (Dixit, 1997; Bahuguna, 2005). According to Bramwell and Lane, the greatest founders of these concepts in the tourism industry (Bramwell & Lane, 2012; Bramwell & Lane, 1993), tourism development is seen as a solution that can create positive changes through the ideas of sustainable development. A lot of scientists in their works tried to build models of tourists flows (Lew & McKercher, 2006; McKercher & Lew, 2004; Xing-zhu et al., 2011; Gheasi et al., 2011; Yang et al., 2013). Based on 773 articles, Wen-Jung Chang and Katrichis discovered "the number of publications on tourism management has significantly increased since 2000 and a steady growth since 2008" till now (Chang & Katrichis, 2016).

In general, the multiplier effect of tourism on the economy is substantial. As a multidisciplinary activity involving several branches and applying different competencies, tourist benefits extend to a much wider segment of society than other sectors of the economy (Telce & Schroenn, 2006). Researches related in this field highlighted its possible implications for promoting growth, revenues for the government and job creation (Lea, 1988; Sinclair, 1998). This economic connection is pointing to growth in the leadership of tourism. Therefore, tourism is a significant impetus for economic growth (Sinclair & Stabler, 2002; Samimi et al., 2011).

Today, tourism is viewed as an important outward-oriented growth sector (Brohman, 1996). Tourism expenditures, which are an alternative export type, contribute positively to the balance of payments due to foreign currency revenues and becomes a crucial source of income for a country's national economy with the development of tourism (Kim, Chen, & Jang, 2006; Kaletnik et al., 2011). This income from the tourism sector is used for the import of goods and services required for other sectors for economic growth and development purposes (McKinnon, 1964). The tourism sector, which is regarded as a "regional development strategy, contributes to development of underdeveloped regions, restructuring of the economy and ultimately economic growth as a whole" (Tosun & Timothy, 2001; Baidal, 2004). The tourism sector is often used as a means to progress economic development with the effect of employment and income enhancers and to revive marginalized economies (Liu & Wall, 2006).

Consequently, many countries with developing and tourism potential want to take advantage of this sector in the long term with their tourism development plans and develop their economic development with the help of this sector (Pearce, 2000; Toivonen, 2002). Therefore, many of the developing countries have big problems at the point of providing effectiveness in the international tourism market, many of these countries consider tourism as an attractive development and development option (Liu & Wall, 2006).

Table 1. International tourist arrivals, 1990–2017 (million)

Source: Build by the authors based on the materials from Tourism Highlights (2018).

Regions	Years								The rate of change, 2017, as % till	
	1990	1995	2000	2005	2010	2015	2016	2017	1990	2010
World	434.6	530.8	680.1	808.6	952.1	1195.0	1240.1	1326.5	305.2	139.6
Europe	261.5	308.5	392.9	452.7	487.7	605.1	619.5	671.7	256.9	137.7
Asia and the Pacific	55.9	82.0	110.4	154.1	208.2	284.1	306.0	323.1	578.0	155.2
America	92.8	108.9	128.2	133.3	150.4	194.1	201.3	210.9	227.3	140.2
Africa	14.8	18.7	26.2	34.8	50.4	53.6	57.7	62.7	423.6	124.4
Middle East	9.6	12.7	22.4	33.7	55.4	58.1	55.6	58.1	605.2	104.9

Processing of large amount of statistical information assumes the use of modern methods and algorithms of data analysis. Application of such methods in the sphere of tourism is investigated by Song and Liu (2017), Miah, Vu, Gammack, and McGrath (2017), Palomo, Figueroa-Domecq, Flecha-Barrio, and Segovia-Pérez (2017). A lot of modern researches focuses on the assessment of entrepreneurship in rural tourism (Mura & Kljucnikov, 2018) or development of "green" and "blue" tourism (Loganathan et al., 2018; Dluhopolskyi, 2013; Tourism in the Green Economy, 2012).

In spite of increasing importance, tourism attracted relatively little attention in the Ukrainian literature (Boiko et al., 2013; Kyfiak, 2016; Mazaraki & Sagalakova, 2015a; Mazaraki & Sagalakova, 2015b; Stemplewska & Ramazanow, 2014; Mykhailichenko, 2013; Sagalakova, 2015). The examination of literature did not provide significant reviews and discussions relevant to this subject. The analysis of the latest publications on these issues makes it possible to conclude that there are positive trends and the presence of factors hindering the further development of tourism enterprises.

2. RESEARCH METHODOLOGY

The theoretical and methodological background is the fundamental principles of the systematic approach, the methods of scientific abstraction, analysis and synthesis, induction and deduction, the dialectical method of knowledge of economic phenomena, the corresponding provisions of economic theory in the study of economic processes,

scientific works of domestic and foreign erudites, which cover the fundamental positions, the main problems of tourism enterprises.

The information basis for the study is data of the State Statistics Service of Ukraine (State Statistics Service of Ukraine, 2018) and of Department of Tourism and Resorts of the Ministry of Economic Development and Trade of Ukraine.

3. THE TENDENCIES OF THE DEVELOPMENT OF INTERNATIONAL TOURISM

According to the data presented in the Statistical Bulletin (Tourism Highlights, 2018), the number of international tourist arrivals in the world increased from 25 million persons in 1950 to 278 million in 1980, 530.8 million in 1995 and 1326.5 million persons in 2017. The cash inflows from international tourism increased from 2 billion US dollars in 1950 to 104 billion US dollars in 1980, 405.9 billion US dollars in 1995 and 1340 billion US dollars in 2017 (Tables 1, 2).

Starting from the post-crisis period of 2010, the growth rate of international arrivals exceeds the average level, and each year this indicator increased by 4% or more.

According to the United Nations World Tourism Organization (UNWTO), in 2017, the tourism segment provided about 10% of the world's GDP, every tenth of the world's employment, 1.6 trillion US dollars of foreign exchange earnings, 7%

Table 2. International tourism receipts, 1990–2017 (billion US dollars)

Regions	Years								The rate of change, 2017, as % till	
	1990	1995	2000	2005	2010	2015	2016	2017	1990	2010
World	263.6	405.9	475.9	679.7	986.5	1221.1	1244.6	1340.0	508.3	135.8
Europe	143.5	211.7	231.5	350.3	412.2	468.0	468.1	519.2	361.8	126.0
Asia and the Pacific	41.2	78.1	87.6	135.0	275.7	355.6	370.8	389.6	945.6	141.3
America	69.2	100.5	136.4	145.3	215.2	307.3	313.7	326.2	471.4	151.6
Africa	5.3	8.1	10.7	21.8	31.2	32.2	33.0	37.3	703.8	119.6
Middle East	4.4	7.5	9.7	27.3	52.2	58.0	59.0	67.7	1538.6	129.7

of world exports, 30% of world trade in services (Tourism Highlights, 2018).

In the world of tourism, practically all countries are involved now. As tourism is a highly profitable business, a rigid competition continues between countries on the international tourist market. In this struggle, the states that have significant tourist and recreational resources and can offer various quality tourist services at competitive prices for the tourists are the winners. This is possible only in the conditions of the developed tourism industry, which has the support and attention of the state.

Table 3 shows the ranking of countries in terms of tourist arrivals.

Table 3. TOP-30 country by indicators of tourist arrivals, 2000–2017

Country	Years											
	2000		2005		2010		2014		2015		2017	
	Million	Place	Million	Place	Million	Place	Million	Place	Million	Place	Million	Place
France	75.5	1	76	1	77.6	1	83.7	1	84.5	1	86.9	1
Spain	48.2	3	55.6	2	52.7	4	64.9	3	68.2	3	81.8	2
USA	50.9	2	49.4	3	60.0	2	75.0	2	77.5	2	76.9	3
China	31.2	5	46.8	4	55.7	3	55.6	4	56.9	4	60.7	4
Italy	41.2	4	36.5	5	43.6	5	48.6	5	50.7	5	58.3	5
Mexico	20.6	8	21.9	7	23.3	10	29.3	10	32.1	9	39.3	6
United Kingdom	25.2	6	30.0	6	28.3	7	32.6	8	34.4	8	37.7	7
Turkey	7.6	20	20.3	9	31.4	6	39.8	6	39.5	6	37.6	8
Germany	19.0	10	21.5	8	26.9	8	33.0	7	35.0	7	37.5	9
Thailand	9.5	19	11.6	18	15.9	16	24.8	14	29.9	11	35.4	10
Austria	18.0	11	20.0	10	22.0	11	25.3	13	26.7	12	29.5	11
Japan	4.8	27	6.7	27	8.6	26	13.4	22	19.7	16	28.7	12
Hong Kong	13.1	14	14.8	16	20.1	14	27.8	11	26.7	13	27.9	13
Greece	12.5	15	14.8	17	15.0	17	22.0	15	23.6	15	27.2	14
Malaysia	10.2	17	16.4	14	24.6	9	27.4	12	25.7	14	26.0	15
Russia	21.2	7	19.9	11	20.3	13	29.8	9	31.3	10	24.4	16
Portugal	12.0	16	10.6	19	6.8	29	9.3	29	10.2	29	21.2	17
Canada	20.4	9	18.8	12	16.2	15	16.5	17	18.0	17	20.8	18
Poland	17.4	12	15.2	15	12.5	18	16.0	18	16.7	19	18.4	19
Netherlands	10.2	18	10.1	20	10.9	20	13.9	21	15.0	20	17.9	20
Macao	6.7	22	9.0	22	11.9	19	14.6	19	14.3	22	17.3	21
Saudi Arabia	6.3	24	8.0	24	10.9	21	18.3	16	18.0	18	16.1	22
United Arab Emirates	3.9	29	7.1	25	7.4	27	10.0	27	14.9	21	15.8	23
Hungary	15.6	13	10.0	21	9.5	22	12.1	24	14.3	23	15.8	24
Croatia	4.7	28	8.5	23	9.1	24	11.6	26	12.7	25	15.6	25
India	2.6	30	3.9	30	5.6	30	7.7	30	8.0	30	15.5	26
Ukraine	6.4	23	17.6	13	21.2	12	12.7	23	12.4	26	14.2	27
Singapore	6.9	21	7.1	26	9.2	23	11.9	25	12.1	27	13.9	28
Republic of Korea	5.3	25	6.0	28	8.8	25	14.2	20	13.2	24	13.3	29
Indonesia	5.1	26	5.0	29	7.0	28	9.4	28	10.4	28	12.9	30

4. RESEARCH OF TOURIST ARRIVALS TO UKRAINE

Data from Table 3 show that the tourism industry of Ukraine is an integral part of the world tourism process. But, unfortunately, Ukraine today is considerably inferior to the world trends in the development of the tourist market (Mazaraki & Sagalakova, 2015). In the ranking of countries in terms of international tourist arrivals, she descended from the 12th place in 2010 to 27th place in 2017 (Tourism Highlights, 2018). The hypothesis about incomplete use of the potential of tourism as a powerful component of the national economy is confirmed by the decline of the development of the tourism industry due to the military-political and economic crisis in Ukraine.

The dynamics of tourist flows in recent years is significant stochastic process (Figure 1).

According to the information from State Border Guard Service of Ukraine, in 2017, compared with 2013, the inflow of tourist traffic to the country decreased by 42.5%. The largest inflow of foreign citizens to Ukraine in 2017 was observed from the following countries: Republic of Moldova (31.2%), Belarus (19.2%), Russian Federation (10.3%), Poland (8.0%), Hungary (7.9%), Romania (5.6%), Slovakia (2.6%), Turkey (1.9%), Israel (1.8%) and Germany (1.5%).

Military actions in the eastern part of the country, the annexation of the territory of the Crimea, de-

valuation of the national currency had a negative impact on the state of tourism in Ukraine. Since 2014, there has been a negative trend towards reducing the number of travelers (Table 4).

Table 4. Indicators of tourist arrivals in Ukraine, 2000–2017

Source: Build by authors based on the materials from State Statistics Service of Ukraine (2018).

Year	Persons
2000	6,430,940
2001	9,174,166
2002	10,516,665
2003	12,513,883
2004	15,629,213
2005	17,630,760
2006	18,935,775
2007	23,122,157
2008	25,449,078
2009	20,798,342
2010	21,203,327
2011	21,415,296
2012	23,012,823
2013	24,671,227
2014	12,711,507
2015	12,428,286
2016	13,333,096
2017	14,229,642

Negative dynamics of tourist arrivals in Ukraine leads to building a forecast model for the development of this component of tourism activity. This will provide an objective assessment for the future tourist arrivals and make effective management decisions on improving the state of tourism in Ukraine based on the forecast.

Source: Build by authors based on the materials from State Statistics Service of Ukraine (2018).
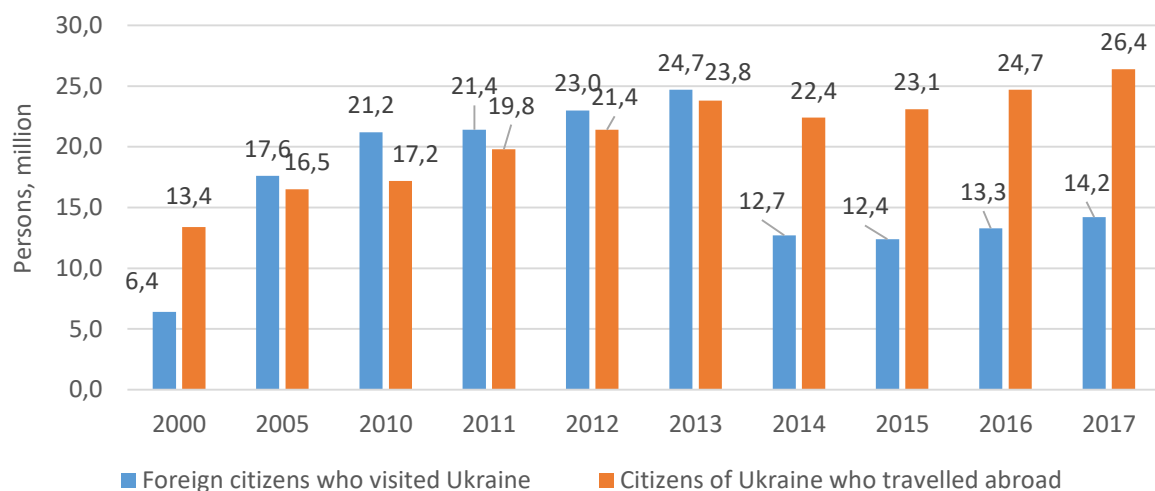

Figure 1. Tourist flows of Ukraine, 2000–2017

To obtain a more objective assessment of the build of the forecast of tourist arrivals in Ukraine, we will apply different systems and methods of forecasting.

5. BUILDING OF THE FORECAST OF TOURIST ARRIVALS BY CURVEEXPERT

Curve Expert system automatically searches for the best model for forecasting (Figure 2).

Based on the data in Table 4, the optimum modeling result gives the Gaussian Model with a correlation coefficient $r = 0.908$ (Figure 3).

6. BUILDING OF THE FORECAST OF TOURIST ARRIVALS BY MAPLE

The use of spline interpolation in the system of computer algebra Maple (Thompson, 2016) gives an opportunity to obtain an analytical description of the predictive model in the form of a piecewise linear or piecewise polynomial function (Figure 4).

A detailed information about creating the matrices of data in Maple, functions description of linear, quadratic and cubic splines is given in Appendix (see Figures A1, A2, A3 and A4 in Appendix A).
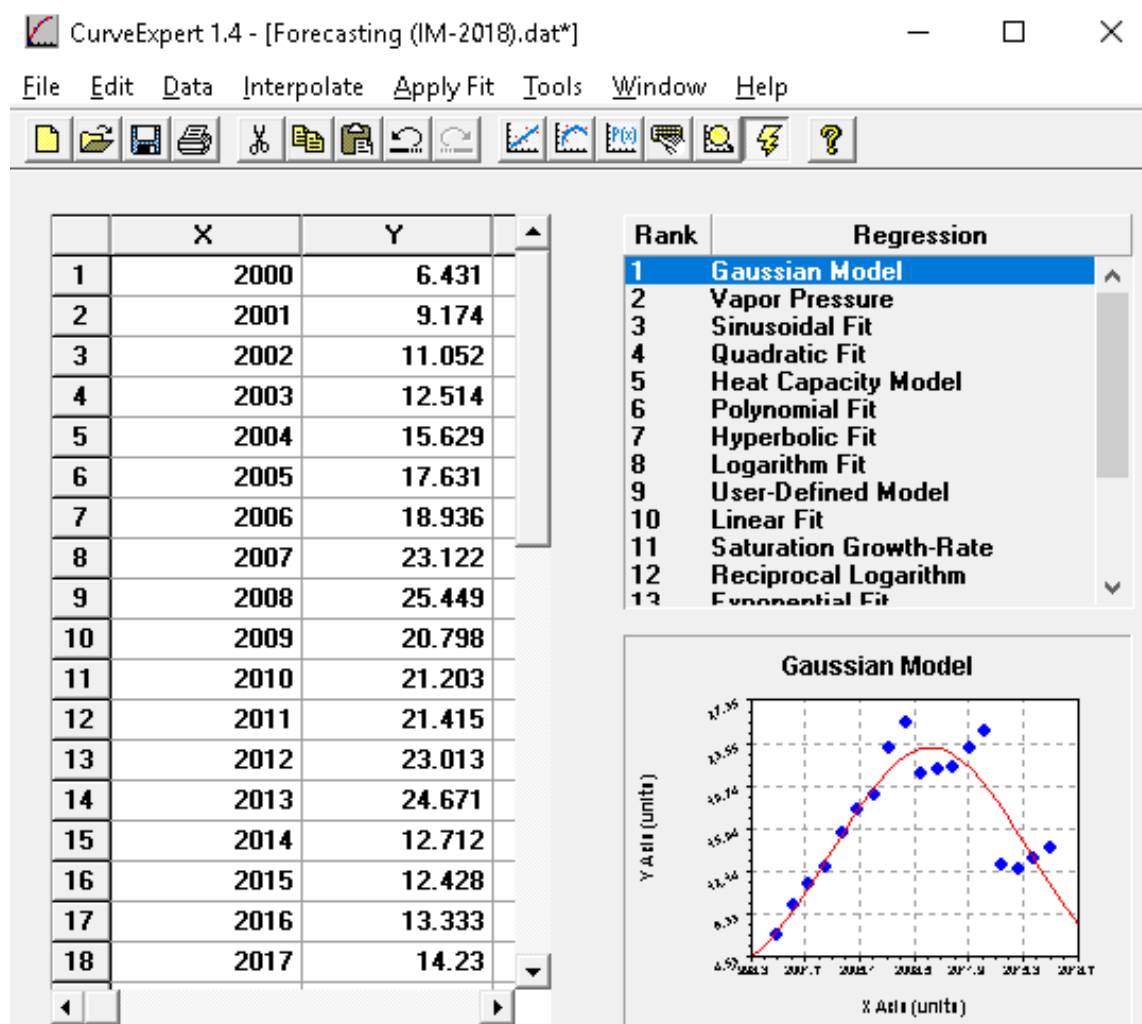
Source: Built by the authors.

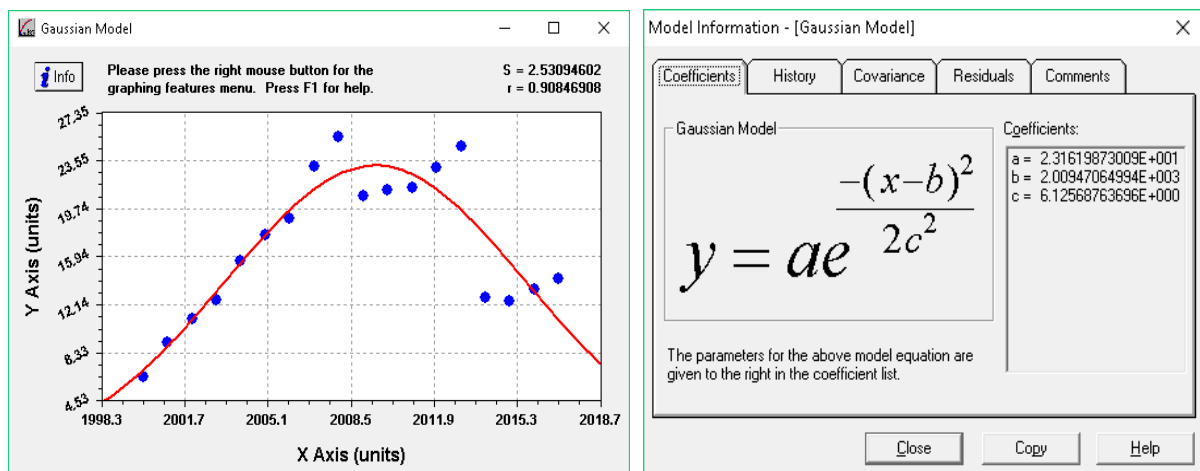**Figure 2.** Building of forecast model by CurveExpert

Figure 3. High rank model – Gaussian Model and information about it
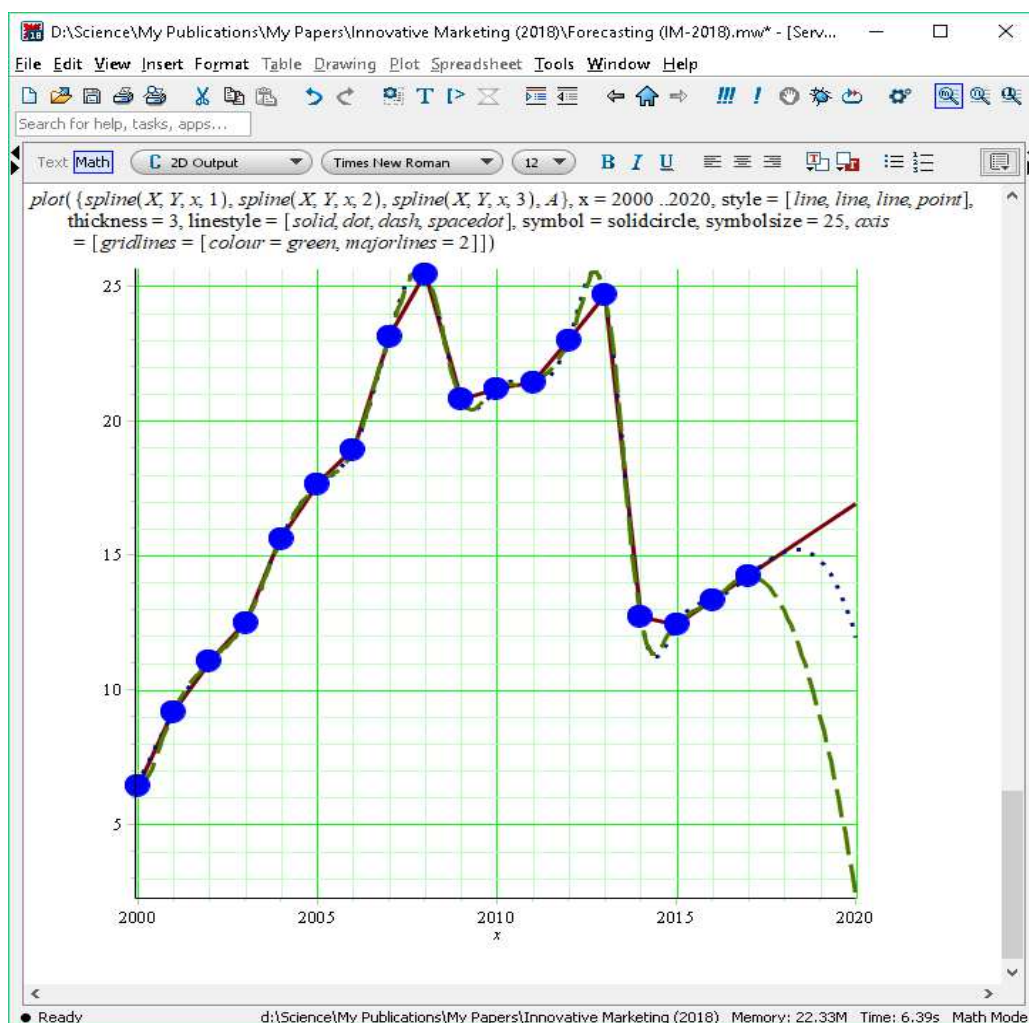
Figure 4. Visualization of forecasting models by Maple

7. BUILDING THE FORECAST OF TOURIST ARRIVALS BY MATHCAD

The MathCAD system (Maxfield, 2009) has two powerful forecast tools, the forecast function based on interpolation of different types of splines (Figure 5), and the predict function that provides predictions based on some set of last points in the statistical series (Figure 6). A detailed information about creating the matrices of data in MathCAD is given in Appendix (see Figure A5 in Appendix A).

The comparative analysis of forecasting results by the different systems is presented in Table 5.

The results of the comparative analysis indicate that almost all methods of forecasting provide a positive outlook for the development of inbound tourism in Ukraine. Forecasting in the MathCAD system based on the predict function shows the significant dependence of the forecasting results on the number of points involved in the building of the forecast. If the statistical basis for forecasting covers the period of the political and economic crisis in Ukraine in 2014–2015, then the simulation results give a slightly pessimistic forecast for the future. However, it is evident that the trend towards increasing inflow tourism flows over the last three years has a positive effect on the results of forecasting, which gives confidence in the development of inbound tourism in Ukraine.
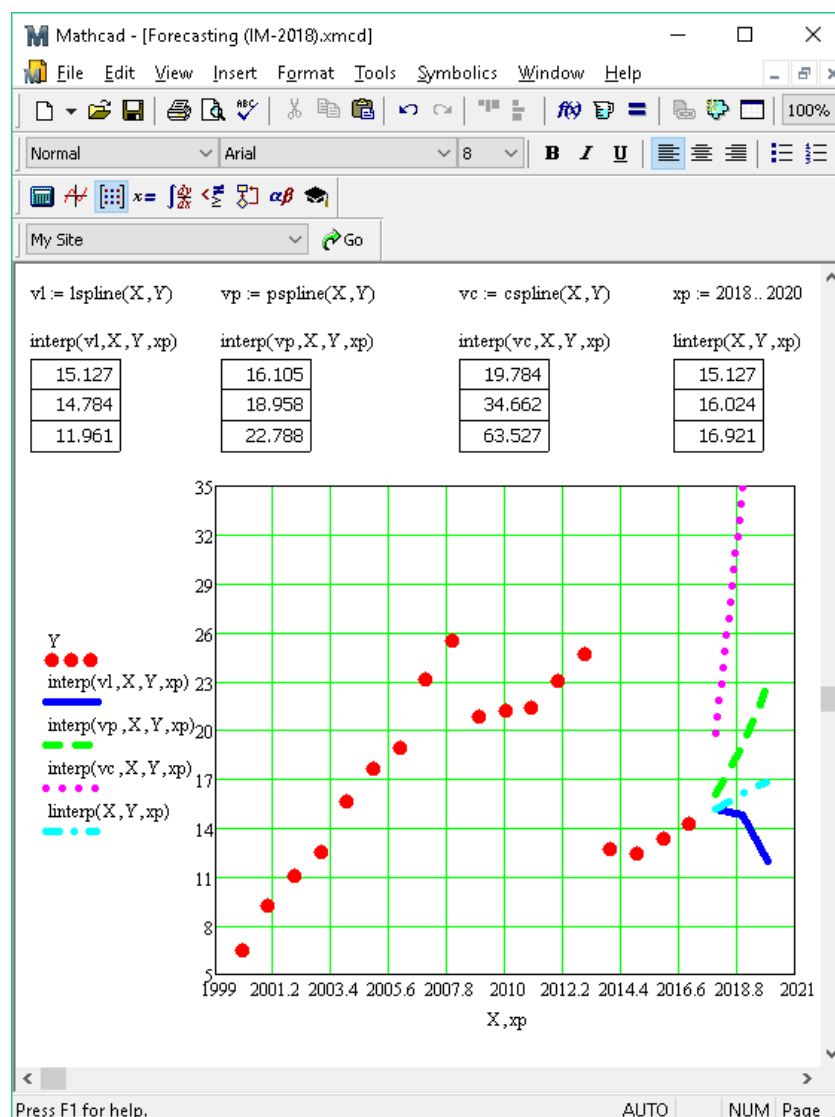
Source: Built by the authors.

Figure 5. Building the forecasting models by spline interpolation in MathCAD

Table 5. Comparative analysis of forecasting results

System and method of forecasting	Forecasting results, million persons		
	2018	**2019**	**2020**
MathCAD (linear spline)	15,127	16,024	16,921
MathCAD (quadratic spline)	16,105	18,958	22,788
MathCAD (cubic spline)	19,784	34,662	63,527
MathCAD (predict, 2 last points)	13,981	13,668	13,356
MathCAD (predict, 5 last points)	12,774	12,342	12,284
MathCAD (predict, 10 last points)	13,502	5,648	4,944
Maple (linear spline)	15,127	12,913	7,66
Maple (quadratic spline)	16,024	8,962	7,25
Maple (cubic spline)	16,921	2,377	4,3
CurveExpert (polynomial fit)	61,062	77,674	101,473
Average value	20,041	20,323	25,450
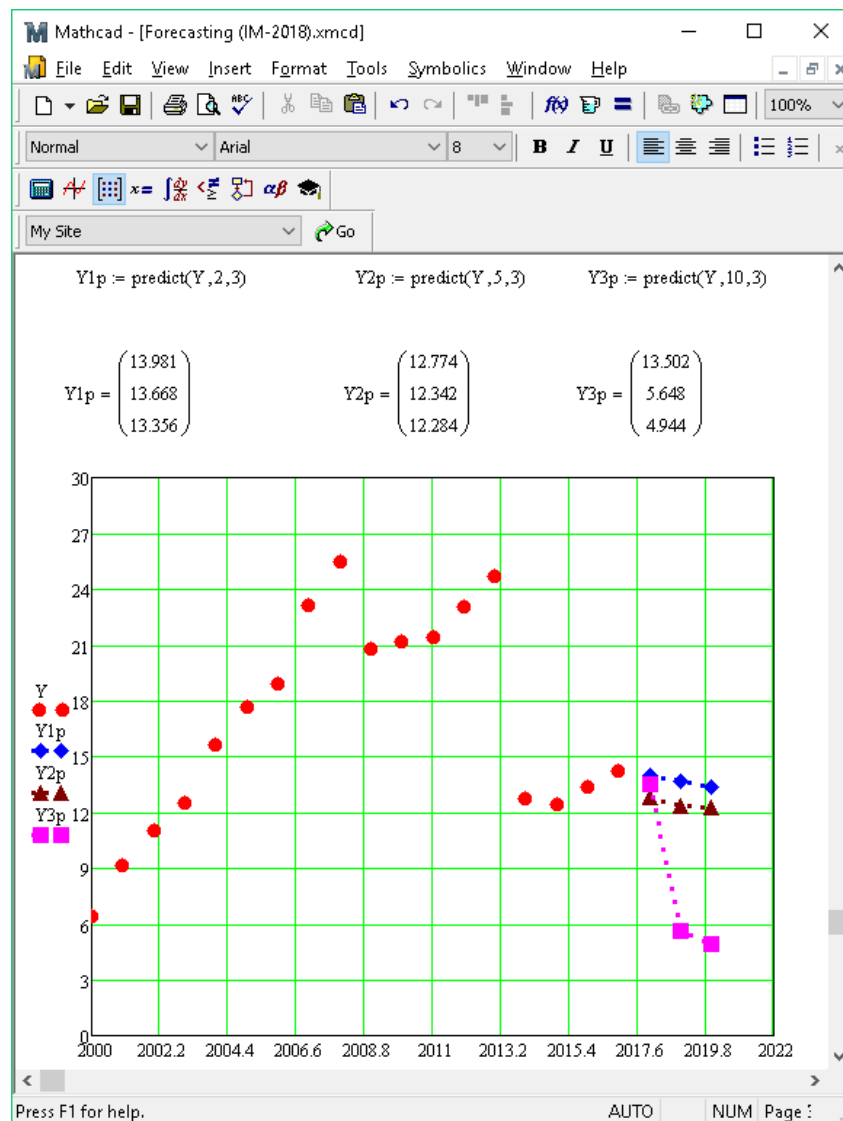
Figure 6. Building the forecasting models by predict function in MathCAD

CONCLUSION

Despite all the hardships, tourism in Ukraine can and should become a sphere of realization of market mechanisms, a source of replenishment of state and local budgets, a means of public and full-time recreation and rehabilitation, as well as acquaintance with the historical and cultural heritage and the present state of our people and the state. Entrance tourism is a priority tourism destination for Ukraine and a significant factor in replenishing the currency revenues of the state treasury and creating additional jobs.

Based on research results and our opinion, for the effective development of tourism in Ukraine, it is necessary to take the following measures:

- develop a methodology for integrated assessment of tourist resources, their classification and categorization, an effective marketing and management system;

- to provide state support to perspective applied research in the tourism industry;

- to improve the activities of Ukrainian tourist offices abroad;

- to study and implement progressive international experience of public administration and regulation of tourism industry;

- develop appropriate methodological recommendations for the further reformation of the training system of specialists-managers of the respective direction;

- to improve the competitiveness of the national tourism product through the improvement of the pricing management process at tourist enterprises.

The implementation of these recommendations will increase the efficiency of using the country's tourism potential, increase the competitiveness of tourism enterprises, increase budget revenues, reduce unemployment in the regions, and attract real investment in tourism.

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APPENDIX A

Figure A1. Creating the matrices of data in Maple

Figure A2. Function description of linear spline
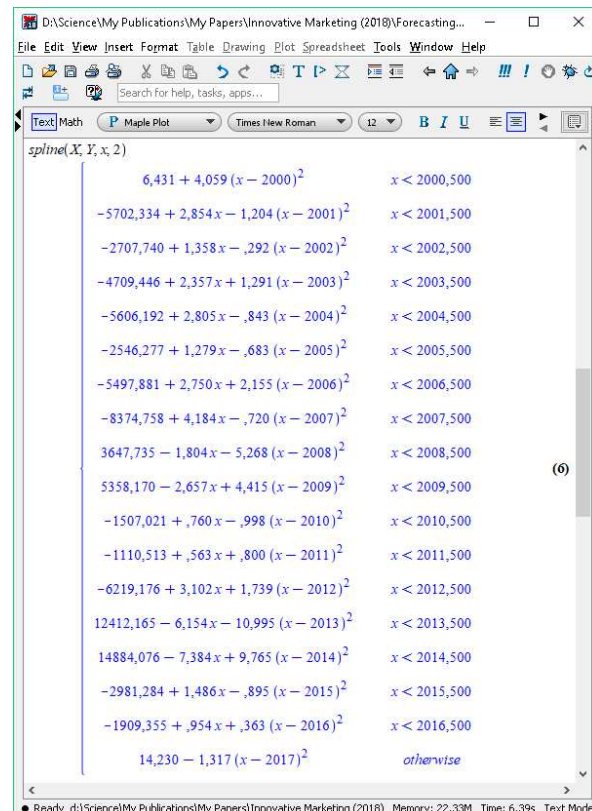
Figure A3. Function description of quadratic spline
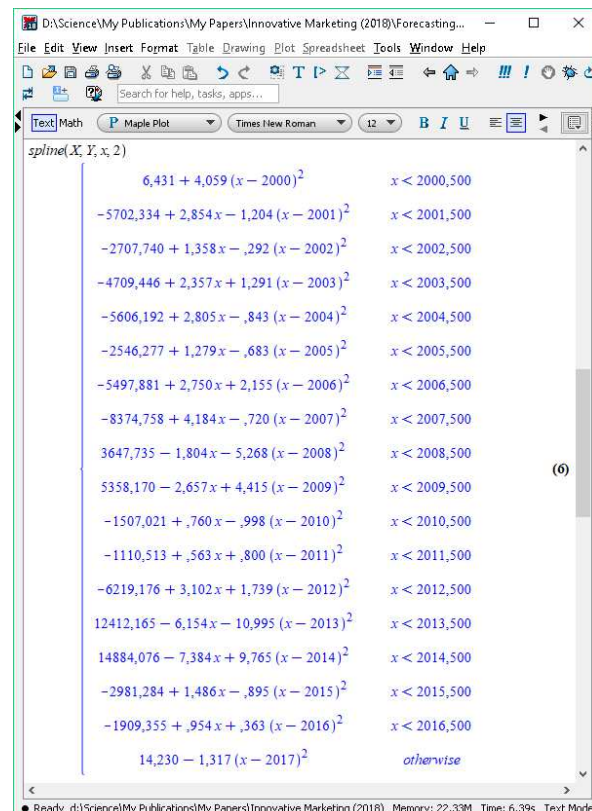
Figure A4. Function description of cubic spline

Mathcad - [Forecasting (IM-2018).xmcd]

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$$X := \begin{pmatrix} 2000 \\ 2001 \\ 2002 \\ 2003 \\ 2004 \\ 2005 \\ 2006 \\ 2007 \\ 2008 \\ 2009 \\ 2010 \\ 2011 \\ 2012 \\ 2013 \\ 2014 \\ 2015 \\ 2016 \\ 2017 \end{pmatrix} \quad Y := \begin{pmatrix} 6.431 \\ 9.174 \\ 11.052 \\ 12.514 \\ 15.629 \\ 17.631 \\ 18.936 \\ 23.122 \\ 25.449 \\ 20.798 \\ 21.203 \\ 21.415 \\ 23.013 \\ 24.671 \\ 12.712 \\ 12.428 \\ 13.333 \\ 14.230 \end{pmatrix}$$

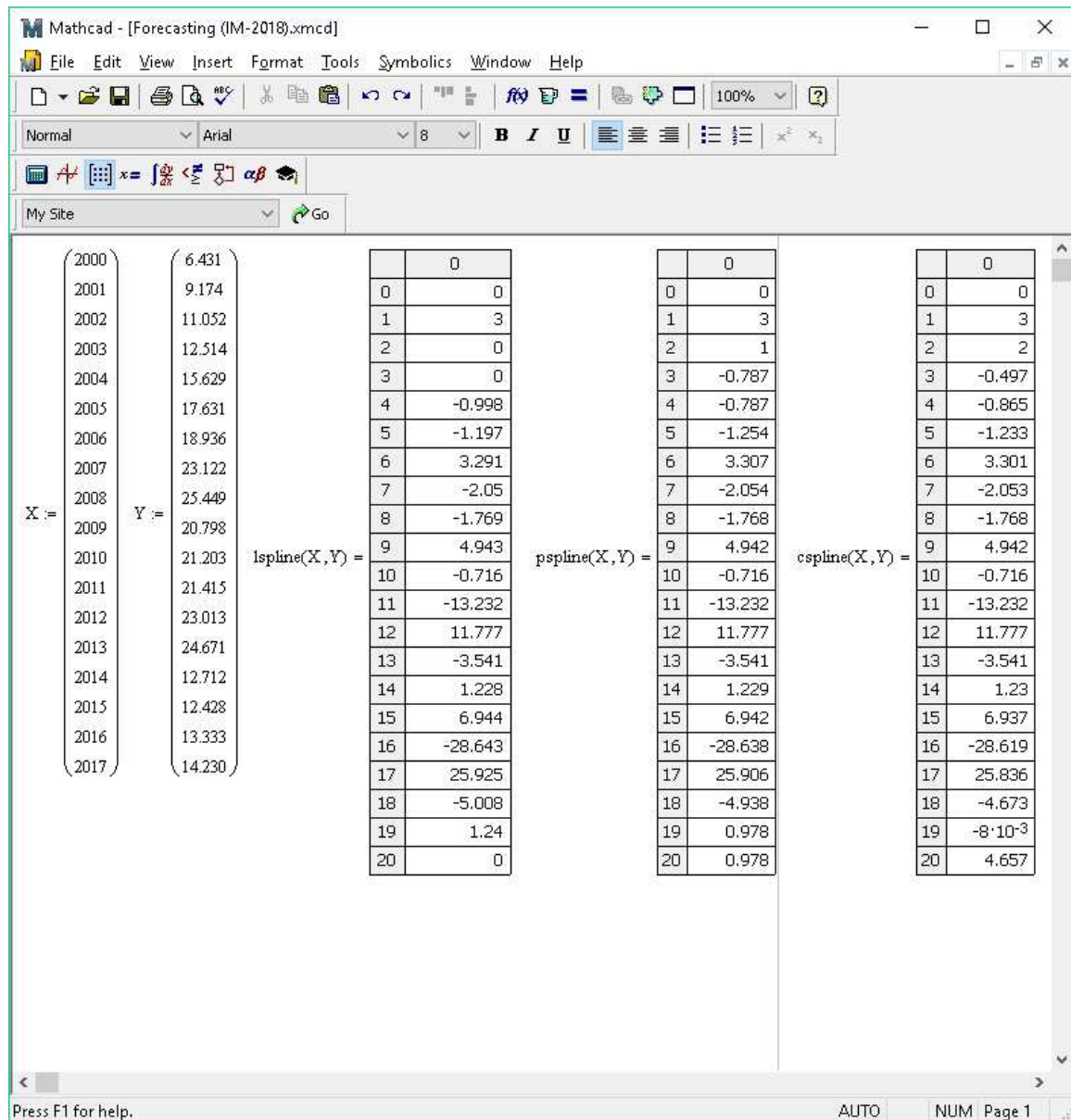| lspline(X,Y) =	0	pspline(X,Y) =	0	cspline(X,Y) =	0
0	0	0	0	0	0
1	3	1	3	1	3
2	0	2	1	2	2
3	0	3	-0.787	3	-0.497
4	-0.998	4	-0.787	4	-0.865
5	-1.197	5	-1.254	5	-1.233
6	3.291	6	3.307	6	3.301
7	-2.05	7	-2.054	7	-2.053
8	-1.769	8	-1.768	8	-1.768
9	4.943	9	4.942	9	4.942
10	-0.716	10	-0.716	10	-0.716
11	-13.232	11	-13.232	11	-13.232
12	11.777	12	11.777	12	11.777
13	-3.541	13	-3.541	13	-3.541
14	1.228	14	1.229	14	1.23
15	6.944	15	6.942	15	6.937
16	-28.643	16	-28.638	16	-28.619
17	25.925	17	25.906	17	25.836
18	-5.008	18	-4.938	18	-4.673
19	1.24	19	0.978	19	$-8 \cdot 10^{-3}$
20	0	20	0.978	20	4.657

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Figure A5. Creating the matrices of data in MathCAD