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IMPACTS OF CLIMATE CHANGE ON WINTER TOURISM IN BOROEVETS

Nearly all European regions are anticipated to be negatively affected by some future impact of climate change, which will pose challenges to many economic sectors, including tourism. Favourable weather conditions and especially snow availability and depth are crucial to visitor satisfaction and are a fundamental factor for the development of winter tourism. The purpose of this paper is to outline the current sensitivity and future economic impacts of climate change on winter tourism in one of the major Bulgarian ski resorts – Borovets.

The paper is structured as follows: firstly, the past and present of winter tourism in Bulgaria is presented. Secondly, the future development with climate change is analysed in detail. The basis of climatological part of the study is the regional climate model REMO. The scenario simulation (2001 – 2050) is based on emission scenario A1B and snow models for different heights of Borovets resort. The economic meaning of climate changes is assessed by regression analyses (ARIMA models) that study the relationship between tourist numbers and meteorological parameters and make forecasts for the period 2021-2050. The quantitative analysis has been supplemented by qualitative research, based on the case study methods. The paper describes how a representative local hotel perceives its dependence on weather and climatic conditions. The relative regional vulnerability is assessed too. Finally, recommendations for policy makers concerning the adaptation to climate change are outlined.

JEL: Q54; L83; O52; C22

1. Introduction

According to the Intergovernmental Panel on Climate Change (IPCC, 2001) climate impact is the consequences of climate change on natural and human systems. It can generally be described quantitatively by changes in biophysical indicators (e.g., the primary productivity of an ecosystem) or in socio-economic indicators (e.g., the

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revenues from ski tourism in a mountain region) (Füssel et al., 2006). In this paper the potential economic impacts are defined as a function of the exposure of human (socio-economic) systems and their sensitivity to climatic stimuli.⁴ Most of these impacts in turn have economic costs.

Winter sports tourism depends very much on snow conditions and implicitly ski tourism industry is considered to be very sensitive to climate variability. However, most studies on these issues are dedicated to biophysical impacts only. There are few studies on economic impacts, including the impacts on tourism, mainly on a global or regional scale. At the European level studies on this topic are oriented mainly on Alpine region. Bulgarian mountains also demonstrate to have a winter tourism sector vulnerable to climate change. These examples support an in-depth analysis of tourism industry in these areas and moreover a study of the socio-economic impact of climate changes based on estimations of future trends of climate parameters on the one hand and of tourism indicators on the other.

2. Methodology

The study applies different quantitative and qualitative research methods. The basis of climatological part of the study is a regional climate model REMO version 5.7 developed by Max Plank Institute for Meteorology, Germany. Hemispheric synoptic-climatological studies were realised based on the ERA-40 re-analyses data (for the past) and the ECHAM 5 global climate model's results (for the past and the future as well). The scenario simulation (2001-2050) is based on greenhouse gas emission scenarios A1B⁵ and can be used to quantify climate change signals by comparing it to the control simulation (1951-2000) which is based on observed greenhouse gas concentrations. Daily and six hourly mean, minimum, and maximum temperatures, as well as daily precipitation amounts, are error corrected by quintile mapping (CLAVIER Deliverable D2.3).

Snow models for four heights at Borovets resort (1244 m, 1300 m, 1700 m, 2500 m) have been developed by WegCenter⁶. Scenarios for the period 1951-2050 have been produced. They are based on the post-processed REMO 5.7 climate simulations, global climate model ECHAM5, and emission scenario A1B as boundary forcing.

Statistical tests of hypothesis and regression analyses are applied to study the relationship between tourist numbers and meteorological parameters. The quantitative analysis has been supplemented by qualitative research, based on the

⁴ The results presented in the paper are part of CLAVIER project (Climate Change and Variability. Impacts on Central and Eastern Europe) funded by the Sixth Framework Programme of the European Commission.

⁵ Climate changes are studied by considering different developments of human activity and society in the future. There are 40 socio-economic scenarios, systematised in the IPCC Special Report on Emission Scenarios (2000). They describe different changes in CO₂ concentrations until 2100. A1B scenario is most often used. It is considered as an "average" scenario in contrast to the other extreme ones.

⁶ Wegener Center for Climate and Global Change (WegCenter), University of Graz, Austria.

case study methods. A representative local hotel has been selected. The paper describes how “the local hero” perceives its dependence on weather and climatic conditions, as well as what climate changes would that mean for the hotel. Half-structured interviews with open and closed questions have been conducted in February 2009.

The concept of endogenous regional adaptive capacity (EARC) has been used to evaluate the adaptive capacity of the case study region. The degree of tertiarization and industrialization measured by employment shares and value added, the economic development (the level and growth of GDP per capita), and also touristic capacities and spatial conditions such as the accessibility are main determinants of ERAC. The classification was performed by utilizing the explorative instruments of factor and cluster analysis (see CLAVIER deliverable 4.2).

3. Borovets Winter Resort

Bulgaria has favourable resources for the development various types of tourism products – summer (sea), winter (ski), cultural, spa, eco, sport, adventure, congress, etc. tourism. However, the so called mass tourism (sea and ski) dominates with almost 70% of the total supply of the tourist product. Tourism is distributed unevenly across the year. In 2007 19% of total nights spent in accommodation establishments were in first and fourth quarter of the year, 25% - second and 56% in the third quarter.

In contrast to sea tourism, winter tourism depends critically on one single meteorological parameter – snow (snow depth and the length of snow season), thus it is the most vulnerable tourist sector in Bulgaria concerning climate changes. That is why, the scope of the paper will be the winter tourism.

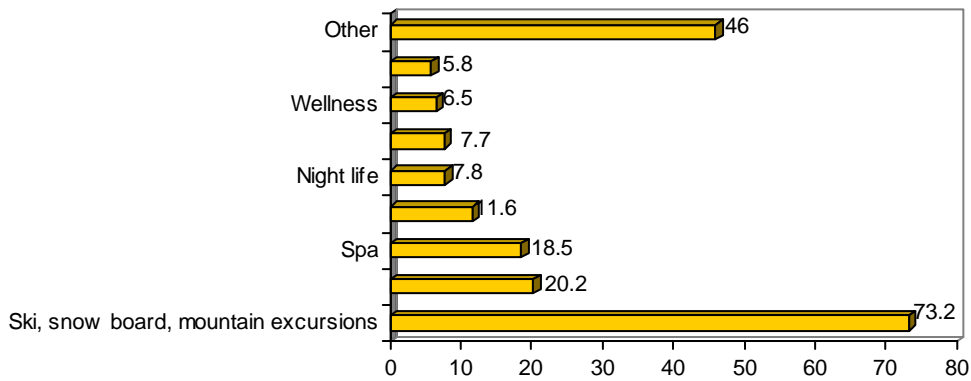
Winter tourism in Bulgaria is well developed in the mountains – Rila, Pirin, the Rodopi, Vitosha, Stara planina. There are three major winter resorts for ski tourism – Borovets, Bankso, Pamporo, located in Sofia oblast, Blagoevgrad and Smolyan districts respectively.

Both domestic and foreign tourists are important for the winter session in Bulgarian resorts, including for Borovets. A sociological research of the tourists in the winter 2008 in Bulgaria shows the profile of the tourists, their activities and preferences (SAT, NOEMA, 2008). The majority of the foreign tourists in the winter season are young people (26.8% are 18-25 years old and 34.8% are 26-25 years old, average age – 35 years), with secondary or higher education, and they are working (63.1%) or studying (23.4%). The tourists come from Greece (20%), Russia (19%), the UK (17%), Germany (9%), Ireland (8%), Romania (6%) and other countries (16%). 13% of them are regular visitors and 69% visit Bulgaria as tourists for the first time. Winter sports play an important role in the types of tourism practiced by the foreign guests (fig. 1).

The average age of Bulgarian tourists is 32 years. In contrast to foreign tourists, only a third of Bulgarian tourists have practiced winter sports (33%) during the holidays, the others have practiced spa and health tourism, visited friends and relatives or simply spent their vacation in the mountains (fig. 2).

Figure 1

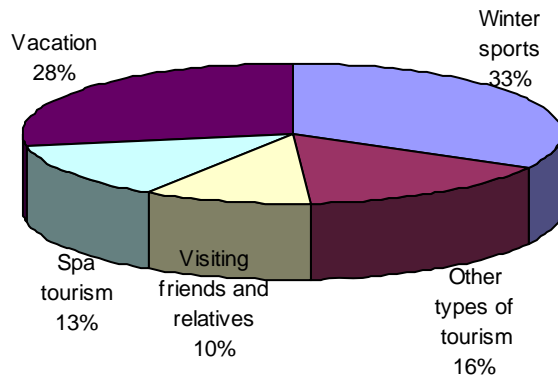
What types of tourism did you practiced during your stay in Bulgaria?
(Answers by foreign tourists, N = 2840)



Source: SAT, Noema, 2008.

Figure 2

What types of tourism did you practiced?
(Answers by Bulgarian tourists, N = 1500)



Source: SAT, Noema, 2008.

Most of the foreign guests have planned their vacation several months in advance, whereas Bulgarians have taken a decision to go on a holiday one or two weeks in advance. A significant share of the foreign tourists in winter (36.2%) have used a

tourist package including all travel costs, accommodation and full board, whereas only 8.8% of Bulgarians have had packages.

More than 90% of the foreign guests are satisfied with the ski zone and facilities.

Winter tourism sub-sector is concentrated in three resorts Borovets, Pamporovo and Bansko located in the three biggest mountains in the country Rila, the Rodopi and Pirin respectively.

Figure 3
Number of available bed-nights and nights spent by resorts during the season 2006/2007

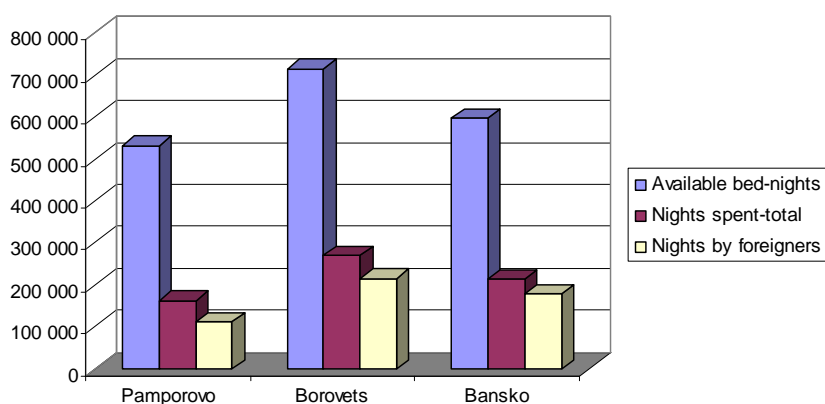
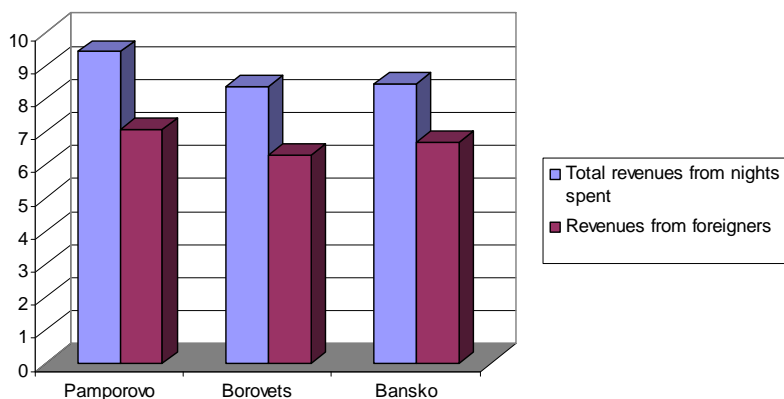


Figure 4
Revenues by resorts during the season 2006/2007 (million BGN)



Source: NSI, 2008.

The study is going to be focused on Borovets. Bansko is a relatively new resort and there is no long term series data about it, which makes the statistical analysis impossible. Borovets and Pamporovo have been developing actively since 1970s

and they are very similar – constructed after the plans of French consultants hired by the former Committee of Tourism in the socialist period.

However, Borovets is the oldest and the biggest mountain resort in Bulgaria. Borovets has the largest number of available bed-nights (713 841), nights spent (270 250) and arrivals in hotels (74 379) during the season 2006/07, as compared to Bansko and Pamporovo, the other two major ski resorts in Bulgaria (fig. 3). Moreover, in the course of the case study research it turned out that it was possible to find reliable detailed data about overnights from a representative hotel only for Borovets. Such information is not collected by the National Statistical Institute. Therefore, Borovets has been selected for the study.

Borovets has existed as a settlement since 1896. It was proclaimed a national resort in 1948. Borovets is the first international mountain resort in Bulgaria. It has been developing actively from the 1960s, when a lot of hotels and restaurants were built. In the 1970s and the beginning of 1980s ski facilities were constructed – tow-lifts, chairlifts, gondolas.

The resort is located at 1350 m above the sea level on the northern slopes of Rila mountain among age-old pine woods, at the foot of peak Mousala (2925 m) the highest one on the Balkan peninsula. Borovets is easily accessible, being at a distance of 73 km from Sofia. The nearest town is Samokov, which is 10 km far from the resort. Borovets resort is located in Samokov municipality, Sofia oblast district.

The ski season in Borovets usually spans from mid-December till April. Snow availability is critical for winter sports - alpine skiing, snowboarding and cross country. Lift facilities are not dependent on snow but on other weather parameters – they are stopped in cases of very strong wind and danger of avalanches.

There are three ski centers in Borovets ski resort: Central Borovets ski center – starting from 1337 m altitude up to 1780 m., Yastrebets ski center – from 1340 m up to 2369 m, Markudjik ski center – from 2340 m up to 2550 m. The resort offers excellent conditions for winter sports: alpine skiing, cross country, and snowboarding; biathlon facilities, ski jumping – in Central Borovets ski center.

There is a snowmaking system installed by Borosport Ltd. the operator of ski facilities. There is also night skiing on ski runs “Rila”, “Igljika”, “Martinovi Baraki 2” and “Martinovi Baraki 3” (altogether 2300 m). Six mobile snow-guns are installed on every 80 meters along the ski runs. The runs are sound-tracked and lit up by modern lighting systems, installed on 54 posts according to European standards. The resort also offers a number of adventures both in winter and in summer.

The resort is significant for the development of tourism in the district. Although in Borovets are located only 34.3% of accommodation establishments and 41.5% of bed places of Sofia oblast, it earns 88.8% of revenues from nights spent and 98.2% of revenues from nights spent by foreigners. There are 22 municipalities in the

district, most of them small ones with population below 10 000. Samokov is the largest municipality in Sofia oblast with about 40 000 people and which is 15% of the total population of the district.

The occupation rate⁷ of winter resorts (IV 2006 – I 2007) is as follows 38% in Borovets, 36% for Bansko and 30% for Pamporovo. The total occupation of the bed-places in accommodation establishments in Bulgaria is 33% in 2006 and 31% in 2007. The occupation rate in Borovets is higher than that in other winter resorts and the average rate for Bulgaria. The low occupation rate, and the overcapacity of hotels is a common problem for all resorts in the country. It is especially evident in comparison with other EU countries – in Bulgaria the net occupancy rate is lowest. For example, during the 2007–2008 winter season net occupancy rates of bed places in European countries ranged from 18.3 in Bulgaria to 70.3 in Austria. Only in three member states (Austria, Malta and Spain) was the net occupancy rate of bed places in the peak month more than 50% (Eurostat, 2008).

In 2006 about 4% of all workers in Sofia oblast were employed in the Hotels and restaurants sector. The activity rate in the district is 50.2%, the employment rate is 45.7% and the unemployment rate - 9% (2006). However, in Samokov municipality the unemployment is 14.88% or 2890 people, out of which 65% are registered for more than one year, and 32% are young people (up to 29 years). In Samokov municipality, where Borovets resort is located, 15% of all employees or 1266 people work in the Hotels and restaurants sector. If taking into account only enterprises (excluding public services sector) the share of employed in tourism is 17.4%. Therefore, winter tourism is an important employer on a local level in Samokov municipality.

About 13% of enterprises in Samokov municipality are operating in the tourism sector, but they own 38% of the fixed assets in local economy. However, the effectiveness of sales and operative effectiveness of tourist enterprises are lower than the national average and the average of Samokov. Perhaps this is a result of the overcapacity of the resort, the low occupancy rates of the hotels which in turn lead to relatively low effectiveness.

In conclusion, snow depth is critical for winter tourism and sports. However, past experience in Borovets resort shows that the influence of snow conditions on the tourist sector is complex and should be considered at least in two aspects. In the short-run the number of tourists and the hotel occupancy rates do not depend on the day-to-day snow conditions. In the long-run a snow deficient winter months or a season will influence negatively the booking of the organised tourists. Nevertheless, the total hotel occupancy perhaps might not drop down. It depends on the success of the marketing policy and the alternative services offered by a hotel. If it is flexible enough, it could attract “hesitant” tourists from Bulgaria and the neighbouring countries, and fill in the capacity of the accommodation establishment.

⁷ The ratio “Total nights spent” to “Available bed-nights”.

Case study: Samokov Hotel

Samokov hotel has been selected for a local hero. Interviews were conducted with the marketing manager and the executive director of the hotel in February 2009. Samokov hotel is a four-star hotel situated in the centre of Borovets resort (1300 m above the sea level) and only an hour drive from the capital – Sofia. The hotel is an eleven-store building in alpine style, surrounded by pine forests. The hotel offers rooms and apartments, congress centre with eight halls and a great variety of extra services – indoor swimming pool, sauna, solarium, steam bath, fitness hall, bowling, table tennis, mini-golf, etc. It has also several restaurants, bars and a night club. A ski school and depot are located at the ground floor of the hotel. The hotel is open all the year round. In summer it offers summer sports, mountain tours, excursions.

The hotel is owned by a joint stock company, which has also another hotel at the Black Sea coast in Slunchev Bryag resort. Samokov hotel was built in 1989 and in the beginning it was owned and managed by the state. Later it was privatised in 1991.

The respondents described the general development of the tourism sector in Borovets as following. Tourism has been expanding very fast recently. A lot of new accommodation establishments have been built. According to the managers of Samokov hotel this unplanned and unregulated expansion of bed-places causes a lot of problems related to infrastructure – insufficient ski facilities (not enough lifts and tracks, and the tourists have to queue up), problems with waste management and snow cleaning in the resort, lack of a common advertising policy for Borovets as a tourist destination. The managers' opinion is that there is no market for all these bed-places in Borovets. In general the overcapacity of Borovets worsens the quality of the services offered in the resort, at the same time prices are increasing and approaching the price levels in other EU countries, and thus, the competitiveness of the resort is aggravating.

The tourism sector is important for the local economy in the municipality. Construction projects have stimulated the economic development, especially the Super Borovets project. However, this project is suspended now. According to the respondents Borovets resort is a significant employer in the municipality, though not the only one. There are other companies providing jobs for the people living in Samokov municipality – hotels in the town of Samokov, as well as agricultural and industrial enterprises. Also a lot of people work in Sofia, which is one-hour drive away from Sofia.

Employees in Samokov hotel must be well-educated people, speaking foreign languages, even chambermaids and cleaners. Minority groups, especially Roma, live in Samokov, but they usually have low or no education. That is why, only few Roma people work in the hotel. A significant number of the qualified personnel of the hotel are employed in winter in Borovets and in summer – in the Black Sea resorts. They are not inhabitants of Samokov municipality.

In winter most of the tourists in Samokov hotel are foreigners organized by tour operators and the bookings are made well in advance (several months). The majority of the guests use tourist packages. This tourist segment is the most important one for the hotel in the winter season. In summer a significant segment is the seminar and congress tourism.

About 80% of the guests of the hotel come from the UK, the Netherlands, Belgium, Russia, Serbia, Macedonia, Germany, etc. The rest 20-25% are Bulgarians. There are no tourists from Austria and Switzerland. The number of tourists from Germany has been decreasing and that from the UK – increasing during the last years. However, in 2008/2009 season the UK tourists are dropping off because of the economic crisis, at the same time there are more Serbians and Macedonians.

According to the interviewed managers the number of tourists in the hotel does not depend directly on the day-to-day snow conditions. However, tourists will book their next winter vacation in Bulgaria depending on their satisfaction of the stay during the current year.

The average stay of a tourist in the hotel is one week in winter (in summer 2-10 days). Tourists from abroad are coming by plane, carrying expensive ski equipment, a ski vacation is a relatively expensive one and a shorter stay in the hotel is not paying (efficient) for them. Ski vacations in terms of travel dates and duration are relatively inflexible. Thus, a tourist stay does not depend directly on the current snow conditions. For example, if a guest of the hotel has just arrived for a week vacation, s/he will stay in the hotel for a week regardless of the snow and ski conditions in Borovets. However, snow deficient winters are a problem in the long-run. They cause a decrease in the tourist numbers, moreover skiing on bad ski tracks (with less snow and bare stones) damages the ski equipment that the hotel rents to the tourists.

Organised tourist groups with advanced bookings occupy about 70% of the hotel rooms, the rest 30% are “impromptu” tourists. In snow deficient weeks the number of these hesitant tourists decreases and vice versa. According to the hotel managers a tendency can be observed during the recent years that tourists do not make as very early bookings, as in the past, but they book a hotel usually 2-3 weeks in advance.

The main reasons of foreign tourists for coming to Borovets in winter are the ski sports and parties (bars, restaurants, night life). Other types of tourism practiced by the guests of Samokov hotel in winter are spa and wellness.

The most favourable meteorological conditions for skiing according to the managers of Samokov hotel are the sunny, windless and clear days with deep snow. The first snow should be at least 50-60 cm high in order to have suitable ski conditions. However, the beginning of the season is determined by the organised tourists with bookings in advance. The date of the first charter flight is usually fixed for 20th December and does not depend on the snow conditions. A possible decision for shifting of the winter season cannot be taken by Samokov hotel alone; it would be a decision on a global level by the tourist companies around the world.

According to the hotel managers good or bad meteorological conditions in a certain season have a positive or negative impact, respectively, on the booking for the next season. Thanks to the internet, tourists abroad are well informed and before deciding for a booking in Borovets, they make careful investigations about the past winter season.

In managers' opinion changes in climate have been observed in Borovets. The winters are not as snowy as in the 1980s. The snow cover does not hold for a long period but melts quicker than in the past. The interviewee does not observe changes in December, i.e. the beginning of the winter season, but believes that there are some changes in March. Currently there is snow at the end of March. However, the tourist companies run programmes until 20-25 March only. In order to use the favourable ski conditions and fill in the gaps at the end of March, the hotel attracts unorganised tourists by internet marketing and special promotions.

Until now there were certain snow-less periods but there have never been absolutely snow-deficient winters. In respondents' opinion unfavourable ski conditions have influence on the hotel to a certain extent. Nevertheless, they have never incurred a loss because of the bad snow conditions. The hotel has a diversified market and relies on organized mass tourism. For example, the winter season 2007/2008 was snow deficient. The hotel experienced cancelling of reservations. However, the marketing was flexible enough and quickly took measures to attract tourists from Bulgaria – for congress tourism, as well as for spa programmes.

Until now Samokov Hotel has kept the number of employees, irrespective of the weather conditions. They do not dismiss workers, because it is difficult to find highly qualified personnel. If they have few guests and free rooms, they react quickly, offer lucrative services and try to attract new tourists. The hotel also offers a wide range of services to its guests in addition to the simple accommodation and food.

If there is no snow during a certain week, the foreign tourists who stay in the hotel at that time find other entertainment opportunities, e.g. go on excursions to Sofia, the Rila Monastery, etc. The hotel has not yet received complains because of unfavourable weather. According to the interviewee, the tourists do not get bored with staying in Borovets for a week, even if there is no snow. There are some snow-making facilities in Borovets but they can operate under low air temperatures only.

Concerning external factors that have influenced the hotel in addition to the weather conditions, the marketing manager mentioned in the course of the interview the shortages of gas supply in Bulgaria in January 2009. In fact Samokov hotel has an alternative fuel – mazut and the building was well-heated at that time. However, seeing the media headlines about the gas problems in the country, a lot of guests phoned and asked questions about the heating in the hotel, and perhaps there were tourists who had cancelled their reservations.

The respondent has also pointed out the problems with the nature management in Rila Mountain concerning the intensive construction during the recent years, as well

as the illegal clearing of forests. All these have aggravated the situation with soil erosion and avalanches. Also there were floods at the foot of the mountain. However, there have been no natural disasters in Borovets resort up to now. According to the interviewee climate change and other nature-related problems are a result of the uncontrolled anthropogenic activities.

Nevertheless, according to the hotel managers the challenges to the tourist business in Bulgaria are related to the economic crises in Western Europe and the necessity to direct their efforts towards other markets – Bulgaria, Greece, Macedonia, Serbia, etc. The crisis has had different effects on the West European and Balkan markets. West Europeans have strict budget for spending on holidays and many of them when confronted with low income, have cut their plans to travel far away from their home country. In contrast, the hotel welcomed a lot of guests from Bulgaria, Serbia, Macedonia and Russia during the season 2008/2009.

4. Regression Analysis

The objective of the regression analysis is to study the relationship between nights spent in Borovets resort and the number of days with snow (snow days) and the snow height. The total duration of the winter season in Bulgaria is six months from October until March; however according to hotel managers the busiest season is from the second half of December till the second half of March. Regression analysis has been applied to model the relationship between the variables. Statistical testing of hypothesis has been used to prove that there is a significant relationship between the factor and resulting variables.

It has been determined also that there is a trend for decreasing of snow cover and the number of snow days, which impacts negatively the number of nights spent in Borovets.

4.1. Data Analysis

In order to determine the significance of climate conditions for the winter tourism it is necessary to study the existing relationship between nights spent, the number of days with snow cover and the snow height. The best option is to analyze tourist data about the entire resort. However, in the course of the case study research and the database preparation it has turned out that it is impossible to find long-term detailed tourist data about the resort. The National Statistical Institute publishes only quarterly data about tourism. Monthly or 10-day data is not available for the whole resort. Moreover, the resort has been developing very fast for the last years and new hotels have been built, which infringes upon the comparability of the time series data. That is why efforts have been made to find information from a representative hotel in the resort. Data from one big hotel in Borovets has been used for the regression model. In 2006 the nights spent in this hotel are almost 20% of all nights spent in the resort. The share of the nights spent in this representative hotel during the first quarter of 2007 is even higher – 23%.

The information about the factor variables has been provided by NIMH for the period 1992-2006: ten-day data for the months October – March from the NIMH meteorological station at 1924 m height. Hotels in Borovets are located at this altitude; however the ski tracks are around 2500 m above the sea level.

The time series for nights spent is for the period 1993-2006 and the information is for 10-day periods – dates 1-10; 11-20 and 21-30 (31) of the months from October till March.

Before running the real regression analysis, it is necessary to define the type of the time series, which is going to be used. In this case there are three possibilities:

- times series by ten days (decades), as the original data available;
- time series by months, which makes necessary to regroup the data;
- time series by years, which also requires the regrouping of the original data. In fact the information is about six months of a year only (from October till March which is the winter season).

In order to choose the proper type of data for the regression, the three time series have been analysed

The ten-day time series may contain a trend and a cyclic element in two varieties: a seasonal element shorter than a year and an element longer than a year.

The trend showing the change in the overnights number in the course of time measured in decades is presented by the following linear equation:

$$Y_t = 3198,9 - 0,2911t \quad (1)$$

The intercept is near the average value of the overnights – 3194 per decade. According to the regression coefficient by moving to the next ten-day period the overnights number decreases by 0,2911. This means that for a month the hotel loses about 1 overnight which is a negligible value. The small value of the regression coefficient means that the time series could be classified as stationary. The times series under consideration contains also a seasonal element which requires a special analysis.

The second times series contains monthly data, calculated by regrouping the original data. It also contains a seasonal element, as the figure shows, which requires relevant modeling. The presence or lack of a trend could be judged by looking at the following equation:

$$Y_t = 9594,5 - 2,5477t \quad (2)$$

Like in equation (1), the intercept in equation (2) is almost identical with the average monthly value of the overnights – 9585. The effect of the trend is a decrease of 2.6 overnights on average every month. The small value of the regression coefficient could be considered as a symptom that the time series is stationary.

The third times series contains yearly data. The analysis of this series shows it has a certain cyclic element and a minimum trend.

The linear trend is described by the following equation:

$$Y_t = 54305 + 348,33t \quad (3)$$

Like in the previous two equations the series with the yearly data shows minimum change in the overnights 348, but the direction is the opposite – towards an increase – which could be explained by the regrouping of the data. In this case attention should be paid to the dynamics in the overnights numbers during the different years (seasons). In the beginning of the period 1993 – 1994 this number is quite high and is near the possible maximum. After that there is a serious drop down and a minimum occupancy is observed in 1999. This low rate is preserved until 2002, irrespective of some fluctuations. After 2002 an upward trend is observed until 2005 when the maximum number of overnight for the whole period is reached. This is followed by certain stabilization at a somewhat lower level. The question is if a trend could be found in this case. The analysis of the data should take into account the characteristics of the period under consideration. Its beginning coincides with the first years of the transition to a market economy in Bulgaria. In 1999, the year with the minimum registered overnights, the situation on the Balkans has repelled tourists as a whole and this also has impacted the winter tourism in Bulgaria. The lack of long-term data does not allow making justified conclusions about a trend and a cyclic element.

The analyses of the three dynamic rows give reasons to work with the longest times series, which is the data by decades. Its length of 252 observations makes possible the good modelling of the trend and the cyclic element.

4.2. Regression Results

The identification of the regression model requires defining the parameters, that are going to be evaluated, and as well as the type of the model, through which they are going to be evaluated. The type of the data and the characteristics of the changes in the dependent variable (the number of overnights per decade) assume the application of ARIMA model, and specifically its modification for the evaluation of factor impacts and seasonality $ARIMA(p, d, q)(ps, ds, qs)$. In this case the factors are the number of snow days and the snow height. It has been determined through statistical tests of hypothesis that there is a relationship between the number of nights spent, the number of snow days and the height of snow cover. Based on the method of competitive models with Schwarz's Bayesian Criterion (BIC) ARIMA

model of the type $ARIMA(1,0,0)(18,0,0)$ has been determined to be most appropriate.

The model is autoregressive of order 1, $p = 1$, there is no need to remove trends - $d = 0$ and moving averages are not applied - $q = 0$. The seasonality is modeled by autoregression too $ps = 18$. The model is the following:

$$Y_t = c + b_1X_1 + b_2X_2 + AR(1)\varepsilon_{t-1} + \sum ARS(p)\varepsilon_{t-(12-p)} + u_t \quad (4)$$

where

Y_t - dependent variable (result), number of overnights

c - intercept

b_1 - regression coefficient, showing the quantity relationship between the first factor and the dependent variable (result)

b_2 - regression coefficient, showing the quantity correlation between the second factor and the dependent variable (result)

X_1 - first independent variable (factor) – number of days with snow cover

X_2 - second independent variable (factor) – snow height

$AR(1)$ - autoregression coefficient, showing the quantity correlation between the residual from the period $(t-1)$ and the result Y_t

$\sum ARS(p)$ - autoregression coefficients, modeling the seasonality and showing the quantity correlation between the residual from the period $(t-(p-12))$ and the result Y_t

ε_{t-1} - residual from the period $(t-1)$

$\varepsilon_{t-(12-p)}$ - residual from the period $(t-(p-12))$

u_t - error in the new time series

The following equation is used for developing the forecast:

$$Y_t = 3066,753 + 12,947X_1 + 2,334X_2 + 0,542\varepsilon_{t-1} + \sum ARS(p)\varepsilon_{t-(12-p)} + u_t \quad (5)$$

where for seasonal element the sum symbol is replaced with the specific values of the parameters, and the error u_t is equal to zero.

The interpretation of the above equation concerning the climate change, i.e. the change in the values of the factor variables, is as follows:

- when the number of snowy days increases by one day, the number of overnights will increase on average by 12.947 for a period of ten days;
- when the snow height increases by one centimeter, the number of overnights will increase on average by 2.334 for a period of ten days.

When interpreting the above two parameters, as well as the others related to the seasonality, one should take into account that some of them are not statistically significant. A possible explanation is that a certain proportion of the variation in the dependent variable is described by seasonality, the ability of the hotel management to attract tourists, etc.

There is a lag in the seasonal element, equalling to 18, which means that number of overnights in a given decade depends on the number of overnights in the same decade of the previous year.

Using the above equation, a forecast has been made about the number of overnights until 2050. The accuracy of the forecast has been checked by the classical way, it is calculated that $MSE = 628536$. A similar forecast has been made on the base of the second competing model $ARIMA(1,0,0)(9,0,0)$. Its error in the forecast is $MSE = 671183$.

Fig. 5 presents the observed and the forecasted number of overnights during the period 1993-2006 by decades. The linear equations modelling the trend are as follows:

for the observed values

$$Y_t = 3198,9 - 0,2911t \quad (6)$$

and for the forecast values

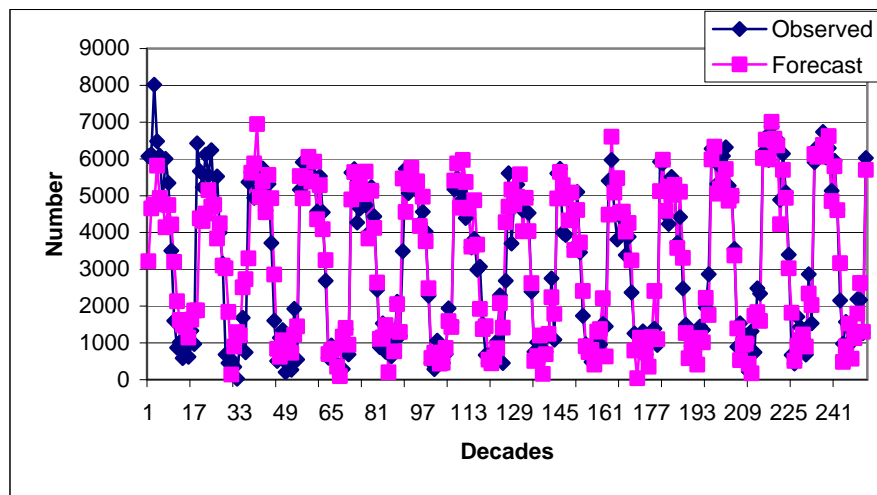
$$Y_t = 3197,5 - 0,2909t \quad (7)$$

According to the WegCenter model⁸ $y = -0,0015x + 4,5485$ the number of snow days decreases with each coming decade, but this decrease is negligible –

⁸ Details in CLAVIER project, WP2 Interface. Case studies: Computation of snow water equivalent and snow height from regional climate model data.

0.0015. The average number of snow days in the resort is expected to be about 4.5 per decade.

Figure 5
Actual versus forecasted overnights at the hotel: January 1993 – December 2006



According to the WegCenter snow model $y = -0,003x + 8,7402$ the average snow height at 1300 m. at Borovets resort will be about 8 cm and is projected to decrease very slowly during 2007-2050. The decrease is 0.003 cm per decade, which means that it totals up to 0.009 cm for a month.

The forecast has been made for the period 2007 – 2050 based on the developed model and values of the factor variables – the number of snow days and the snow height.

The data clearly shows the seasonality, caused by the climatic characteristics of each month in the winter season. The trend could be modelled through a linear equation, as follows:

$$Y_t = 3187,6 - 0,1252t \quad (8)$$

The small difference between the values of the parameters of equations (7) and (8) are due to the fact that the parameters of (7) for the historic period are calculated on the base of observed value of the factor variables provided by National Institute of Meteorology and Hydrology at the Bulgarian Academy of Sciences (NIMH).

What is important for the economic analysis is the value of the regression coefficient in front of the factor variable “time”. Its value - 0.1252 is negative. This means that the transition to the next decade of the winter season months will lead to a decrease

in the number of overnights by 0.1252 on average, i.e. about 0.80 or 1 overnight per month on average.

The main part of the ski tracks and facilities in Borovets are located at about 2500 m (Markudjik and Yastrebets), which is below Musala peak. The other part (Sitnyakovo) is located at about 1700 m. Forecast have been developed about these two heights.

According to the snow models for the period 2007-2050 at the two altitudes where the ski tracks are located, climate changes will influence negatively the two factors – number of snow days and the average snow height. However, the changes are expected to be very small, which is proved by the values of the respective regression equations.

Regression analysis has been conducted about the altitudes of 1700 m and 2500 m like that of 1300 m. It has been experimenting with various competing regression models. It has been confirmed that the most suitable model for forecasting the overnights is the model used for the altitude 1300 m. The model is: *ARIMA* (1,0,0)(18,0,0), autoregressive type of first order $p=1$, without trend removal - $d=0$ and without moving averages - $q=0$. The seasonal element is modelled by autoregression $ps=18$, which means that the overnights for a given decade depend on the number of overnights for the same decade during the previous year. The type of the model has been already described, as well as the symbols used:

$$Y_t = c + b_1X_1 + b_2X_2 + AR(1)\varepsilon_{t-1} + \sum ARS(p)\varepsilon_{t-(12-p)} + u_t \quad (9)$$

The common characteristic of the two forecasts is that the initial number of overnights is very similar – 3258 and 3253. The effect of climate changes on the number of overnights is negative. According to the autoregression model the impacts are almost negligible – for each decade the number of overnights is going to decrease by 0.15 and 0.17 respectively, i.e. about 3-4 nights spent per winter season.

The difference in the impacts of climate change at the three altitudes is quite small. The changes are smallest at 1300 m and can be seen from the regression equations.

At altitude:

$$1300 \text{ m } Y_t = 3187,6 - 0,1252t \quad (10)$$

$$1700 \text{ m } Y_t = 3258,7 - 0,1472t \quad (11)$$

$$2500 \text{ m } Y_t = 3253,1 - 0,1754t \quad (12)$$

The difference concerns both parameters:

- the intercept of the model for 1300 m is the smallest as compared to the other two models;
- the regression coefficient of the model for 1300 m is the smallest too, which means that the impacts of climate change at this altitude will influence least the overnight numbers at Borovets resort.

5. Future Developments, Climate Changes and Their Economic Meanings

Relative changes in the temperature and snow height in Borovets in the period 2021-2050 as compared to the 1961-1990 *according to AIB scenario, REMO model* are presented on the following figures.

Figure 6

Daily mean parameters in Borovets

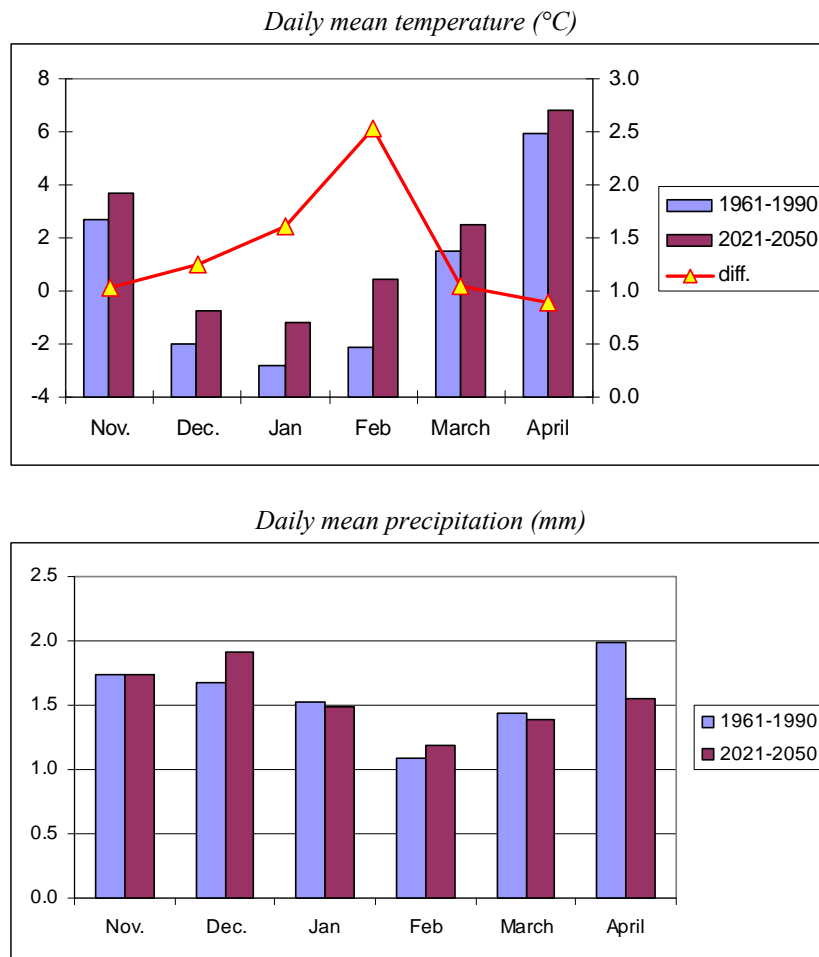
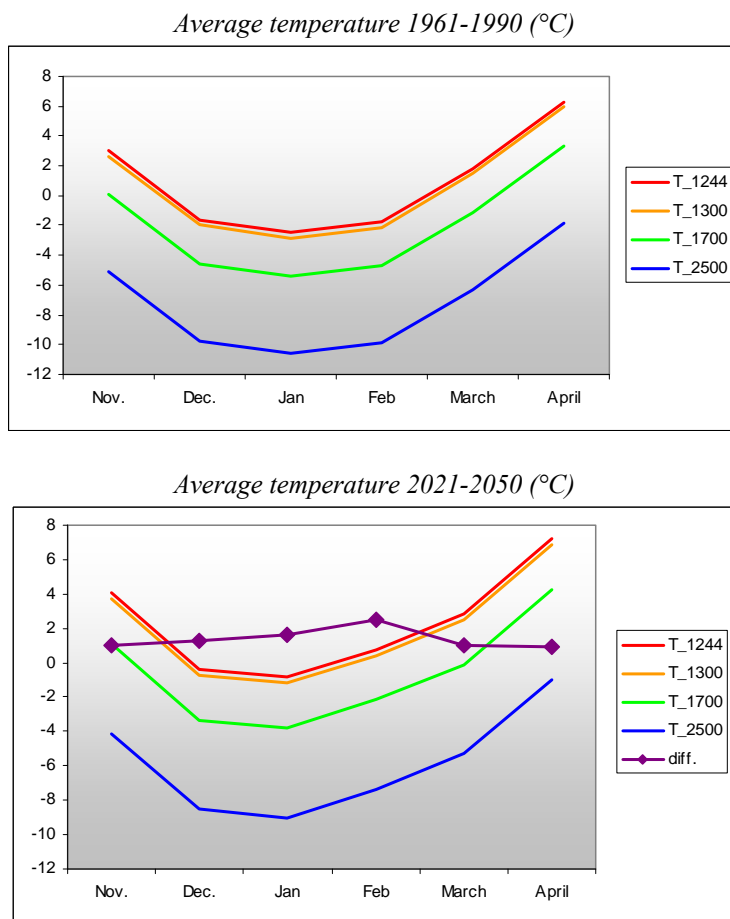


Figure 7

Past and future temperature in Borovets at four different altitudes in Borovets (1244 m, 1300 m, 1700 m and 2500 m)



According to the A1B REMO scenario the mean temperature in the period November – April in Borovets increases slightly by 1.4 °C during 2031-2050 as compared to 1961-1990. The most significant change is observed in February +2.5 °C. The mean precipitation hardly changes. However, an increase is expected in December (+0.24 mm) and a relatively high decrease – in April (-0.43 mm).

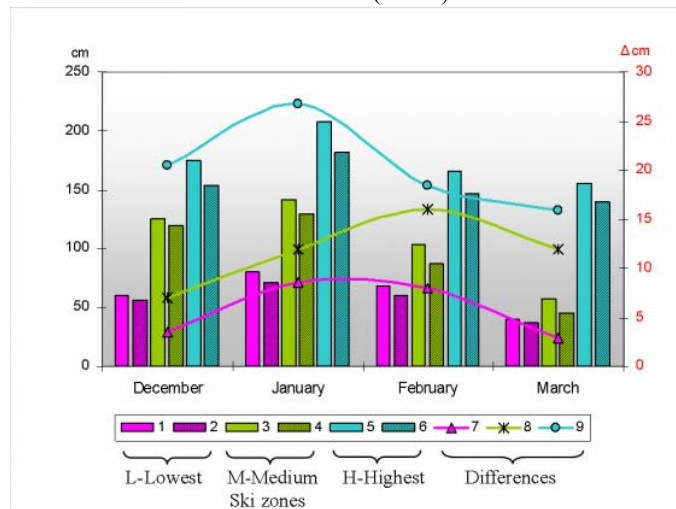
If considering only the active tourist season (December – March) the average expected decrease in the snow depth is 6 cm at 1300 m, 12 cm at 1700 m and 20 cm at 2500 m. According to the snow model the largest decrease is observed at the highest altitude (2500 m) in December (-20 cm) and January (-27 cm).

The mean snow cover in the future at the different ski zones during December – March is around or well above 50 cm (fig. 8). The only exception is the lowest zone in March with a mean snow cover of 37 cm. According to the A1B scenario and the data and assumptions described above, a conclusion could be made that on average Borovets resort will have enough snow for skiing in the future. However, it should be taken into account that the minimum snow covers necessary for skiing depends on the quality of the preparation of the ski tracks.

Moreover, this could explain the regression results: there is a stable downward **trend** in the number of snow days and snow height, but only a small change in the number of overnights is observed, because on average the ski zones will still have enough snow for skiing in the future.

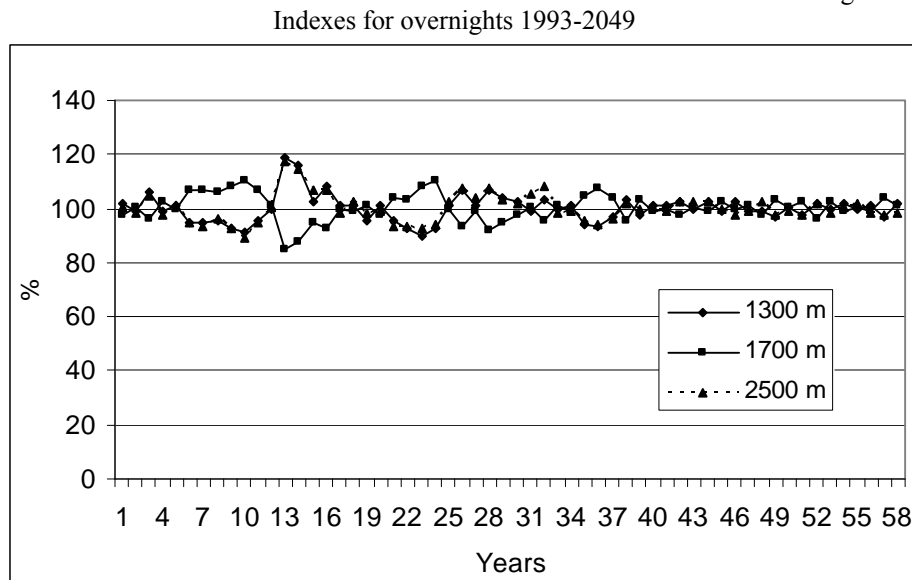
When considering the expected climate change, the **cyclic development** in the snow cover should also be analysed in addition to the trend. The following figures show the indexes of snow cover in the period 1993/94 – 2049/50. The fluctuations above and below the trend (the 100% horizontal line) represent snow-adequate and snow-deficient years, i.e. good and bad years for tourism. The cyclic variations are significant. It is important to note that in the future snow-deficient winters occur more often as compared to the 1990s and 2000s. For example, periods of 2, 4, 5 or 6 consecutive winters with bad snow condition could be expected in 2020-2050 (see the red arrows).

Figure 8
Average snow height in Borovets at the ski zones in 2030-2050 as compared to 2007-2008 (in cm)



* the first column at each height shows the situation today, the second shows the future 2031 – 2050; the curves show the differences in cm on the right axis at the three heights respectively.

Figure 9

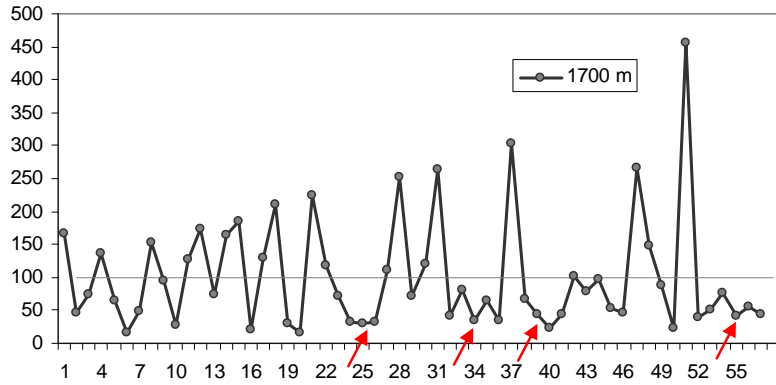


The economic implications of the climate changes described above are complex and should be analysed in several aspects:

- trend vs. cyclic fluctuations;
- short term – long term impacts;
- impacts on small vs. big hotels.

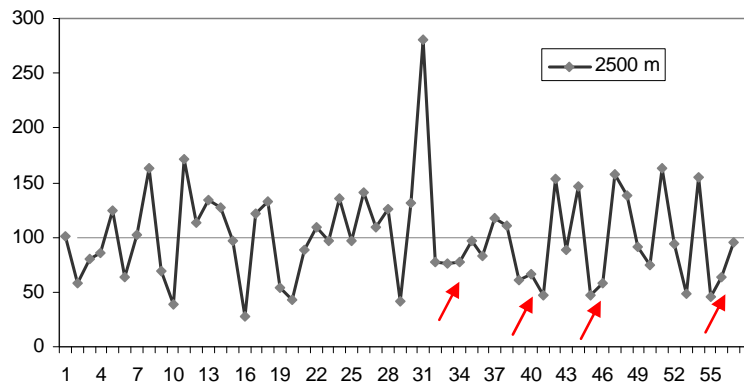
The regression analysis has shown small negative trend and negligible fluctuations of the index of overnights. However, the ARIMA model, as well as the interviews with hotel managers, have proven that overnights in a given season depend on the snow availability in the previous year. When potential tourists make a decision about their ski vacation in Borovets, they take into account the ski condition in the previous years. There are different sources of this historic information on the internet and they can easily get informed about the snow cover in Borovets during the previous years. Thus, when they get confronted with cyclic fluctuations and see information about several consecutive snow-deficient winters, as expected in the period 2021-2050 (fig. 10 and fig. 11 – the arrows), most likely tourists will not choose Borovets for their ski vacations, but will select another destination. Thus, when taking into account both the behaviour of tourists and the indexes fluctuations of snow cover, a conclusion should be made that according to the A1B scenario a substantial decrease in the overnights could be expected in the long-term future.

Figure 10
Indexes of snow height at the medium ski zone 1993/1994 – 2049/2050



It might be misleading to make conclusions about economic impact of climate change in Borovets resort considering only the change of bed-nights. One should take into account the changes in snow cover at different altitudes. It is possible the ski tracks at low altitudes to suffer permanently from the lack of snow. Thus, the same number of tourists will have to use a limited number of facilities (ski tracks). This might lead to overloading of the facilities at high altitudes, worsening the quality of services and dissatisfaction of tourists, which might cause a sharp drop in the tourist numbers. An additional effect of the lack of snow and tourists will be the fierce competition among the hotels.

Figure 11
Indexes of snow height at the highest ski zone 1993/1994 – 2049/2050



In addition, the short and long-term periods should be distinguished in the economic analysis. According to the A1B scenario in the near future (the 20s of the century) the decrease in the snow cover is relatively insignificant, the resort is snow-reliable and the number of consecutive snow-deficient winters is small – one or two “bad”

winters, when followed by several “normal” or “good” winters (fig. 10 and fig. 11), perhaps will not influence negatively the decisions of potential tourists about their future ski vacation in Borovets.

When considering the near future, the possibilities of short-term lack of snow and the respective economic impacts, the type of the hotels should be taken into account. If it is a big hotel, which offers a variety of services, such as the Samokov hotel, the guests staying there will have alternative entertainments in case of bad weather or lack of snow. It is not the case with a small hotel, which offers only bed and breakfast.

The economic impacts in the long-run for both types of hotels might be significant according to the A1B scenario when there will be cyclic occurrence of several consecutive “bad” winters.

Winter tourism in Borovets plays a relatively small role in the economy of Sofia district and South West planning region. However, it is quite important for the local economy of Samokov municipality in terms of employment, foreign currency revenues, investments, share of fixed assets, etc. The impacts on Samokov municipality should be considered at least in two aspects. If not taking into account adaptation measures, the decrease in the overnights is relatively small in the short-run. When considering adaptation measures, which are already taken by big hotels (such as diversification of services and markets), the tourist numbers might remain the same there, whereas small accommodation establishments might suffer from climate change. The economic impact on the regional economy will be moderate.

It is likely that the impacts in the long-run are much more negative. They depend both on the snow conditions, as well as on the preferences of tourists in Borovets and the flexibility of hotels' marketing policy. The worst possible scenario (the collapse of tourist numbers visiting Borovets because of a long cycle of “bad” winters) will lead to closing down of hotels and survival of the most competitive ones. The unemployment rate in Samokov municipality will go up. Taking into account that the number of workers in the tourism sector is almost equal to the number of employed, the worst scenario will double the rate of unemployment. It will reach as high as 30% as compared to the current levels. This will bring pressure also to the labour market in the nearest city – Sofia. Under this scenario the investment plans will be definitely suspended, which will influence negatively the construction sector.

Borovets's share in the national tourism of Bulgaria is relatively small – 2.1% of the number of overnights and 1.6% of the value of revenues. A possible worse scenario (closing down of hotels in Borovets) will have negligible effects on the national GDP. However, it will influence the labour market in the tourism sector on a national level. As already mentioned, a lot of highly qualified employees in the hotels in Borovets work there in winter and move to the Black Sea hotels in summer. Also, sport trainers work as ski teacher in winter in Borovets and as sea sport trainers in summer. All these people are not residents of the town of Samokov, but

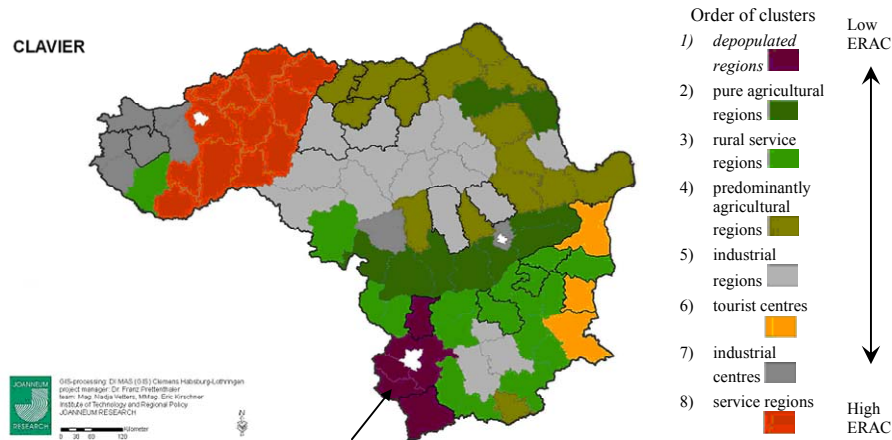
they usually live in the Black sea towns. Therefore, a dismissal of personnel in Borovets will bring pressure to the labour markets in these towns in winter.

6. Relative Regional Vulnerability and Policy Recommendations

According to the analysis of the endogenous regional adaptive capacity (ERAC) the South-West planning region of Bulgaria (including Samokov municipality) is a depopulating region. The districts of the South-West planning region are part of the depopulated cluster, which is the cluster with the lowest ERAC among all regions in Bulgaria, Romania and Hungary (fig. 12).

The depopulated cluster type includes five regions all of them are located in Bulgaria and Sofia oblast district is one of them. Whereas the average of the population projections for all the regions in Bulgaria, Romania and Hungary amounts to 84.9, the forecast for the Depopulated Regions only amounts to a mean of 66.5. Therefore there is an above-average depopulating tendency in the regions under consideration.

Figure 12
Adaptive capacity of the regions in Bulgaria, Romania and Hungary – map of clusters and order by ERAC



Source: CLAVIER Deliverable 4.2

The cluster analysis has shown that in general the adaptive capacity of the depopulated regions is low. The ERAC analysis allows the assessment of vulnerability to be done on two levels – level of the region and level of the case study. Following the general characteristics of depopulated regions the adaptive capacity of Sofia oblast and Samokov municipality is not high. The expected negative trends in snow conditions in the long-run will increase the unemployment in the municipality and create severe social problems.

As it concerns the Borovets resort itself, it is very difficult to determine its adaptive capacity. The study of the winter tourism in Borovets gives evidence of very good adaptive capacity of the big hotels in the resort. Small hotels have low adaptive opportunities.

In the short-run the adaptive capacity of the resort might be considered relatively good.

Firstly, the sociological research of winter tourist in 2007/2008 shows a wide variety of entertainments in snow-deficient period and proves the satisfaction of tourists with the available alternatives in case of lack of snow (tabl. 1 and tabl. 2, fig. 13 and fig. 14).

Table 1

Alternatives in case of lack of snow (%)

	Foreigners		Bulgarians	
	Yes	No	Yes	No
Available alternatives	80.6	19.4	59.6	40.4
Alternatives offered by the accommodation establishment	69.2	30.8	27.0	73.0

Source: SAT, Noema, 2008.

Table 2

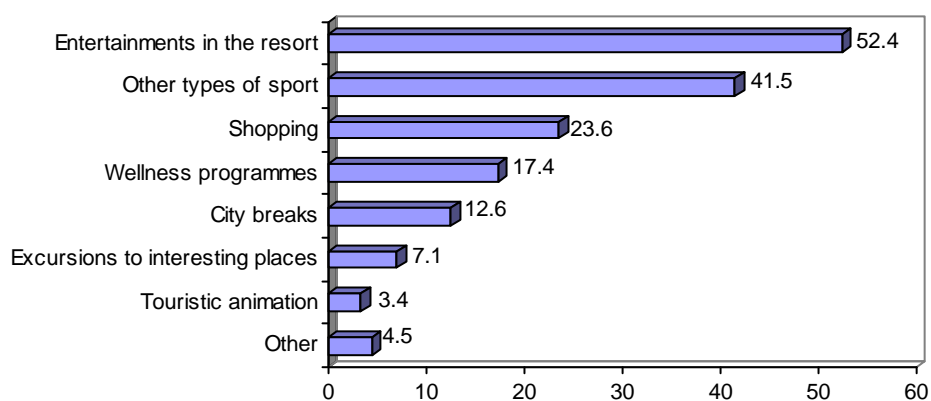
Assessment of the alternatives

	Foreigners	Bulgarians
I am absolutely satisfied	69.1	40.5
Satisfied	25.5	52.7
Not satisfied	3.0	4.1
Not satisfied at all	2.4	2.7

Source: SAT, Noema, 2008.

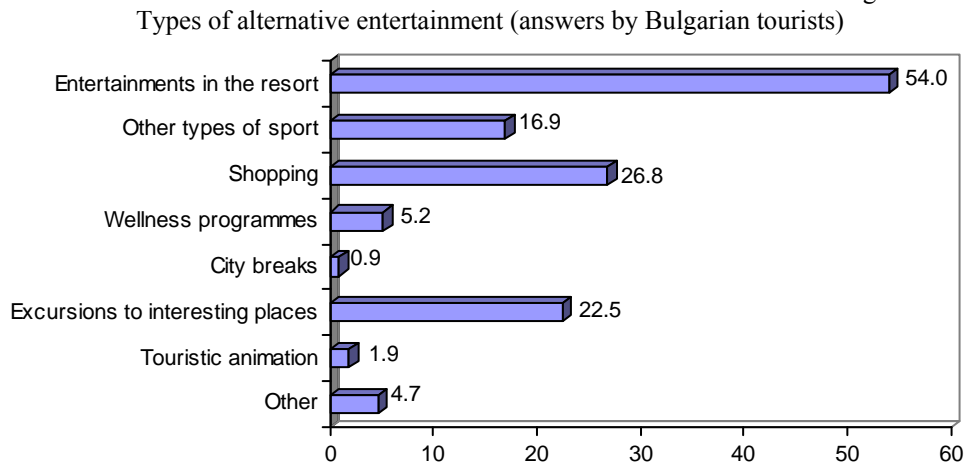
Figure 13

Types of alternative entertainment (answers by foreign tourists)



Source: SAT, Noema, 2008.

Figure 14



Source: SAT, Noema, 2008.

Secondly, the interview with the managers of Samokov hotel proves that the hotel tries to meet immediately the market demand. The tourist market is very dynamic and sensitive, but their marketing policy is quite flexible. Their tourist market is much diversified and they successfully attracted tourists from different markets and fill in the capacity of the hotel.

According to the marketing manager the hotel now offers a wide enough range of services – congress, spa and sport tourism. They have not considered extending the services, but it is possible to offer mountain tours (marches). Now this service is offered only in summer.

Training of the personnel might further improve the adaptive capacity of the hotel. Until now Samokov hotel has participated in projects funded by EU programmes: PHARE and Operational programmes “Human Resource Development”. The hotel managers appreciate highly trainings and consider them as long-term investments in human capital. The specifics of the tourist sector require on-going improvement of the qualification.

Concerning the question who should take adaptation measures according to the interviewee it should be a combination of activities of all stakeholders – the government should support the tourist sector, hotels should take the initiative to adapt on a local level, the operator of the ski facilities should invest in snow-making facilities.

There are problems related with the owner and operator of the ski infrastructure – Borosport. The company is a monopolist and controls all facilities – ski tracks, lifts, etc. According to the respondent there is no dialog between Borosport and hotels in

Borovets. They cannot even agree on producing a common tourist map of the resort and advertising of Borovets as a tourist destination, not to mention joint investments in ski-making machines.

Samokov hotel is very much interested in receiving the results climate modelling and impact analysis. It is difficult for the hotel management to develop a new market alone. They are interested in cooperating with scientists, and especially in future research work on topics such as market analyses of English, German and other foreign tourists, preferences and habits of tourists, etc.

The adaptive capacity (ERAC) of depopulated regions is inferior. The adaptive capacity of the region in the short-run is average, taking into account that only big hotels in the resort offer diversified services. In the long-run the capacity of the region to cope with negative cycles of bad seasons are inferior as compared to the other clusters.

Similar to economic impacts and adaptive capacity, the economic vulnerability of Sofia oblast district should be considered in two aspects. Under A1B scenario in the short-run average the ski zones will still have enough snow for skiing, thus, the district is not vulnerable in terms of winter tourism, because although the adaptive capacity is below the average, the economic impacts are expected to be small until 2020s, other things equal. In the long-run (2020-2050), the combination of a low adaptive capacity and strong negative economic impacts determine the high economic vulnerability of the region as compared to other regions in Bulgaria, Romania and Hungary.

A number of policy recommendations could be made based on the quantitative and qualitative analyses of the study.

The adaptation measures could be defined as short and long term measures. Short-term measures concern the economic agent in the resort which should follow the activities of our local hero (hotel "Samokov"), namely diversifications in the offered services for tourist. Long-term measures concern the municipalities which should try to diversify economic activities and not rely too much on winter tourism.

All measures should be directed towards improving the adaptive capacity of the tourist sector in Borovets, as well as at diversifying the economy of Samokov municipality, such as:

- solving the problems with the ski tracks and lifts infrastructure at the resort and eliminating the monopoly position of Borosport company. All hotels should take part in the management of infrastructure. This will make possible joint decisions and investments in snow-making facilities.
- careful planning of future construction projects and taking into account the physical carrying capacity of the resort, as well as the impacts on the environment. In the long-run a stable downward trend in the snow height is expected. There will be suitable conditions for skiing only at highest altitudes.

Therefore, the results of the TourBul study show that the Super Borovets project for extending the resort is not feasible.

- protection of nature in the Rila mountain: reforestation, biodiversity protection, etc.
- supporting the tourism sector: easy procedures for issuing visas to non-EU tourists, national advertising policy, etc.
- training programmes for the personnel in the tourist sector – raising awareness about climate change issues and adaptation options, incl. opportunities for extending range of tourist services
- solving the problem with the high number of unemployed in Samokov municipality, for example by trainings, programmes for social employment, investments in social enterprises.

7. Conclusions

Climate changes and the expected reduction in snow cover in the future under A1B REMO scenario will impact negatively Borovets winter resort. The regression analysis has shown a small negative trend and negligible decline in the number of overnights in the future. This is due to the fact that the main ski tracks are located at high altitudes and will have enough snow cover even after the expected decrease in the snow cover in 2021-2050. However, the detailed analysis has revealed alarming cyclic variations in the snow cover in the long-run. Snow-adequate and snow-deficient years (good and bad winters for tourism) will succeed each other. In the future snow-deficient winters will occur more often as compared to the 1990s and 2000s. For example, periods of 2, 4, 5 or 6 consecutive winters with bad snow condition could be expected in 2021-2050 in Borovets. These negative trends pose the question for improving the infrastructure of the resort (ski facilities, etc.), as well as for adopting varied and creative marketing and business strategies by the main hotels in the resort.

In contrast to regions in Romania and Hungary, South West region in Bulgaria is poorly-developed with low adaptive capacity, as it is located in a depopulated cluster. This predetermines its higher economic vulnerability in comparison to Romanian winter resorts in the Carpathians, for example. Under A1B REMO scenario in the short-run the ski zones will still have enough snow for skiing, thus, Borovets is not vulnerable in terms of winter tourism, because although the adaptive capacity is below the average, the economic impacts are expected to be small until 2020s, other things equal. In the long-run (2020-2050), the combination of a low adaptive capacity and strong negative economic impacts determine the high economic vulnerability of the region as compared to other regions.

The economic and societal relevance of climate change for tourism will depend crucially on adaptation strategies. This requires more detailed studies regarding the economic cost of climate change and the cost of adaptations at the local level (regional, municipal, tourist resort), and calls for the development of new policy frameworks at European and regional levels.

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