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The Impact of the Weather and Other Factors on Museum Visits

Bachelor thesis

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Abstract

This thesis is devoted to an analysis of the impact of everyday weather conditions on the daily numbers of museum visitors. A closer look is also taken into the influence of other factors such as city events or the effects of different days of the week. Although there have been many studies which have focused on influential factors regarding museum attendance, our research should serve as a starting point in completing existing gaps in this field of study. Empirical methods involving the use of time series data were applied to test the hypotheses. This research shows that weather, although not constituting the key determinant, has a significant impact on the daily numbers of visitors to museums. However, the results indicate that the extent and direction of this impact differ across different types of museums.

Keywords

Museums, attendance, cultural visitor, recreational visitor, weather impact, seasonality

Abstrakt

Táto bakalárska práca je zameraná na analýzu vplyvu každodenného počasia na denný počet návštevníkoch v múzeách. Bližšie sa venuje tiež vplyvom iných faktorov, ako napríklad prebiehajúcim akciám v mestách, či efektu rôznych dní v týždni. Napriek tomu, že veľa štúdií sa už venovalo faktorom, ktoré ovplyvňujú návštevnosť múzeí, náš výskum by mal byť začiatkom vypĺňania existujúcej medzery v tejto oblasti výskumu. Na testovanie hypotéz boli aplikované empirické metódy pre časové rady. Táto analýza ukázala, že počasie, hoci nie je kľúčovým determinantom, má signifikantný vplyv na denný počet návštevníkov múzeí. Navyše, výsledky naznačujú, že veľkosť a smer tohto vplyvu sa líši naprieč odlišnými typmi múzeí.

Kľúčové slová

Múzeá, návštevnosť, kultúrny návštevník, rekreačný návštevník, vplyv počasia, sezónnosť

Declaration of Authorship

1. The author hereby declares that she compiled this thesis independently, using only the resources and literature listed.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or similar degree.

Prague 10th May 2018

Andrea Hrtková

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Bachelor Thesis Proposal

Author:	Andrea Hrtková
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Proposed Topic:	The Impact of the Weather and Other Factors on Museum Visits

Research Question and Motivation

City tourism involves many activities and tourists spend their traveling time in different ways. However, museums and galleries are usually only one of several main attractions cities have to offer. Many city residents spend some of their leisure time in museums as well. When weather conditions are inclement, both tourists and residents seek out avenues of recreation, hence, indoor activities become more sought after and valuable.

Therefore, we cannot question the fact that museums are an attractive source of entertainment and education for the world's population. They are often financed, at least to some extent, from national and/or regional budgets and the cities themselves have a high motivation with regards to their improvement and in making them more attractive.

The numbers of visitors to museums and galleries differ from town to town and are influenced by many factors. The weather plays an important role in people's decision-making about how they allocate their time while travelling or spending their leisure time. The key motivation for this bachelor thesis is, therefore, to investigate the impact of the weather and other factors, such as city effects or the impacts of different days in the week or year on daily museum attendance.

Contribution

The bachelor thesis could offer museums a new perspective on the influences on their attractiveness and popularity.

Previous studies have focused primarily on people's personal motivations to visit museums, such as the learning aspect or the socio-demographic characteristics that affect their motivation to spend time in museums. The effect and importance of exhibitions have been determined, but the location and size of museums, however, have usually been studied separately.

In the following pages, the effects of the weather on tourism have been studied but more in the general concept, as well as the impact of everyday weather conditions on leisure time activities.

This empirical analysis should result not only in further knowledge about the impact of the weather on the numbers of visitors to museums, which has not yet been studied in detail in existing studies, but it should also detect some other factors that influence the numbers of visitors in museums. This research could be useful in the further development of museums, which could lead to higher levels of attractiveness for both tourists and residents.

Methodology

The empirical analysis carried out will predominantly deal with data from the years 2015, 2016 and 2017. The primary source of weather data will be Weather Underground (available online at https://www.wunderground.com/). Information about museums, such as the numbers of visitors per day, were collected directly from museums. Data about different city events were gathered from the cities themselves. Additional sources for other variables were considered throughout the process of data gathering.

This bachelor thesis has worked with time series data in empirical analysis, each museum having been analyzed separately and then the results compared.

Outline

1. Introduction
2. Sustainability of museums
3. Literature Review
4. Data and Methodology
5. Empirical analysis
6. Comparison of results
5. Conclusion

Core Bibliography

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List of Acronyms

NTM	National Technical Museum
TMT	Technical Museum Tatra
WHS	World Heritage Sites

Contents

Introduction

For many years now, museums have formed a part of almost every developed or developing society, providing useful help to communities in many forms. They bring access to knowledge for everybody and store a wide range of information about humankind, nature and much more. Therefore, it is not surprising that museums have always been, and still are, an attractive object for analysis for many fields of study, including economics.

Unfortunately, although providing useful services to communities and often being partly or even fully funded by public resources, museums are not spared from problems such as sustainability and must think wisely about their marketing and management strategies in order to remain attractive to their visitors and to attract new ones.

Seeking an understanding of their visitors has turned out to be the key for the survival of museums, according to the scientists. A closer examination has already been made on individual's internal motivations for visiting museums. The existing literature has analyzed the effects of demographic factors like gender, education or ethnicity. Museums have proven that they serve as a place for the education and culture of society, however it is people's internal motivations that truly determine the purpose of the existence of museums and dictate in which directions their business strategies flow. To put it simply, over time, museums have been developing their importance based on visitor-based roles instead of museum-based roles. Therefore, the importance of good exhibitions, which interest visitors, or, on the other hand, the unimportance of the types of museum as determinants of popularity, have been highlighted in the literature.

On the other hand, the existing literature points out that in the case of tourists, socio-economic factors do not play such a significant role in deciding whether to take a trip to the museum. Unfortunately, little attention has been paid to empirical research into other possible factors which drive them to make such visits.

This thesis seeks to stress that for both tourists and locals there might be other factors influencing museum attendance as well. These factors have little to do with the quality of the museum and more to do with people's decisions about allocating their free time. We believe everyday weather conditions, which have been proven to influence people's allocation of leisure time in general (as has been pointed out in the Literature Review), or

other events (such as festivals, sport events, workshops or days for families with children) occurring in the city might also have an impact on the numbers of museum visitors.

The main purpose of this thesis is, therefore, to investigate the effects of everyday weather, including temperature, rainfall, or wind speed, on the numbers of visitors coming to museums. By means of an empirical analysis, in addition to examining weather factors, a closer look will be taken at the influence of different days in the week and year (such as public holidays or school breaks), city events (such as festivals, sport events, workshops or days for families with children) on the decision-making process of museum visitors. The research started with collecting data about the daily numbers of visitors provided by the museums themselves and the daily weather conditions or events happening each day in the cities. Based on the information acquired, the dataset was created.

The structure of the thesis is, therefore, as follows:

The first part is devoted to the general benefits and functions of museums, whereby it is pointed out to the reader that museums serve as more than just a subsidiary source of education or culture for society. This is followed by a brief overview of the sustainability of museums and of factors which may have or not have a significant influence on it. This part is strongly connected to the Literature Review, which introduces mostly endogenous factors influencing the number of visitors (the internal motivation of people to go to a museum), together with an overview of the effect of the weather on leisure time activities, as well as on tourist activities. This theoretical part should provide the reader with information about already existing research on factors which influence the numbers of museum visitors as well as how they may possibly influence museum sustainability if such research has been done in the past.

The theoretical part is then followed by an empirical analysis of the impact of the weather and the other afore-mentioned factors on the numbers of visitors to museums. The empirical research is local, focusing primarily on Czech museums, plus one Slovak museum. Attention is paid to each museum separately, accompanied by a comparison of these impacts on different types of museums. Naturally, the results of this study are followed by a brief outline of the limitations of the research along with some conclusions. The results will be provided to the museums which participated in our study, with the hope that this research can be particularly beneficial for them.

Museum Functions and Benefits

Museums ameliorate the quality of people's lives, provide them with opportunities to spend their leisure time and often bring them inspiration. They possess a large number of functions from which people can easily benefit and these enhancements for society are the main reasons why museums have survived centuries. Ambrose and Paine, in their book *Museum Basics*, separated these benefits into three groups, described below. (Ambrose & Paine, 1993)

Social and Cultural Benefits

Museums serve as a place of cultural focus, a store of the "memory" of the community, including its cultural and natural heritage, as well as the heritage of minority groups. They give educational opportunities to students and the whole of society, organize cultural events for the community or collaborate with other centers of culture such as libraries or archives. (Ambrose & Paine, 1993)

All these activities might be viewed as tools for learning. Museums are important centers of education and they hold precious resources of education in their hands. Pop and Borza (2016) summarized the realization of these educational functions thus:

a) Providing informative materials;
b) Making interactive programs using their heritage items;
c) Co-organization of workshops in conjunction with institutions for education.

Nevertheless, not every museum can be certain whether the main reason for its existence is really to educate. However, some experts hold the opinion that once a museum opens the doors of its collections to people, it turns into an educational organization and the significance of the educational role is stronger than some might wish to admit. (Hein George E., 2010) Furthermore, this purpose might be often viewed as one that gives museums the privilege of serving as institutions which preserve the culture of the society.

Economic and Regeneration Benefits

Museums increase culture in the community, often working hand-in-hand with other cultural places such as theatres or libraries. Highly developed cultural places can attract investors, as well as potential residents. Many of museums have training and research programs from which the local community and its economy can partially benefit. (Ambrose & Paine, 1993)

They often bring other economic advantages as well. Several studies have produced results that cultural consumers tend to spend more than other consumers. (Juan G. Brida, Meleddu, & Pulina, 2012) In places where profits from tourism play an important role in economy, museums serve as an attraction for potential visitors to these locations. Occasionally, museums are even built with the intention of becoming the main tourist attraction and they very effectively support local economies by maintaining thousands of jobs. (Plaza, 2010)

Political and Corporate Benefits

There is always a two-way relationship with the private sector in the form of sponsorship, which is surely beneficial for both sides. In politics the relationship is similar: there is the financing of public museums and, on the other hand, museums try to make the best appearance possible of prove themselves worthy of sponsorship, either from private or public funds which can, in turn, burnish the reputations of local politicians. (Ambrose & Paine, 1993)

Moreover, those museums which have biological collections can save people and governments millions in expenses per year by preventing catastrophes from happening to public health and securing natural resources. (Suarez & Tsutsui, 2004)

Museum Sustainability

Despite being currently one of the most popular places for people to spend their spare time (Falk, 2016), museums must deal with competition in the leisure market, as well as economic austerity like any other sector. Recently, governments have been reducing public funding for cultural organizations. Together with easier access to learning via the internet, the popularity of some museums has been endangered and, consequently, also their survival. (Hall, Gossling, & Scott, 2015) Nowadays museums must put more effort into their marketing strategies to compete successfully with these and many other challenges.

Once museums admitted their purpose and whole existence is in the hands of their visitors, they realized they must prove themselves worthy of people’s attention. Keeping alive their already established collections would not prove to be enough - they must display innovations, not only in the field of permanent collections but also in their entertaining character as well. (Frey, 1998) In the past few decades museums have put

strenuous efforts into making their collections more comprehensible for lay people: interactive museums have been shown to increase demand from new generations (Juan G. Brida, Meleddu, & Pulina, 2016) and recreational dimensions have been added to the functions of museums. (Sheng & Chen, 2012)

Not being significantly different from any other non-profit (International Council of Museums, 2007) or even profitable organizations, sustainability is one of the most important issues museums must deal with, especially nowadays when the afore-mentioned obstacles lay in their way. And not being substantially differently from other institutions, in order to be sustainable, museums must bear in mind all social, economic, natural, as well as cultural surroundings. (Di Pietro, Guglielmetti Mugion, Renzi, & Toni, 2014)

According to Pop and Borza (2016), both the size of museums' collections and of the organizational structure can have an impact on museums' sustainability. The direction of this impact (whether negative or positive) depends on if there is an increase in the output generated in the market, or an increase in its costs. More importantly, museums' management and marketing strategies can significantly influence their sustainability, both positively or negatively. Therefore, even the best exhibitions are sometimes not enough to guarantee the survival of museums. Similar to any other field, if they wish to succeed in today's competitive environment, good management planning is crucial.

Nowadays, the key factor in becoming or remaining a sustainable museum seems to be to fully understand the museum visitors. Additionally, some authors believe museums need to be primarily interested in their current visitors and how to maintain their interest, rather than focusing on new ones. Not only are current visitors a cheaper alternative, returning visitors serve as "good advertising" and might also bring in new ones. (Falk, 2016)

Although other authors believe that variable costs, which museums have, do not increase with increasing numbers of visitors, on the other hand, they believe that museums still have reasons not to seek for new visitors, too. Since they are often funded from public financial resources, even if more visitors imply higher income, they do not necessarily bring advantages to the museum. Conversely, however, running a deficit might also harm the museum, therefore its management strategies are often orientated towards lowering costs. (Piekkola, Suojanen, & Vainio, 2014) This might, in turn, lead to a poorer economic

performance and also confirm Pop's and Borza's finding that bad management can harm museums.

Literature Overview

Although there exist a considerable number of studies on the impact that museums have on society and the economy, which appears to be very natural based on what we have stated about the important role museums play in society and economy, there considerably fewer complex analyses of the factors influencing the numbers of visitors coming to the museums. However, it is very easy to find literature dealing with a one specific factor at a time. These analyses are often very detailed, and they give us an idea about the diversity of stimuli which drive visitors to museums.

Individuals and Their Internal Motivation

Experiences derived from visits to a museum are influenced by both external and internal factors. Naturally, external ones are easily managed by the museum itself (these might include the quality of exhibitions, the size of the museum, other services provided, such as giftshops or restaurants and so on). On the other hand, internal factors, which include the personal motivation of individuals and their feelings, can hardly be said to be influenced by museums themselves. (Brida, Meleddu, et al., 2016)

When questioning individuals' motivation in visiting a museum, socio-economic characteristics are among the first factors to be considered. (Ateca-Amestoy & Prieto-Rodriguez, 2013) Age, gender, education, income, or social class influence people's decisions-making processes in everyday life and, therefore, these factors surely also have an effect on one's proclivity in spending time in a museum.

Studies show that males have a higher probability of never going to a museum, as well as those who are retired or married. Ethnicity, specifically being black, has a negative effect on this probability also, compared with being white. On the other hand, higher educational attainment, especially college education, either one's own or one's parents, has a significantly positive effect on museum attendance, which supports the thought about museums serving as an important source of education and culture for society. (Ateca-Amestoy & Prieto-Rodriguez, 2013) In particular, participation in cultural events and activities is strongly influenced by the level of education and this factor can be considered

as a key one in deciding whether to visit any cultural event. (Muñiz, Rodríguez, & Suárez, 2014)

However, to meet the expectations of their visitors, museums must understand them. People mostly seek "easiness and fun" during their visits and among visitors who enjoy going to museums (for example returning visitors) or among those who have a higher education, this expectation from a museum is an even stronger factor. (Sheng & Chen, 2012)

Another important indicator of individuals' motivation, which can be considered internal though it still might be very easily influenced by museums themselves, turns out to be experience. In the case of the Noord-Brabant Museums, the results of the final model showed that the only variables which affected visits to the museums directly were a "preference for one of the collections of the Noord-Brabant Museum" and the "number of previous visits to the Noord-Brabant". These effects were proven to be significantly positive, which led to the conclusion that the museum experience was the most important explanatory variable of museum attendance in the model. This information presents useful knowledge about visitors' behavior, namely, that visitors tend to come back to the same museums if they retain positive memories. (Verdaasdonk, van Rees, Stokmans, van Eijck, & Verboord, 1996)

Exhibitions

Based on the findings about Noord-Brabant Museums, if a museum is capable of providing valuable experiences, it becomes a place where people like to repeatedly spend their leisure time. Apart from collections, exhibitions have surely played a role in determining the popularity of museums as well and, in cases where experiences have been positive, they might attract people to come back to the museum.

Serving as a partner for public institutions, such as schools, exhibitions provide an irreplaceable source of knowledge to students. Via contact with subjects, museum visits can give rise to a child's interest in various subjects. Unlike public educational institutions, museums provide their knowledge and information to everybody and therefore these personalized experiences can be profitable for adults as well. (Dean, 2002)

However, to construct a popular exhibition, curators must understand what attracts people to exhibitions in general. According to a study by Minda Borun (1977), there are some significant relationships between the enjoyment of exhibitions and their characteristics.

In the findings of her, she concludes that there is a positive correlation between the number of displays and the percentage of visitors liking the exhibit, as well as pushbutton uses (and other interactive devices and their numbers per room) and this percentage. On the other hand, the study discovered a strong negative correlation between instructional power and the number of participatory devices and a negative correlation was also detected between the number of background colors and the popularity of exhibition.

Altogether, according to this study, interactive features in exhibitions receive a positive acceptance. The popularity of interactive exhibitions can be deduced from Borun's research and their existence might attract visitors to come back, thereby helping to support museum's sustainability as well. The work also supports the idea of the unique benefit of exhibitions, as well as collections, in the sense of the closer contact with the subject matter these provide.

Apart from exhibitions, materials and panels with information provided, high-quality services of museums and tickets prices also give adult visitors an engrossing and enriching experience. Adolescents, on the other hand, rank experience from the museum itself as their priority and do not consider the information provided to be so important. (Di Pietro et al., 2014)

What needs to be kept in mind, however, is the fact that visitors are not usually willing to substitute a better collection (e.g. a well-known painter such as Picasso) for a less impressive exhibition (e.g. a much less well-known painter), even if the price is lower. (Frey, 1998) Therefore, those planning exhibitions must realize that reasonable ticket prices alone cannot be taken as a driving force of a positive (or negative) experience from a museum.

Types of Museums

In addition to demographic characteristics, other personal motivations and personal experiences, the most natural and logical prerequisite for visitors' willingness to visit a museum is that they enjoy the services the specific museum provides them. It would not be a smart allocation of time to go to a science museum if visitors do not have a predilection for science. Therefore, the type of museum can play an important role in the decision-making process of whether to visit a museum.

A German study studied museums in four categories: (1) science and technology museums, (2) natural history and natural science museums, (3) history museums, and (4)

art museums. It was discovered that apart from art galleries, which have a slightly higher participation rate (26% of Germans visited art museums in 1994/95), museums tend to attract a similar percentage of the population (21% visited a natural history or history museum and 20% visited science museums in the same years). (Kirchberg, 1996)

On the other hand, a different study from the United Kingdom exploring visitors' experiences of museums with mixed collections shows somewhat different results. The most likely visited galleries in mixed collections were those with live animals (59% of visitors participated) and natural science (54%), leaving art exhibitions trailing behind with only thirty-six percent people always visiting their gallery. The study also proved that only 3% of all visitors never plan on visiting art sections, and as many as 6% of them never go to live animal collections. (Jenkins, Lisk, & Broadley, 2013)

Another interesting finding about museum types can be seen in the Pop and Borza (2016) study, where they concluded that the type of museum, although possibly presenting some advantages, does not influence its sustainability and, therefore, a museum can be popular regardless of its theme. Their conclusion is very much supported by the study of German museums, which showed that there are almost no differences between participation rates of differently themed museums.

Non-cultural Visitors

In the investigation of people's internal motivation, it is useful to also take into consideration the fact that a higher or lower percentage of all museum visitors museums is always comprised of tourists and their visits are not necessarily cultural but, rather, recreational. Ateca-Amestoy and Prieto-Rodriguez (2013) point out that individuals who do not live in urban areas, where important and famous museums tend to be located, are more likely to visit a museum. Although this statement addresses itself only to museums in cities where certain numbers of tourists visit, in addition to cultural motivation, a recreational one must be considered as well.

This, however, leads to a very different point of view on museum attendance. Excluding all cultural visitors, tourists tend to decide about their allocation of time, not only based on their socio-demographic characteristics, and certainly not primarily based on their previous experience with the place, but other determinants come into play as well.

Cellini and Cuccia (2013) stressed the seasonal co-integration between tourism flows and museum (as well as monument) attendance in Italy. This finding serves as proof of a long-

term relationship between these two variables. However, their analysis clearly showed that museum attendance is more of a consequence of tourist arrivals and overnight stays than a driving force of tourism flows. It can be concluded that most tourists do not travel to places because of specific museums, but their visits can be viewed more as a by-product of their stay. Therefore, the cultural motivation of visitors must be distinguished from tourist or recreational ones.

On the other hand, a study about tourism flows in China came up with results concerning what actually does attract tourists into the country, namely, World Heritage Sites. (Yang, Lin, & Han, 2010) These two studies indicate that although World Heritage Sites are one of the major driving forces in promoting tourist arrivals, museums, which are not usually part of WHS, are not the primary reasons for people to travel.

What also needs to be taken into consideration is the number of times non-locals revisit a museum. According to a case study considering Museum of Contemporary Art in Rovereto, foreigners are more likely to revisit the museum than locals, but the expected number of visits to the museum decreases in proportion to the distance from the city where the visitor comes from. Naturally, advertising focused on locals or tourists traveling from neighborhood areas or areas which are within short distances seems to be more reasonable and cost-effective than advertising in more distant places. (Juan G. Brida et al., 2012)

Conversely, Brida, Nogare and Scuderi (2016) in their study of visitors' cultural vs. recreational motivations in attending museums discovered a negative relationship between the number of visits into a museum per year and the number of "recreational visitors". Choosing different explanatory variables, the findings of these two studies are not by any means contradictory. The first only considers tourists in general, with no specific characteristics, while the latter does not distinguish tourists from locals but refers to "light consumption" of visitors (i.e. recreational, whether visiting a museum was a form of entertainment when being bored) from "hard consumption" (the motivation of these visitors being a real interest in the museum). The latter study sums up by concluding that looking at the reasons why people visit museums is more important than just differentiating tourists from locals.

Brida, Nogare and Scuderi (2016) stated the possible reasons for visiting museums by holidaymakers to be bad weather conditions while visiting the city, a lack of other options in allocating their leisure time or the attractiveness of the particular museum in their so

called “must-do list”. According to them, apart from the attractiveness of exhibitions, or the quality of collections, factors such as the quality of services provided by museums (such as restaurants and bookshops) or opening hours might increase the number of visitors.

Altogether, the results of their study lead to the conclusion that, for many tourists, museum attendance might just be a combination of a limited number of alternative attractions and a relatively large amount of spare time. Therefore, previously acquired knowledge about the positive relationship between positive experiences of previous museum visits and the revisiting of a museum cannot be applied in the case of recreational visitors, or for tourists living far away from the museums. Moreover, according to Brida, Nogare and Scuderi, entertainment and learning appear to be two different driving forces which bring tourists into museums.

However, we believe this thought might also be applied to residents and not only limited to tourists. Their research did not only include tourists but all visitors that preferred “light consumption” of the museum. In addition, based on a study by Di Pietro (2014), visitors in general are attracted not only by cultural experiences. Moreover, the limitation of a particular town’s attractions and events might be even more noticeable for locals than tourists. Since they spend more time in the city, they might need more activities to keep them entertained throughout the year. There is no good reason to postulate from the beginning that locals’ decision-making process are much different from tourists’. Inhabitants may feel a desire to visit well-known places in their city in the same way as tourists, not excluding museums, and they may easily get bored too.

Weather as a Determinant of the Allocation of Leisure Time

People tend to spend 8 or more hours a day working, which, together with an average of 7-8 hours of sleep and ordinary, necessary, everyday activities such as cleaning, cooking, taking care of children and suchlike, provide them with not much time for their leisure activities. A survey of fifteen European countries showed that people only have about 4 to 6 hours of free time per day. (TÁRKI Inc, 2009) However, it was proven that over the five decades from 1965 to 2003, that the spare time people have for leisure activities was boosted weekly by 7.9 hours for men and by 6.0 for women in the United States. Nevertheless, people still choose their spare time activities wisely, often also because of

a lack of substitutes to what they prefer to do as their free time activity. (Aguiar & Hurst, 2006)

Naturally, what has an effect on how people decide to spend their leisure time are weather conditions. (Humpel, 2002) When planning how to spend free time, people often do not have an opportunity to fully decide by themselves and based exclusively on their preferences. Some activities are very connected to the weather and some cannot even be performed where weather conditions are bad. Wind speeds of over 15 km/h tend to cause harm to fishing or water skiing, and motor boating cannot even take place if the wind speed exceeds 50 km/h. Skiing is limited by snow conditions, temperature and wind and even activities such as swimming and hiking can sometimes be prohibited based on the weather forecast (dangerous tides, thunderstorms and so on). (Becken, 2010)

A study of the impact of daily weather conditions on leisure activities in the city of Halifax in Canada discovered there is a generally positive relationship between temperature and participation rates in spare time activities (higher temperatures are associated with higher numbers of leisure activities). Higher temperatures and the amount of daylight are positively correlated with outdoor leisure activities as well. However, their effects were proven to be not very significant. Altogether, the research concluded that daily measurements of the overall effects of the weather on the allocation of spare time are actually limited and people mostly decide based on other factors. (Spinney & Millward, 2011) On the other hand, among children and adolescents, for every 10 mm increase in rainfall, participation rates in physical activities decreased by 2-4%; however, the study lacked any explanation concerning alternative activities. (Bélanger, Gray-Donald, O'loughlin, Paradis, & Hanley, 2009)

Another study about the influence of the weather on outdoor spare time activities came up with findings that, apart from weather conditions, what has a much more significant impact on the number of visitors coming into The Danube Floodplains National Park is the day of the week. Most visitors come to this park on Sundays and public holidays. (Brandenburg & Arnberger, 2001)

Tourists and the Weather

Climate and the weather have an undoubted impact on people's tourist decision-making process. However, both come into consideration at different stages of travel planning. Climate, by definition, represents an atmospheric "behavior" over a longer period of time

and, therefore, must be considered before travelling. On the other hand, weather, as a determinant of actual atmospheric conditions, becomes relevant during travelling because it cannot be correctly predicted in advance. (Scott & Lemieux, 2010) Weather conditions might significantly influence activities performed during the trip, however, so a degree of subjectivity in the perception of weather conditions must be borne in mind. (Gutro, 2015)

A paper entitled "The Impacts of Weather on Tourist Travel in New Zealand" presented findings that the most common change associated with weather changes is leaving a place earlier or staying longer (depending on whether the weather conditions worsen or improve). More than half of the respondents in this research reported changes in activities during their stay in New Zealand because of changes in the weather and a non-negligible number of tourists chose to do indoor activities over outdoor ones such as "museum visiting instead of hiking" if the weather conditions were not suitable. (Becken & Wilson, 2013) The authors also pointed out differences in this decision-making process based on the period of the year. For example, in early summer, a much higher number of tourists did not make changes to their activities compared to the number of changes made in late summer.

Despite not having done any more detailed research about how exactly these people changed their plans, these findings prove that tourists are capable of significant changes in their plans based only on the weather. Our previous conclusion about the necessity of distinguishing between cultural and recreational visitors to museums is thus strongly supported.

Research Questions and Hypotheses

The aim of this thesis is to investigate whether certain external factors, which cannot be influenced by museums and do not have so much to do with the internal motivation of people, have an impact on daily museum attendance. Therefore, the research questions should help us to identify this effect on the chosen variables and provide the reader and museums themselves with information which could possibly be helpful for their management strategies.

Research Question 1: Do the daily weather conditions influence the number of visitors coming into museums? If so, how?

We strongly believe that the effects of weather can be mixed. Since going to a museum is mostly an indoor activity, people might want to opt for this kind of activity in bad weather conditions; on the other hand, they might also choose to stay at home because they do not want to go outside (they must get to the museum somehow and this, in itself, might be challenging in bad weather). However, the following hypotheses should help us to determinate the exact impact of the weather on museum attendance.

Hypothesis 1.1: Whether snowy or rainy days and, additionally, the amount of precipitation, have a more positive influence on the number of visitors going to museums than a negative influence.

Although the amount of daylight does not have a significant impact on outdoor activities, as mentioned in the Literature Review, and while people might be discouraged from performing leisure time activities outside their homes, we still believe rain might also encourage them to take a trip to a museum if they do not want to only stay at home. Moreover, tourists often decide to change their plans based on weather conditions and they might choose to do indoor activities such as "going to a museum" as well.

Hypothesis 1.2: Humidity, air pressure and wind speed of a given day do not have a significant impact on the number of visitors going to museums.

The pressure does not change rapidly during the day and, although people are physically influenced by the pressure and it might easily influence their activities too (Didyk et al., 2012), together with humidity and wind speed, we expect it to not very significantly influence the choice of people in going to a museum.

Hypothesis 1.3: Temperature has a significantly negative effect on the number of visitors going to museums.

As stated in the Literature Review, it was proven that higher temperatures have a positive effect on participation in leisure time activities, but they also increase participation rates in outdoor activities. Therefore, we believe higher temperatures negatively influence museum attendance since people are encouraged to spend more time outside.

Research Question 2: Do different days in the week or in the year, including public holidays, school breaks, or days on which a city or a town prepare some public events (such as sport events) have an impact on the number of visitors going to museums?

Hypothesis 2.1: Weekends and public holidays are characterized by higher numbers of visitors, however there is no significant difference between Saturday and Sunday. Moreover, this impact is larger than the impact of the weather.

As stated in the Literature Review, studies on the effect of the weather on leisure time activities came up with conclusions that even when with regard to outdoor activities, the day of the week has a larger impact on the number of visitors than the weather. For this reason, we expect similar results to come from our study.

Hypothesis 2.2: School breaks have a significant positive effect on museum visits, although this effect is lower than the effect of weekends or public holidays.

Although many museums are not primarily for children, they often visit museums with their parents. Furthermore, people who visit a museum with a child are more likely to revisit than visitors without children. (Brida, Meleddu, et al., 2016) Parents need to entertain their children during school breaks, therefore, we expect school breaks to have a positive effect on the numbers of visitors coming into museums.

Hypothesis 2.3: Some types of city events have a negative influence on the numbers of visitors going to museums.

Cultural, or sport events, happening in a city are ways how people tend to spend their leisure time (Kotāne, 2012). Therefore, we believe these might reduce the rates of museum attendance due to the fact that they offer alternatives in how to spend people's free time.

Research Question 3: Do the effects of these factors differ among different types of museums?

Hypothesis 3.1: Weather impacts visitors of every type of museum.

Hypothesis 3.2: The effect of weekends and holidays is positive for all types of museums.

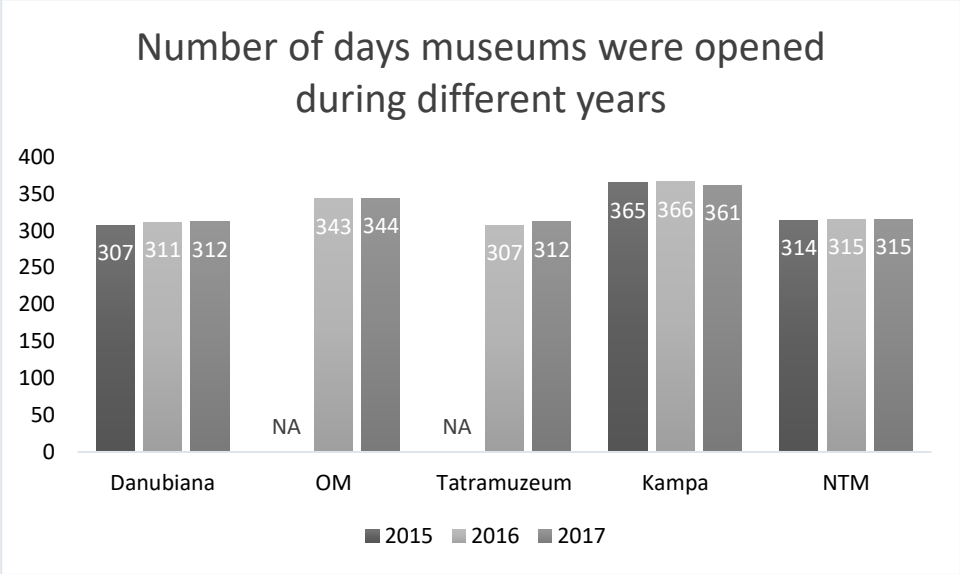
Hypothesis 3.3: The impact of school breaks is more significant for museums which are more attractive to families and children.

Data

In this section the variables used in the analysis are described, these being based on time series data. For our analysis, several data sources were used and different forms of data gathering were applied.

Data were collected from three different years, 2015, 2016 and 2017, from three museums for all three years and from only two museums for two years. Although using data from the whole year, the same number of observations was not collected from every museum due to different opening times. Some museums were closed on Mondays (as typical for museums all over the world) and one, as an exception, is almost never closed, including at Christmas. However, these closing arrangements are set out in advance and none of the museums closed due to seasonality (for example during the winter season) or some unexpected events. In the final version, we was able to work with time series models with datasets which contained from 620 to 1093 observations.

Figure 1: Number of days during which museums were opened during the observed years



Source: author, based on data provided by the museums participating in the study

Number of Visitors to the Museums

The data on the number of visitors going to different museums were collected directly from the museums. We were interested in local, Czech and Slovak museums, therefore, no foreign museum took part in this research. Our request concerning the publication of the data were addressed to more than thirty museums of different types and sizes and from different cities and towns.

Many museums, including National Galleries in both countries, and more than a few very well-known museums do not gather data on visitors in such detail (because of a lack of staff and owing to the difficulties entailed in dealing with such measurements in larger museums). Since our main interest was in gathering daily information about the numbers

of visitors without any missing days (except those when museums were closed) in years 2015, 2016 and 2017, we ended up with five museums fulfilling our requirements.

Fortunately, museums of four different types and from four cities provided very detailed information about their visitors. Hence, it has been possible to analyze whether the effects of the weather and other chosen variables vary with regard to different types of museums or in different cities.

Danubiana Meulensteen Art Museum

Danubiana is a modern art gallery situated approximately twenty kilometers from the capital city of Slovakia. The gallery was established in 2000 by Dutch art lover Gerard Meulensteen and Slovak gallerist Vincent Polakovič as a private museum. However, in 2014, Danubiana underwent an extensive reconstruction program funded partly by public resources. Nowadays, visitors can admire its permanent collection of paintings and sculptures, as well as temporary exhibitions which are changed several times a year. (Danubiana, n.d.)

Ostrava Museum

Ostrava Museum has been owned by the city of Ostrava since 1993 and is located in the city hall. This museum owns more than 300,000 objects with significant historical value. Their collection is very wide, ranging from archeological artefacts found near the area of the city, natural sciences, arts and historical furniture, to musical history. The museum also has its own library and not unlike the other museums participating in our research, temporary exhibitions are arranged too. (Ostrava museum, n.d.)

Technical Museum Tatra

In 1997 the Regional Museum in Kopřivnice was established, representing a transformation from the original Technical Museum Tatra. The museum was founded by the town of Kopřivnice and the joint stock company Tatra. The collection includes sixty Tatra vehicles, as well as many motor parts from cars or trophies from sports car events. Although situated in a small town, this museum is the most visited museum in the region. (Regionální muzeum Kopřivnice, n.d.)

Kampa Museum

Kampa Museum is also a modern art gallery in the Czech capital. This museum, situated in the center of Prague, exhibits the collection of Jan and Meda Mládek and contains the

largest collection of works of a modern abstract painter, František Kupka. During the years, it has hosted many short-term exhibitions by many famous European artists. (Museum Kampa, n.d.)

National Technical Museum

The National Technical Museum in Prague is a state museum established in 1908, but only finished and fully equipped in October 2013. In the museum visitors experience 14 permanent exhibitions including transportation, architecture, astronomy or mining. The NTM has its own Department of Museum Pedagogy, which prepares interactive educational programs for schools; the NTM also possesses its own research center. (National Technical Museum Prague, 2012)

Weather

Weather information was collected from the commercial weather service, Weather Underground, which collects very detailed information about everyday weather from all over the world. Unfortunately, they do not provide information about daylight and, since we did not find any other website that provides this kind of information in the detail we needed, such information about the amount of daylight could not be included in the models presented in this thesis.

In the end, the average temperature (measured in degrees Celsius), humidity (measured in percentage), pressure (measured in hectopascals) and wind speed (measured in kilometers per hour) of any given day or year were collected separately for each city and this information was set as its own variable, together with the sum of the precipitation of a given day.

Since the cities in which the museums are located are all situated in similar climate, the mean values are very similar. The reader can find the descriptive statistics of the data in the Appendix 1.

Whether it rained or snowed on the given day was not necessarily connected to a positive sum of precipitation on that day – simply put, the fact that it rained does not necessarily indicate that it rained so heavily that the sum of precipitation was different from zero. Therefore, individual information about whether it rained or snowed on a given day was also taken into consideration and established as an own dummy variable.

City Events

Information about events happening in the cities on the days studied were only available from official sources for the cities of Bratislava and Kopřivnice. For Bratislava, the information was gathered from the official city website, which has a very detailed archive of all the events which were organized, sponsored or advertised with the help from the city. The city of Kopřivnice stores its events on the official website of their House of Culture, where detailed information can be found as well.

Concerts, theatres and similar cultural events have not been considered in this study because of the large number of such events happening in bigger cities like Bratislava every day. It would be exceedingly difficult to define whether such an event is connected to the city and also to what extent. Nevertheless, concerts and plays rarely happen during the day.

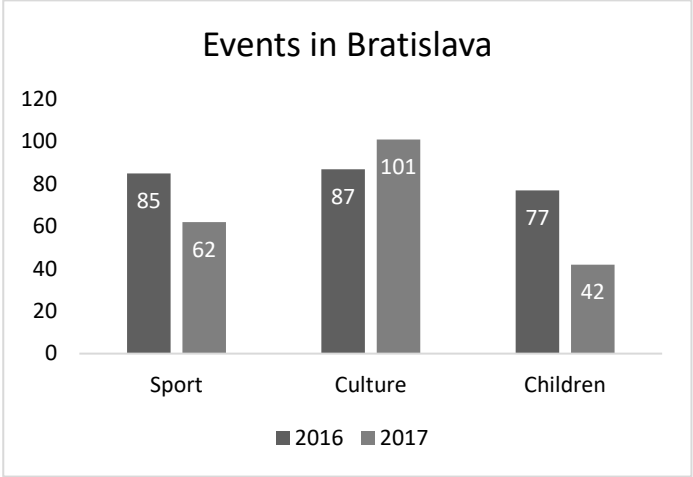
For this research, three variables mapping events happening in the cities were created.

Sport events: Every important sport event organized by the city or by the state (therefore events such as the European Figure Skating Championships are also included in the research) happening in Bratislava or Kopřivnice are included in this variable, as well as all sport events supported by the city (such as the ČSOB Marathon held annually in Bratislava).

Cultural events: Although labelled "cultural", this variable represents festivals, workshops, fairs and markets, notable lectures organized by the city, talks with the mayor and so on.

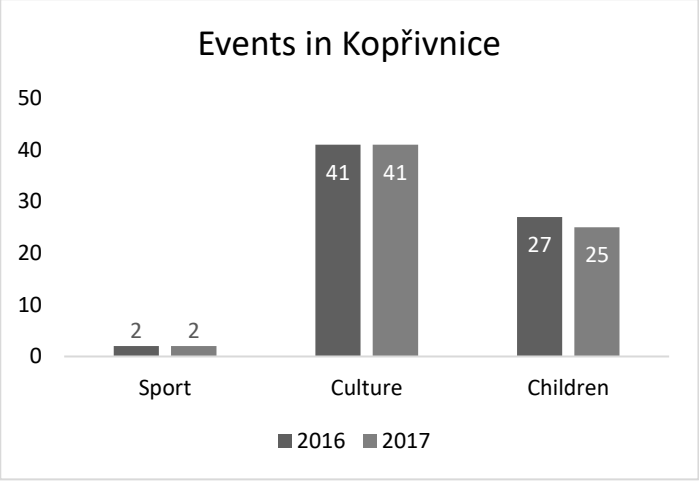
Family events: Every family-friendly event primarily focused on children, such as fairs for families, Saint Nicolaus Day celebration, fireworks on New Year's Day or workshops organized primarily for children, are included in this variable.

Figure 2: Numbers of events happening in Bratislava in the years 2016 and 2017



Source: author, based on the official Bratislava website of city events – Calendar of Events

Figure 3: Number of events happening in Kopřivnice in years 2016 and 2017



Source: author, based on the official website of Kopřivnice's House of Culture

Naturally, in the capital city, Bratislava, a higher number of events happen during the year and there is a strong willingness from the city to support sporting events in the same way any other events happening in the city, in contrast to Kopřivnice, where sport seems to be somewhat ignored by the city and cultural events are supported more strongly. However, we can see that in both cities cultural events are more often organized than events for children.

Exhibitions

Since Kampa Museum and Danubiana are galleries, their popularity can be easily influenced, or even changed, based on exhibitions, which currently can be seen in the galleries.

For both museums, a dummy variable representing exhibitions was established. Evidently, not every exhibition could be taken into consideration, therefore, they were chosen based on two criteria:

1. Local newspapers wrote positively about the specific exhibition

Although local newspapers serve as a very independent and objective source of information about exhibitions happening in a museum, it transpired that they cannot be used as the only source because of the high numbers of exhibitions which are usually mentioned in the local newspapers, especially in their cultural section. Bratislava's news portal, Bratislava 24, provides information about many cultural events in the city. This way even less prominent exhibitions receive some promotion and residents gain useful information about what they can do in their free time.

Therefore, we selected all positively mentioned exhibitions from the newspapers and, in addition, we included a second criterion for the selection of exhibitions:

2. Museums themselves considered the exhibition to an important one and did so based on:
    a) the significance of the works exhibited;
    b) its popularity among visitors

The information from the second criterion was very easily gained in the case of Danubiana – the museum itself wrote about their experiences with the exhibitions and chose the ones that were successful with visitors and where the exhibiting artists were of high quality. In the case of Kampa Museum, annual reports had to be used. These reports were, however, very detailed and provided similarly extensive information as that provided directly from Danubiana.

Although not a gallery, Ostrava Museum is mentioned in the local newspaper, particularly with regard to an exhibition of replicas of different world crown jewels. This exhibition was retained as a variable for later analysis as well.

Methodology

Model Structure

The empirical analysis provides an explanation of the relationships between the dependent variable, daily number of visitors, and independent variables, which were explained in detail in the previous section. The general form for the regression used in this thesis is set out as follows:

$$y_t = \beta_0 + \boldsymbol{\beta X_t} + u_t \; ; \; t = 1, \dots, T$$

y_t	dependent variable
β_0	intercept (constant term)
$\boldsymbol{\beta}$	vector of estimated coefficients
$\boldsymbol{X_t}$	vector of explanatory variables
u_t	error term

Despite the analysis only working with one dependent variable, a time series regression for each museum was carried out and since each museum is different, to protect the models from omitted variable bias, we added variables specific for each of the museums (such as exhibitions) into our regressions. The exact formulas that we used in our analysis can be easily understood from results of regressions and therefore are not provided.

Methodology

Although originally gathering the data as panel data, we encountered the issue of having a large time dimension and a small number of museums participating (five museums with daily information about number of visitors for two years). For these kinds of data, both random effect models and fixed effect models are unsuitable. (Schmidheiny, 2016)

Therefore, it was decided to organize the data as a time series and constructed five different time series regressions. This approach seems reasonable since, in simplified models, the problem of omitted variable bias often raises concerns. Every museum is different and, hence, influenced by specific things which can be better checked in time series regressions than in panel data ones. Variables of particularly successful exhibitions were added into the models for three museums and one of the time series regressions was boosted with a very different additional variable.

First, the Augmented Dickey-Fuller test for stationary, or the presence of a unit root process in regressions was applied (Harris, 1992) and luckily, the data turned out to be very stationary (the presence of a unit root process was rejected even at a 1% level).

Secondly, we had to deal with a possible problem of seasonality in our models in advance because of measuring the effects of the weather. Usually when dealing with seasonality in time series regressions, economists suggest choosing between using weather variables or seasonal parameters. In many economic models, choosing seasonal parameters or dummy variables for seasons is very reasonable since the weather variables are often not specific enough. The dependent variable is often not connected to one particular location and different weather averages must be taken as a variable. (Gersovitz & MacKinnon, 1978) Moreover, the dependent variable can be more sensitive to some seasons than to the weather (such as the GPD might be influenced by the Christmas season but not so much by weather conditions) or to the weather in the season more than to the actual, daily weather.

However, if both are included in the regression, we could run into the problem of multicollinearity between temperature and monthly dummy variables, which is only moderate (about 0.5) for January and the summer months, but still present. We wanted to measure the effects of school breaks on daily museum visits, too, which are very highly correlated with July and August. Therefore, the multicollinearity is a problem here as well. The summer season is partially affected by school breaks too (more than 75% of school breaks during the year are generated by summer break). Moreover, our data allow us to work only with a period of two or a maximum of three years and the effects of different seasons might be a little bit skewed because of these short periods.

In the end, to avoid multicollinearity, the variable representing school breaks was divided into two – summer breaks and other breaks. If the variable summer break is dealt with in the models by means of a treatment of seasonality both regressions, with and without seasonal dummy variables, can be run.

Unfortunately, all our models suffer from a serial correlation detected by the Breusch-Godfrey test (alternatively by the Durbin-Watson statistic). The test for heteroskedasticity, the Breusch-Pagan test, was also applied and detected that the error terms variance depended on the actual values of the respondent variables. Since fulfilling the Gauss-Markov Theorem requires not only the assumption of homoskedasticity, but

serial uncorrelation as well, the models needed to be treated for both problems. Without this treatment, the standard errors are invalid and one cannot perform precise test statistics. (Wooldridge, 2012) To solve these problems, the Newey and West standard errors which are robust against both, heteroscedasticity and serial correlation, were applied. (Newey & West, 1987)

We also tried to include lagged dependent variables in our regression. However, although these autoregressive terms were very statistically significant, they visibly changed the coefficient near all the explanatory variables and had some effect themselves. In the presence of serial correlation, which is a problem we must deal with in this research, the autoregressive term in the regression behaves as a proxy and it takes part of the effect of unobserved variables. Moreover, it takes part of the effect of the explanatory variables, which are included in the model as well and they might become less significant, or even lose their significance altogether. (Achen, 2000) They do more harm than good; therefore, we did not include them in our regressions.

Finally, in the case of the endogeneity of the variables, we believe the weather and many other variables used in the regression are very exogenous. On the other hand, city events variables might easily suffer from endogeneity. Among many other things, an appropriate instruments variable cannot be only weakly correlated with the variables suffering from endogeneity (Bound, Jaeger, & Baker, 1995) and we failed to find such instruments variables. However, these variables were not provided for every museum and for a better comparison of results, regressions without them were performed too.

Results

To make it easier for readers to orientate themselves to the results of this study, each museum has been analyzed in a separate section and then statements and conclusions are made about all the participating museums. Since different types of museums participated in the research, each type is influenced by several different factors. However, there are some common characteristics which are true for all the museums.

The important results of the regressions are provided in the text directly; others can be seen in the appendices.

Danubiana Meulensteen Art Museum

First, we added noticeable exhibitions into the models as a variable, ExhibitionDan, which, in both our models, increased the adjusted R-squared by about 5%. The variable is very significant and therefore to omit it would not be desirable.

Whether it rained or snowed on the given day is a significant variable in all our models. However, its impact is significantly negative and not positive as expected in Hypothesis 1.1. This might be caused by the specification of Danubiana: first, it is located outside the city near Gapčíkovo Dam and second, it also has an outdoor collection of statues. The area of the museum is very pretty and people might visit the gallery as part of their trip to the dam or as part of their boat trip on the Danube, which, during the summer season, ends in Danubiana. In addition, as stated in our research questions, the mixed effect of the weather might be found in the results and the pleasant area of the museum supports the contention that people might choose not to go there in bad weather conditions.

Temperature has a relatively strong influence on museum visits and has very low standard errors, if we do not include monthly seasonal dummies in the models with both city events included ((3)) and not included ((1)). However, this variable loses a large portion of its significance and its coefficients also decrease once the regressions are checked for seasonal effects. If city events are taken into consideration (which decreases the extent of our observations by one year because of a lack of data), the temperature factor is significant to a degree of 10%; if city events are omitted, the temperature factor loses its significance completely. Since one whole year was added into the regression, which moreover visibly decreases the adjusted R-squared, there might be some unobserved events that happened in 2015 which have little to do with the weather or seasons and which significantly influence the numbers of visitors. The reader can find the results of the regression, without events run only for years 2016 and 2017 in Appendix 2.

Nevertheless, the seasonal variables are very significant with high coefficients for the summer months (July, August, September), which indicates that, rather than the temperature factor itself, what drives people into Danubiana is the summer season. We can also see that the coefficients near the monthly dummies increase as the summer gets closer and decrease as winter approaches. The different seasons have effects on the visitors as well, but how large and significant these are depend on the specific month. However, although in the warmer seasons, especially summer, which involves higher temperatures, more people visit Danubiana, the smaller impact of the temperature factor

and its lost significant indicates that, on the other hand, differences in temperatures within a specific month are not very large and significant. However, for Danubiana the impact of the temperature factor is positive.

Overall, we can conclude that in the case of Danubiana, the weather has a significant impact on the numbers of people attending the museum on a daily basis; during inclement weather, this is a very significant determinant. However, the effect of the seasons must be taken into consideration as well.

In both regressions, the results are clear – the largest impact on attendance at Danubiana with the lowest p-values, and therefore with the highest significance, can be seen in the weekend periods. Their influence is almost the same for both Saturdays and Sundays, however on Sundays the number is slightly higher. Public holidays are equally significant, with a lower, but still very noticeable, impact.

The effect of school breaks is positive, but its significance depends on whether the model considers all three years, or only 2016 and 2017. There is a positive impact of school breaks outside those occurring during the summer months and this is visible from models (2) and (4). We can conclude that our hypothesis about school breaks is proven to be true in the case of Danubiana because this impact is lower than the impact of weekends and public holidays.

Finally, there is a significant negative relationship between the numbers of visitors coming to Danubiana and events for families and children happening in the city of Bratislava. Therefore, based on the results from these regressions, Hypothesis 2.3 is true for this museum as well.

Table 1: Danubiana Meulensteen Art Museum – regressions outputs

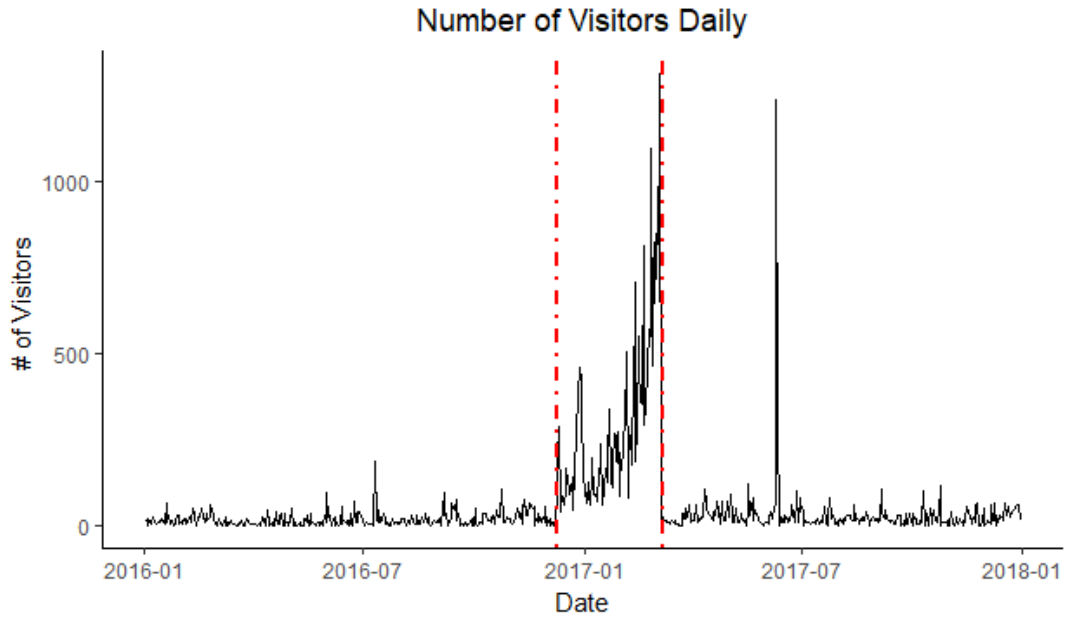
	Dependent variable: ***Number of Visitors***			
	(1)	(2)	(3)	(4)
Time	0.12*** (0.02)	0.12*** (0.02)	0.05** (0.02)	0.04** (0.02)
Saturday	148.50*** (11.57)	148.56*** (11.52)	171.65*** (12.99)	171.85*** (13.28)
Sunday	161.25*** (11.51)	161.31*** (11.49)	182.67*** (12.67)	181.72*** (13.00)
PublicHoliday	108.04*** (18.77)	103.52*** (19.12)	121.53*** (18.18)	122.13*** (19.63)
SummerBreak	21.33 (21.73)		46.77*** (11.50)	
OtherBreaks	23.26** (10.07)	26.97** (10.53)	22.61* (12.65)	23.16 (14.80)
AvgTem	3.17*** (0.63)	1.26 (0.86)	3.35*** (0.59)	1.40* (0.73)
AvgHum	0.51 (0.36)	0.55 (0.41)	-0.14 (0.28)	-0.21 (0.24)
AvghPA	0.54 (0.35)	0.58 (0.38)	0.71 (0.48)	0.52 (0.48)
AvgWind	0.01 (0.49)	-0.15 (0.48)	-0.10 (0.45)	-0.33 (0.47)
Precipation	-0.10 (0.97)	-0.20 (0.96)	-0.60 (1.21)	-0.82 (1.21)
RainSnow	-17.12*** (5.52)	-16.29*** (5.31)	-20.39*** (6.08)	-20.67*** (6.05)
January		4.32 (14.15)		-12.92 (9.83)
February		24.10 (16.92)		7.83 (24.02)
March		36.14* (18.67)		14.28 (14.00)
April		62.38*** (21.80)		36.89*** (13.83)
May		60.62*** (22.89)		46.75*** (15.46)
June		45.10* (26.07)		26.66 (19.05)
July		87.05** (36.10)		91.74*** (21.88)
August		85.56*** (30.82)		85.04*** (19.01)
September		69.22*** (25.23)		41.61*** (15.94)
October		62.46*** (14.74)		48.62*** (14.83)
November		38.65** (19.34)		5.64 (7.18)
Sport			-6.70 (7.12)	0.92 (7.48)
Culture			1.75 (5.49)	-0.80 (4.78)
Children			-20.50*** (7.05)	-22.64*** (6.65)
ExhibitionDan	52.75*** (13.70)	49.01*** (12.36)	75.34*** (12.17)	70.44*** (13.49)
Constant	-633.11* (377.85)	-691.31 (420.14)	-724.75 (494.46)	-520.98 (496.60)
Observations	930	930	623	623
Adjusted R^2	0.62	0.63	0.74	0.74
F Statistic	115.67*** (df = 13; 916)	69.38*** (df = 23; 906)	109.83*** (df = 16; 606)	69.16*** (df = 26; 596)
Note:				*p<0.1; **p<0.05; ***p<0.01

Source: author, based on Danubiana data, Weather Underground and city of Bratislava

Ostrava Museum

The graph of the number of visitors visiting the museum on each day of our time-line, which the reader can see below, provides interesting results. This number can be considered almost stable over time, with only a few outliers. The median number of visitors is 20, with the mean number being 57, which is caused by the very significant difference between the highest (1317) and lowest (1) values. It is clearly visible from the graph that at the end of the 2016 and in the first quarter of 2017, there was a very noticeable increase in the numbers of visitors. Since this increase occurred at around the time when the exhibition of replicas of different world crown jewels was taking place in the museum, this exhibition was used in the regression. We can see that the exhibition does not have a constant effect, but the number of visitors increases as the exhibition progresses in time. Therefore, the variable Exhibition is not a dummy variable, but represents this increase in time, which is, for the sake of simplicity, set as a linear increase.

Figure 4: Numbers of visitors to Ostrava Museum daily in the years 2016 and 2017



Source: author, based on Ostrava Museum data.

The effect of the exhibition is very noticeable from the results of both regressions, with seasonal dummy variables included (column number (2)) and without them ((1)). Its impact on the numbers of visitors is large and statistically very significant. Some other variables are significant for these two regressions, too, such as summer school breaks and the variable for the rest of the school breaks. Seasonal dummies all have a strong negative impact on the attendance. However, if this exhibition is omitted from our regressions, the

measured effects change very rapidly as can be clearly discerned from the results of regressions (3) and (4).

First, the adjusted R-squared decreases rapidly to only 9% if seasonality is not considered ((3)) and to 23% if it is taken into consideration ((4)). The only significant variable from the monthly dummy variables is February, which has a highly positive impact in comparison with other months. The peak of the exhibition was in February 2017, therefore, there is a strong connection between this month and the extremely high attendance figures. In addition, almost none of our variables are significant in these regressions. The models do not behave properly because of the extreme effect of the crown jewels exhibition. Therefore, a regression without the days when the exhibition took place in the museum was also run. However, the results came out even more poorly – the adjusted R-squared was only 3.4% without seasonality treatment and 4.8% with it. As in the previous models, the small number of our variables was significant. The results of these regressions can be found in Appendix 3.

Altogether, based on these results it can be concluded that there is not a significant connection between the variables included in these regressions and the attendance figures of the Ostrava Museum.

Table 2: Ostrava Museum – regressions outputs

	Dependent variable: ***Number of Visitors***			
	(1)	(2)	(3)	(4)
Time	0.02 (0.01)	-0.04 (0.03)	0.06 (0.05)	0.14** (0.06)
Saturday	8.16 (11.90)	7.17 (12.44)	11.25 (12.43)	13.05 (12.82)
Sunday	27.70 (18.24)	27.92 (17.90)	31.97 (21.30)	31.61 (20.35)
Holiday	-23.15 (15.91)	-15.89 (16.26)	-47.71* (27.39)	-14.71 (17.21)
SummerBreak	-28.16*** (9.68)		-5.73 (11.46)	
OtherBreaks	41.60* (25.21)	34.95** (17.66)	6.66 (42.87)	-18.28 (54.28)
AvgTem	1.62** (0.81)	1.41 (0.88)	-4.20* (2.25)	-1.36 (1.36)
AvgHum	-0.93 (0.63)	-1.19* (0.71)	-2.24 (1.67)	-1.40 (1.38)
AvghPA	0.24 (0.66)	-0.05 (0.58)	0.86 (1.09)	1.51 (0.94)
AvgWind	0.77 (0.71)	0.07 (0.43)	2.58 (1.97)	2.43 (1.72)
Precipitation	3.75 (3.28)	4.07 (3.22)	3.62 (3.46)	3.15 (3.28)
RainSnow	-1.21 (5.21)	5.05 (5.47)	-5.11 (5.73)	-10.75** (5.27)
January		-107.71** (42.86)		46.40 (45.37)
February		-94.32** (45.69)		189.31* (104.57)
March		-43.15* (22.21)		55.09 (73.88)
April		-61.83** (27.79)		-10.67 (46.84)
May		-70.39** (30.28)		-5.02 (47.92)
June		-50.87 (41.78)		19.34 (52.78)
July		-84.12*** (32.47)		-13.32 (52.27)
August		-78.57*** (29.88)		-22.79 (51.62)
September		-58.66** (22.75)		-19.63 (47.16)
October		-47.72*** (17.91)		-31.44 (45.56)
November		-31.81** (14.99)		-36.40 (40.23)
Exhibition	6.80*** (1.02)	7.49*** (1.10)		
Constant	-191.18 (681.16)	209.88 (618.89)	-669.01 (1,191.03)	-1,453.55 (994.45)
Observations	687	687	687	687
Adjusted R^2	0.65	0.67	0.09	0.23
F Statistic	97.60*** (df = 13; 673)	60.69*** (df = 23; 663)	6.73*** (df = 12; 674)	10.15*** (df = 22; 664)
Note:				*p<0.1; **p<0.05; ***p<0.01

Source: author, based on Ostrava Museum data and Weather Underground

Technical Museum Tatra

One can view the Technical Museum Tatra as a museum for families with children since its collection can be attractive for both girls and boys. Moreover, the museum also has a special worksheet for children called "Dráček Tatrováček" and welcomes many school trips each year. Therefore, it is not surprising that in the case of the TMT, whether it rained, or potentially snowed, both ad a positive and very significant effect on the number of visitors coming to the TMT in all the regressions, rather than negative as in case of Danubiana. Simply stated, we can expect more parents to wish to entertain their children with some indoor activities when it is raining outside. Moreover, the sum of precipitation has also a significant and positive effect on the dependent variable. Hence, keeping other factors fixed, an additional millimeter of rainfall increases the number of people who visit the museum by almost 9.5 in cases where the seasonal dummy variables are not included (columns (1)).

The temperature has a similar effect as in Danubiana - it significantly positively influences the attendance if the effect of seasonality is not taken into consideration. If it is included in the regressions (columns (2) and (4)), the temperature becomes insignificant. It can be explained in the same way as in case of Danubiana – the number of visitors increases as summer gets closer and decreases when winter approaches. The peak visitor season occurs during the summer school break – the reader can see a rapid decrease in September. The idea is supported by a high coefficient in front of the variable SummerBreak, as well in columns (1) and (3). Moreover, in all the regressions, other school breaks than summer ones are also very significant and have a strong influence in determining how many people come to this museum.

Altogether, our hypotheses about the weather can be considered to be true in case of the TMT. In the case of Hypothesis 1.2 the average humidity, pressure and average wind speed have some effect on the visitor numbers as well. However, this effect is just moderate and not very statistically significant in all the regressions which were run. Therefore, we conclude the pressure, humidity and wind speed do not have a strong influence on attendance figures, but they do have some impact.

In comparation to Danubiana, events for families and children do not have a significant impact on attendance at the TMT. On the other hand, the variable "culture" (we should keep in mind how this variable is defined - it does not include exhibitions in other

museums or theatres) is very significant and its effect is negative. Therefore, these city events decrease the numbers of visitors which come to the museum.

After having fixed the problems of autocorrelation and heteroscedasticity, which were also present in the models for this museum, sport events became very significant as well: their impact is positive, the opposite of what we might expect for city events. Not many sport events were held in the city during the years 2016 and 2017. However, every September there is an event called "Běh rodným krajem Emila Zátopka", a race which starts in front of the TMT. The museum has in addition to the car exhibition, one devoted to this famous runner and the participants of the race have free entrance to this exhibition. (Kulturní dům Kopřivnice, 2016) There are also many family members who, while waiting for participants to finish, can seek out some activities which could entertain them. We believe this event explains the opposite effect of sport events on the numbers of visitors than is stated in our hypothesis.

Altogether, the Technical Museum Tatra is influenced by the seasons and days of the week, however, here the weather also plays a role. The museum can be viewed as family-oriented, therefore attendance figures are higher when children do not have school or cannot be entertained outside.

Table 3: Technical Museum Tatra – regressions outputs

	Dependent variable: ***Number of Visitors***			
	(1)	(2)	(3)	(4)
Time	0.07 (0.05)	0.09** (0.04)	0.07 (0.05)	0.09** (0.04)
Saturday	200.55*** (36.36)	206.11*** (35.99)	193.34*** (36.29)	199.67*** (35.55)
Sunday	172.49*** (28.65)	177.89*** (27.57)	168.83*** (28.03)	175.14*** (26.62)
Holiday	272.01*** (39.12)	247.94*** (40.88)	270.35*** (37.04)	248.05*** (37.78)
SummerBreak	386.31*** (33.60)		385.38*** (33.14)	
OtherBreaks	118.37*** (41.29)	141.72*** (45.17)	114.03*** (41.01)	134.63*** (45.42)
AvgTem	8.36*** (1.24)	-2.42 (2.58)	8.12*** (1.26)	-2.35 (2.59)
AvgHum	1.57* (0.94)	2.73*** (1.03)	1.61* (0.93)	2.80*** (1.00)
AvghPA	-1.84 (1.13)	-2.48** (1.07)	-1.77 (1.11)	-2.33** (1.06)
AvgWind	-1.81* (1.03)	1.17 (0.98)	-1.87* (0.98)	1.10 (0.96)
Precipitation	9.47*** (3.01)	7.24** (3.18)	9.55*** (3.04)	7.36** (3.23)
RainSnow	45.47*** (14.61)	36.55*** (13.76)	44.46*** (13.65)	35.24*** (13.19)
January		-51.34** (21.68)		-54.40** (23.28)
February		43.25 (32.27)		50.13* (27.97)
March		146.63*** (31.33)		146.40*** (30.35)
April		155.09*** (35.41)		160.39*** (34.82)
May		220.74*** (50.57)		217.41*** (50.04)
June		331.66*** (57.52)		327.78*** (57.35)
July		670.47*** (63.69)		663.20*** (62.72)
August		661.25*** (87.45)		657.39*** (86.07)
September		225.61*** (45.14)		215.78*** (44.09)
October		116.50*** (32.56)		114.60*** (32.18)
November		52.13*** (17.08)		58.79*** (18.67)
Sport			177.57*** (40.43)	163.55*** (38.51)
Culture			-50.74*** (18.63)	-50.44*** (18.71)
Children			12.73 (32.36)	3.48 (33.87)
Constant	1,801.88 (1,136.30)	2,280.72** (1,058.70)	1,742.46 (1,113.41)	2,131.82** (1,049.00)
Observations	619	619	619	619
Adjusted R^2	0.59	0.61	0.60	0.62
F Statistic	75.44*** (df = 12; 606)	45.83*** (df = 22; 596)	61.63*** (df = 15; 603)	41.08*** (df = 25; 593)
Note:				*p<0.1; **p<0.05; ***p<0.01

Source: author, based on TMT data, Weather Underground and the House of Culture of Kopřivnice

Kampa Museum

The variable ExhibitionImp was at first included in the models (columns number (1) and (2)) and it represents the important exhibitions based on their mentions in local newspapers, as described in the Data section. After running the two regressions with this variable, an alternative one was created to improve the overall significance of the regressions.

Kampa Museum usually exhibits at least three or four exhibitions at once, therefore, the variable, now called ExhibitionCom, was modified in such a way that it only includes dates when the noticeable exhibitions took place and in conjunction with the time at least three other exhibitions were exhibited in the museum as well. The results of these regressions are visible in columns (3) and (4). The coefficients in front of the ExhibitionsCom are higher than the ones of ExhibitionImp and the R-squared also increases when considering this variable. If these four regressions are compared with two different adjustments of exhibitions happening in Kampa Museum, it can be concluded that the number of visitors in this museum is not only sensitive to good exhibitions, but also to combining more attractive exhibitions at the same time.

Temperature has a significant positive impact on the number of visitors if the seasonality is not dealt with, but once the models are checked for it, its effects become negative and, eventually, even significantly negative. The seasonal dummies indicate that similarly to previous cases, the peak season for Kampa Museum is the summer. Whether it rained or snowed has a negative impact, just like in the case of Danubiana and this might arise due to the fact that Kampa Museum is also situated in a very nice area (near the river, in a park) and it similarly has an exhibition of sculptures outside (although a smaller one). In conclusion, more visitors come to this museum in the warmer months of the year; however, the number decreases with rain and higher temperatures within particular months.

Surprisingly, the average humidity and wind speed are also relevant variables with a positive impact on attendance. Therefore, the stated Hypothesis 1.3 is proven to be true for this museum, however the results related to Hypotheses 1.1 and 1.2 proved the opposite. The weather has a significant effect on the number of visitors coming to Kampa Museum, but the effect is different than we expected.

As in the case of every museum, except Ostrava Museum, weekends have a positive impact, which is very significant. The difference for this museum is that there is a noticeable difference between Saturdays and Sundays – visibly more visitors come to Kampa Museum on Saturdays. Moreover, there is no significant relationship between the number of visitors and school breaks. Kampa Museum is a gallery and, except for a few exhibitions that attract children (such as one called Večerníčky), the main audience probably comprises adults. Therefore, we believe that this museum is not the first choice of parents to take their children to if they want to entertain them during school breaks.

To conclude: the findings about Kampa Museum indicates certain unobserved effects that have an impact on how many people choose to visit the museum on a given day. One of them might be the number of tourists which come to Prague on the given day since this museum might be very attractive for them as well. Unfortunately, we did not have an opportunity to observe this effect since the daily data on tourism in Prague were not available to us. However, we have proven that everyday weather conditions and different days in the week significantly influence the dependent variable.

Table 4: Kampa Museum– regressions outputs

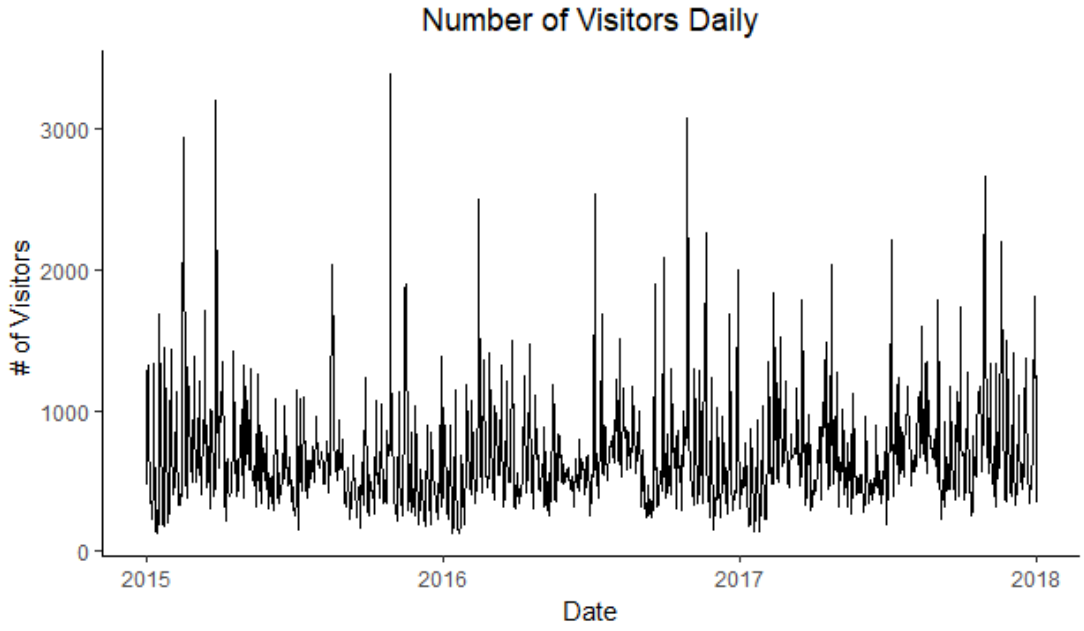
	Dependent variable: ***Number of Visitors***			
	(1)	(2)	(3)	(4)
Time	0.13** (0.06)	0.11** (0.05)	0.13*** (0.04)	0.13*** (0.04)
Saturday	238.70*** (37.32)	241.98*** (36.91)	235.27*** (36.97)	241.35*** (36.67)
Sunday	156.06*** (27.16)	157.44*** (27.06)	154.30*** (26.46)	156.15*** (26.01)
Holiday	50.30 (43.75)	48.34 (41.06)	62.18 (39.34)	66.95* (37.53)
SummerBreak	18.56 (42.37)		32.48 (34.36)	
OtherBreaks	31.74 (38.59)	64.73 (40.34)	28.32 (35.99)	32.85 (37.60)
AvgTem	5.80*** (2.02)	-1.05 (2.85)	4.72*** (1.75)	-4.58** (2.33)
AvgHum	2.94*** (1.13)	2.87*** (0.85)	1.63* (0.90)	2.43*** (0.86)
AvghPA	-0.86 (1.31)	-0.93 (1.27)	-1.13 (1.39)	-0.60 (1.07)
AvgWind	3.10** (1.44)	4.48*** (1.44)	2.51** (1.15)	4.26*** (1.21)
Precipitation	-1.10 (1.47)	-1.31 (1.24)	0.39 (1.34)	-0.93 (1.04)
RainSnow	-33.37** (16.78)	-34.96** (15.73)	-32.92** (15.35)	-30.26** (13.47)
January		23.58 (69.87)		-138.73*** (39.95)
February		5.31 (48.51)		104.73 (64.98)
March		44.41 (51.60)		83.64* (46.03)
April		100.44** (47.49)		137.70*** (44.21)
May		143.26** (59.78)		196.86*** (54.86)
June		165.51** (65.87)		233.55*** (60.30)
July		169.28** (84.02)		251.63*** (72.88)
August		237.16*** (82.63)		232.16*** (62.06)
September		215.73*** (75.61)		183.97*** (66.74)
October		101.98 (80.00)		14.68 (39.38)
November		125.83 (79.42)		101.97** (50.37)
ExhibitionImp	251.81*** (34.95)	238.40*** (41.10)		
ExhibitionCom			303.44*** (37.29)	373.87*** (44.37)
Constant	734.02 (1,335.12)	764.70 (1,315.67)	1,100.01 (1,430.64)	437.11 (1,114.13)
Observations	1,092	1,092	1,092	1,092
Adjusted R^2	0.36	0.39	0.45	0.50
F Statistic	49.16*** (df = 13; 1078)	30.80*** (df = 23; 1068)	70.97*** (df = 13; 1078)	49.07*** (df = 23; 1068)
Note:				*p<0.1; **p<0.05; ***p<0.01

Source: author, based on Kampa Museum data and Weather Underground

National Technical Museum

The model with the results in column (1) represents the original thought behind the creation of the models – it only includes weather variables and dummy variables of weekends, holiday and school breaks. However, we can see that this model does not explain a lot – it accounts for only 26% of all impacts on the number of visitors. There is certainly a problem of an omitted variable, but no obvious explanations such as a special or successful exhibition emerge. The graph of the number of visitors per day, however, shows that on some days there was a much higher number of visitors.

Figure 5: Numbers of visitors to National Technical Museum daily in the years 2015, 2016 and 2017



Source: author based on NTM data

This daily increase is often associated with the days when the NTM offers special prices for everybody – an entrance fee of 50 CZK. These discount tickets days are usually associated with some events, such as the celebration of the reopening of the museum and so on. Therefore, more visitors can be attracted to come to the museum, not only because of the low entrance fee, but also because of these special occasions. The effect of this special price is very marked and statistically significant (visible from columns (3) and (4)). Moreover, since two of these days with special entrance prices take place during a public holiday each year, the variable PublicHoliday loses its significance once the variable SpecialPrice is added to the regressions.

Neither the sum of precipitation or whether it rained or snowed on the given day has a significant impact on the numbers of visitors and their robust errors are very high. The NTM can be considered as a family and children-oriented museum as well, therefore, these results might be viewed as surprising in comparison with the results fom the Technical Museum Tatra.

Once the effect of seasonality is taken into consideration in the regressions (columns (2) and (4)), the temperature becomes a very significant variable with a negative effect. It can be explained in a similar way as for Kampa Museum, where temperature also has a negative effect on levels of attendance; moreover, the coefficients are even higher and more significant in the case of this museum. Hence, it can be concluded that daily temperature has a negative effect on attendance figures within a given month. The monthly dummy variables indicate the same here as in case of any other museum that is part of this research – the peak season is the summer season for the NTM.

On the other hand, average humidity and wind speed are significant variables and their effects are both positive, just like in the case of Kampa Museum. These results are different to many of our previous findings and they prove the opposite to what is stated in our hypotheses about the effect of the weather. Therefore, we conclude that, in case of the NTM, weather has an influence on the numbers of visitors, however, its effect is partially different from what we expected, just as in other museums.

Both Saturdays and Sundays positively influence the numbers of visitors and, just as in case of Museum Kampa, more visitors come to the National Technical Museum on Saturdays: the difference between these two days of the week is even larger here. Public holidays, as mentioned above, lost its significance once the variable SpecialPrice was added and, therefore, the difference between weekends and the insignificant impact of holidays are exactly same as for Kampa Museum as well. Moreover, school breaks, both summer and other ones, are also significant and their effects are similar those of Sunday. This can be explained by the fact that this museum is family and children friendly, therefore, during school breaks more parents bring their children there (as in case of the Technical Museum Tatra).

Even the second set of hypotheses cannot be concluded to be completely true because there is a significant difference between Saturdays and Sundays and on the other hand, school breaks do not have a weaker impact than Saturdays.

Finally, one of the omitted variables might be the number of tourists coming to Prague (since Prague is a very popular city for tourists) just like we suspected it to be in the case of the Kampa Museum: this number might be connected to certain monthly trends. This connection between the number of visitors to the National Technical Museum and the numbers of tourists cannot be tested because of a lack of data; therefore, we cannot make any further statements. However, by checking for seasonality, we can at least render the effects of the weather freer from the effects of tourism flow into the city.

Table 5: National Technical Museum – regressions outputs

	Dependent variable: ***Number of Visitors***			
	(1)	(2)	(3)	(4)
Time	0.08 (0.07)	0.06 (0.05)	0.07 (0.07)	0.05 (0.05)
Saturday	435.90*** (59.04)	438.58*** (55.49)	434.29*** (55.76)	437.07*** (55.49)
Sunday	205.77*** (41.66)	202.55*** (37.14)	189.04*** (37.58)	185.97*** (37.14)
Holiday	490.44*** (170.76)	511.86*** (114.89)	155.10 (121.75)	170.69 (114.89)
SummerBreak	192.48*** (41.19)		208.09*** (41.50)	
OtherBreaks	121.79** (52.77)	113.73** (52.03)	174.48*** (46.34)	184.38*** (52.03)
AvgTem	-3.88 (3.45)	-12.34*** (3.21)	-3.62 (3.30)	-13.03*** (3.21)
AvgHum	2.76* (1.42)	4.18*** (1.15)	3.72** (1.45)	5.39*** (1.15)
AvghPA	-0.97 (1.71)	-0.10 (1.43)	-2.11 (1.52)	-1.27 (1.43)
AvgWind	5.23** (2.30)	8.31*** (1.76)	4.59** (1.85)	7.89*** (1.76)
Precipitation	0.06 (2.99)	-2.32 (2.88)	-0.87 (2.89)	-3.89 (2.88)
RainSnow	8.62 (26.17)	12.29 (18.91)	11.09 (22.33)	11.37 (18.91)
January		-98.76 (71.94)		-78.93 (71.94)
February		249.45*** (50.02)		207.47*** (50.02)
March		259.77*** (70.39)		233.81*** (70.39)
April		308.28*** (53.63)		357.80*** (53.63)
May		282.08*** (68.02)		305.37*** (68.02)
June		268.17*** (72.03)		313.74*** (72.03)
July		454.03*** (79.48)		486.61*** (79.48)
August		569.02*** (79.41)		622.41*** (79.41)
September		248.02*** (69.68)		257.05*** (69.68)
October		312.48*** (71.00)		300.51*** (71.00)
November		172.67*** (50.90)		204.50*** (50.90)
SpecialPrice			1,178.21*** (171.54)	1,176.91*** (161.84)
Constant	1,214.26 (1,762.43)	44.47 (1,461.74)	2,287.59 (1,575.60)	1,130.71 (1,461.74)
Observations	944	944	944	944
Adjusted R^2	0.26	0.32	0.42	0.47
F Statistic	28.80*** (df = 12; 931)	20.76*** (df = 22; 921)	52.91*** (df = 13; 930)	37.22*** (df = 23; 920)
Note:				*p<0.1; **p<0.05; ***p<0.01

Source: author, based on NTM data and Weather Underground

Comparison of the Results

In this part, the results from all the regressions will be compared to investigate whether the effect of our variables on the numbers of visitors coming to the museums is different for different types of museums, or whether some generalized statements can be made about the museums, mainly in Slovakia and the Czech Republic. Research Question 3 should help us to deal with this question.

First, Ostrava Museum can be immediately excluded from this comparison since none of the included variables were truly significant, except the exhibition with jewels that took place there. This museum is characterized by a lower number of visitors on every day of the week and year and in all weather conditions. Therefore, no significant impacts on the included variables were found. However, for both galleries, Danubiana and Kampa Museum, the effects of attractive exhibitions and those of high-quality are also very strong. The conclusion that the number of visitors in different types of museums is strongly influenced by what they exhibit can be made, although this question is not part of the stated hypotheses.

The weather turned out to have a significant impact on different types of museums, as stated in Hypothesis 3.1, however, its impact was not necessarily the same. When a museum is situated in a nice area, and people like to spend time there, even if they do not go to the museum or during their pre-museum (or post-museum) visits, it is negatively influenced by the rain or snow. Moreover, this negative impact might occur if the museum has an exhibition outside. On the other hand, a museum in a smaller city, which is children-friendly, turned out to be positively affected by the rain. As mentioned in the sections Research Questions and Hypotheses, it was discovered that people often choose home-based activities (e.g. watching TV) as an alternative to outdoor activities in bad weather conditions. Therefore, we can expect many people to choose to stay at home rather than to go outside even to perform indoor activities in the rain.

Temperature, on the other hand, often changed its significance and the directness of its impact after the seasonal dummy variables were added into the regressions. In all museums except Ostrava Museum, the attendance was visible higher during summer seasons, therefore, summer is characterized by higher numbers of visitors. Although being connected to the season (in summer, temperature tends to be the highest, opposite in winter), the impact of temperature is usually insignificant within the particular month. However, both museums in Prague, Kampa Museum and the National Technical

Museum, are, in a negative way, sensitive to the changing temperature. Therefore, a city or town and its popularity plays its role in determining the effect of temperature as well.

Different days in the week or year also have a significant impact on museum visits and, as stated in Hypothesis 2.1, this impact is larger than the one considering weather. Both, Saturdays and Sundays, are characterized by much higher numbers of visitors compared toto weekdays. Just like as in the case of temperature, in Prague more visitors come to the museums on Saturdays than on Sundays. However, in other cities no obvious differences were found. In Prague, museum attendance might be influenced by tourists to a higher degree than in other participating cities and towns and hence, we suspect the results of the regressions to have been influenced by this fact as well.

Holidays do not have such a strong significance as weekends, but their effect also tends to be positive, regardless of the type of the museum. When it comes to school breaks, it was proven in this research that the number of visitors in museums that are family and children friendly is significantly and very strongly influenced by them. Therefore, Hypotheses 3.2 and 3.3 were proven to be true as well.

Regarding city events, the models clearly showed that they might have a negative impact on the dependent variable. However, we must take into consideration that data about city events were available only for two museums and they appeared very differently. Hence, any further statements cannot be made. In this research, the situation varies for different types of museums, and different types of events have different impacts, but without special occasions, this impact tends to be negative.

There are two privately-owned galleries, Danubiana and Kampa Museum, from the two capital cities in the dataset and they are both influenced by the included variables slightly differently. The effect of the weather is very similar in the case of the negative effect of rain, however, if temperature is considered, its impact is more significant in the case of Kampa Museum and it is negative in comparison with Danubiana, where the effect is positive. In both museums, weekends are very popular and exhibitions influence visitors' decision-making process too. However, our variables explain more of the influences on the numbers of visitors coming to Danubiana than to Kampa Museum. We strongly believe this might be partially caused by the higher popularity of Prague among tourists, especially by numbers of tourists that came to Prague on each of the observed days and

other unobserved factors that drive tourists into the museum outside of the weather conditions.

The reader can see that, although the sample of museums is not large, two similar museums showed slightly different results with regard to the issue of temperature and, therefore, the information acquired indicates that the effect of the weather is not necessarily similar when considering similar museums if they are situated in different cities or even countries. It is more likely that museums from the same city or town would experience similar effects of temperature, as shown in the case of Kampa Museum and the NTM.

Based on these findings, a usual, successful day for a museum of any type is a Saturday or Sunday during the summer season - if no other interesting events are being held in the city which might lure visitors away from museums. A good season for putting on a special exhibition is, therefore, the summer season. Nevertheless, some impacts cannot be generalized for all the museums around the world but, as mentioned in the Literature Review, museums can be successful regardless of their type. Their success is often connected to a combination of different variables that have an impact on museum attendance. If a museum wishes to maintain sustainability, based on the results of our research, understanding its visitors is one important indicator; however, it is also very important to very clearly delineate what kind of museum they are. If they do so, a museum oriented towards children can hold special events, such as days with special entrance fees on school breaks, rather than during weekdays or on public holidays, or a gallery can focus on promoting exhibitions which take place in winter, since in the summer there are naturally more visitors because of the warmer temperatures.

Limitations of the Study

The main weakness of this empirical research is its necessary generalization of the results. First, the dataset is restricted to Czech and Slovak museums and, therefore, conclusions about museums from all around the world cannot be made without running into the risk of providing misleading information. Interpretations of the results are, therefore, restricted to Czech and Slovak museums and possibly to countries which are similar to the Czech Republic and Slovakia.

The dataset is limited for local museums as well and despite it deals with different types of museums, it does not include all possible types of museums existing in these two countries. Moreover, for one of the museums (Ostrava Museum), our variables turned out to be irrelevant and the data available were not enough to capture what affects the dependent variable. Therefore, in reality, the comparisons made were based on the results of four museums and not five.

Even though a significant number of observations were gathered together, the data were not suited for panel models either because of a long-time dimension, and this constitutes another possible weakness of this study. Some of the impacts were not captured and, with panel model methods, we would have been able to check for some personal effects on the museums, which are constant over the time. On the other hand, time series models helped us to recognize what were the exact effects of different exhibitions and other factors. Therefore, we still consider time series as a good choice for this research.

Finally, the models show signs of seasonality, which was treated by adding monthly dummy variables. However, the dataset only includes two or three years of observations for each museum and the time period for more exact results for the effects of different seasons needs to be longer.

Conclusion

To the best of our knowledge, this is the very first study to discuss the impact of daily weather conditions on the numbers of visitors coming to museums. The contribution of this work to the literature resides mainly on its empirical research based on an analysis of the OLS regressions, which were run on the time series data. The dataset includes five different museums, four Czech and one Slovak, which provided daily information about the numbers of visitors coming to their museum. Two of them have stored this information only for the years 2016 and 2017 and for the other ones we were able to work with the year 2015 as well. Our dataset includes two private modern galleries, one city museum, the National Technical Museum and a museum that exhibits Tatra cars.

Notwithstanding certain limitations, the results provided much more useful information than a more singular focus on the effects of the weather on museum visits since other variables, such as different days in the week or during the years (weekends, public holidays or school breaks), exhibitions or city events, were also added to the models.

Nevertheless, the lack of data on city events did not allow us to include them in the models for all the museums.

The major finding of this research is that the effect of the weather on the numbers of visitors coming to museums is very significant in cases concerning temperature, rain or snow. However, after dealing with the problem of seasonality, we concluded that a stronger effect than that of daily temperature is the effect of the seasons, especially that of summer. The effect of temperatures within a specific month tend to differ across cities; two museums from the same city are influenced by daily temperatures in the same, significantly negative, way.

The impact of rain or snow was more often negative than positive, thus negating our stated hypothesis. However, the sign of the impact is likely to be influenced by many factors, such as whether the museum has an outdoor exhibition or whether it is oriented towards families. The impact of wind speed, atmospheric pressure, and humidity is rather weaker and usually much less statistically significant than the impact of temperature or rain.

Although the effect of the weather is clearly presented, as expected, the impact of weekends is stronger and similar for all types of museums. Whether there are more visitors on Saturdays or Sundays depends not on the particular museum only, but on the city where the museum is located as well. This study showed that only real differences between Saturdays (when attendance is higher) and Sundays were in museums located in Prague.

Whether a museum is oriented to, or at least friendly toward, families and children is strongly connected to the impact of school breaks. Their influence is visibly weaker and less significant for galleries, which do not usually put on exhibitions that are considered attractive for children. Finally, the effect of city events on the numbers of visitors can be viewed usually negatively; however, we only compared two museums and generalized statements are hard to made based on this factor.

In conclusion, we have proved that the effect of many of the variables which we included in our regressions tend to differ and often not across different types of museums but across different cities.

We hope that this bachelor thesis provides museums in Slovakia and the Czech Republic, as well as scientists, with a different point of view on museum attendance and that it sets up the first stage of research into factors which influence the numbers of visitors coming

to museums on a daily basis. We would surely appreciate it if more museums had participated in our research, or if more data had been made available to us, such as information about the daily numbers of tourists coming to the cities in which the participating museums are located. However, this bachelor thesis has answered some fundamental questions regarding the issue and since the data were treated as time-series, the results are not only helpful in answering these questions, but provide detailed information about attendance rates to the particular museums as well.

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Appendices

Appendix 1: Descriptive Statistics of the Variables

	Danubiana	Ostrava Museum	TMT	Museum Kampa	NTM
Visitors					
Min	1	1	5	185	125
Median	85	20	106	260	565
Mean	119.7	57.75	222	345.2	668.5
Max	659	1317	2081	1972	3396
AvgTem					
Min	-11	-14	-14	-12	-12
Median	11	9	9	9	9
Mean	11.43	9.41	9.52	9.41	9.33
Max	29	27	27	28	28
AvgHum					
Min	33	43	43	32	32
Median	67	76	75	74	74
Mean	67.63	75.4	75.14	72.69	72.65
Max	100	98	98	98	98
AvghPa					
Min	980	992	992	976	976
Median	1017	1017	1017	1017	1017
Mean	1018	1017	1017	1017	1017
Max	1040	1041	1041	1041	1041
AvgWind					
Min	3	3	3	3	3
Median	11	11	11	13	13
Mean	12.34	12.28	12.22	13.78	13.78
Max	47	37	37	47	47
Precip.					
Min	0	0	0	0	0
Median	0	0	0	0	0
Mean	0.78	1.17	1.22	0.86	0.83
Max	25.91	22.1	22.1	60.96	60.96

Appendix 2: Danubiana – Alternative Regressions Outputs

Dependent variable: ***Number of Visitors***

	(1)	(2)
Time	0.05*** (0.02)	0.06*** (0.02)
Saturday	170.71*** (13.17)	170.70*** (12.91)
Sunday	182.08*** (13.16)	182.49*** (12.90)
Holiday	120.41*** (19.53)	120.30*** (18.27)
SummerBreak		46.79*** (10.02)
OtherBreaks	28.52* (15.26)	27.20** (12.80)
AvgTem	1.55** (0.72)	3.22*** (0.61)
AvgHum	-0.14 (0.25)	-0.07 (0.28)
AvghPA	0.63 (0.48)	0.76 (0.47)
AvgWind	-0.36 (0.48)	-0.12 (0.44)
Precipitation	-0.74 (1.19)	-0.65 (1.16)
RainSnow	-19.82*** (6.11)	-19.67*** (6.08)
January	-3.46 (10.69)	
February	14.20 (24.12)	
March	20.89 (15.17)	
April	34.82** (13.91)	
May	49.85*** (15.71)	
June	27.32 (18.99)	
July	95.38*** (21.68)	
August	88.89*** (20.28)	
September	43.94*** (16.83)	
October	53.79*** (14.52)	
November	10.49 (7.44)	
ExhibitonDan	70.09*** (13.37)	75.91*** (11.84)
Constant	-637.11 (497.12)	-766.08 (492.21)
Observations	623	623
Adjusted R^2	0.74	0.73
F Statistic	76.62*** (df = 23; 599)	132.52*** (df = 13; 609)
Note:		*p<0.1; **p<0.05; ***p<0.01

Appendix 3: Ostrava Museum – Alternative Regressions Outputs

Dependent variable: ***Number of Visitors***

	(1)	(2)
Time	0.03*** (0.01)	0.03** (0.01)
Saturday	5.09 (12.90)	4.02 (12.23)
Sunday	-3.49 (3.28)	-3.59 (3.30)
Holiday	7.39 (5.81)	3.22 (3.77)
SummerBreak		-16.42* (8.45)
OtherBreaks	4.75 (4.85)	5.35 (6.09)
AvgTem	-0.38 (0.66)	0.30 (0.22)
AvgHum	-0.09 (0.18)	-0.23 (0.25)
AvghPA	0.44 (0.35)	0.42 (0.37)
AvgWind	-0.21 (0.32)	-0.34 (0.42)
Precipitation	3.33 (3.19)	3.64 (3.35)
RainSnow	0.12 (3.14)	1.69 (2.91)
January	8.34 (7.85)	
February	15.97* (8.21)	
March	-2.08 (6.78)	
April	8.30 (7.06)	
May	6.94 (8.71)	
June	37.52 (24.04)	
July	3.03 (10.19)	
August	0.32 (9.34)	
September	3.15 (8.89)	
October	-0.31 (6.79)	-8.14 (6.84)
November	4.40 (8.88)	0.25 (7.12)
Constant	-431.19 (347.40)	-392.12 (358.40)
Observations	604	604
Adjusted R^2	0.05	0.03
F Statistic	2.31*** (df = 22; 581)	2.55*** (df = 14; 589)
Note:		*p<0.1; **p<0.05; ***p<0.01