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Abstract

In this paper we estimate the economic value of selected ecosystem services provided by White Storks in a Polish 'stork village'. A stork village is a common name for a village with a White Stork breeding colony, often inhabited by more storks than people. Zywkowo, the best known stork village in Poland, receives 2000–5000 tourists annually, many of whom come from abroad. The village has about 20–40 White Stork nests and several amenities aiming at improving its recreational attractiveness. To estimate the economic benefits provided by the stork village we apply the travel cost method. This is the first study of this kind for a stork village, and the first study related to the value of birds in Poland. Our results provide a useful input into policy and decision making, indicating that nature has economic value. It also serves as a clear illustration that degradation of nature may entail economic losses.

Keywords:
recreational value of birds; valuation of non-market goods; travel cost method

JEL:
Q26, Q51, Q57

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1. Introduction

Birds play an important role in the delivery of ecosystem services (Whelan et al., 2008). Among others, birds attract the attention of birdwatchers and sometimes also other tourists, especially when a given species is easy to watch and identify by the general public (Whelan et al., 2008; Prokop and Rodák, 2009). In this study we estimate the recreational value of such a species, the White Stork, to recreational birdwatchers and other tourists visiting Zywkowo, a stork village in Poland.

White Stork (*Ciconia ciconia*) is a charismatic species and icon of nature conservation (Schulz, 1998; Tryjanowski et al., 2006). About 23% of world population of White Stork breeds in Poland. It is one of the most widely recognized bird species by nature lovers, as well as by the general public. The bird is large (2 m wingspan), long-lived (c. 30 years) and usually both site- and mate-faithful. White Storks nest in close proximity to human settlements, are generally welcomed and tolerated, and even viewed as 'part of the family'. People living in cities know the species well and have positive associations with it. They often want to see storks in their natural environment, especially in large numbers which is possible in the so-called stork villages. In Poland there are at least ten White Stork colonies counting at least 10 pairs each (Tryjanowski et al., 2006). In the past such colony nesting was more common (Lewandowski and Radkiewicz, 1991) but today only a small part of White Stork is living in breeding colonies, and at least in Eastern population solitary nesting is still more popular. Thus, people decide to visit a stork village not only just to see this particular species, but also to feel a 'stork' atmosphere (Dolata, 2006).

While there have been many attempts to estimate the value of birds, majority of these focused on stated preferences, depicting mostly non-use values. Urban and Melichar (2008) and Kaval and Roskruge (2009) provided useful reviews of several dozen contingent valuation studies of birds. Revealed preference valuation techniques, such as the Travel Cost Method (TCM), allow to estimate (recreational) use value of birds; they are, however, relatively rare. Part of the reason is that the values estimated with the TCM are associated with a specific location, rather than a particular species. Thus, using the TCM to estimate the recreational value of a given species is plausible when it is this particular species that attracts visitors to a specific location. However, it is relatively rare that a place is visited uniquely because of birds or especially a given bird species only.

In the TCM, the value of a given good – storks in stork villages in our case – is estimated based on how much people pay to access and 'use' this good. In absence of access prices, the willingness to pay for observing stork colonies is associated with the costs that people pay to travel to a stork village. These costs include both direct travel costs and the cost of time spent in travel. Looking at the distances from which visitors come and the related costs, it is possible to calculate net benefits that they derive from their visits. The demand function illustrates the relationship between the travel costs and the number of visits, and net benefits (consumer surplus) are equal to the difference between what people are willing to pay and what they actually pay.

The estimated value reflects but a part of the total economic value of storks in that it focuses on recreational use and only indirectly incorporates some other aspects of the storks' cultural importance, such as the species occurring in folklore and literature. Still, such estimates provide useful input into policy and decision making, indicating that nature has economic value and its potential degradation also entails economic losses.

One of the earliest applications of the TCM to value birds relied on zonal averages to estimate the value of a swallow roost in Pembroke, Ontario, Canada (Clark, 1987). Like in the case of stork villages, the study focused on common birds in an uncommon setting – roosting of up to 150,000 of swallows. The swallow roost attracted up to 10,000 visitors annually, and a guest book held by a local bird club was used as a basis for further calculations. TCM was used to calculate the 'intangible' social benefits. Apart from costs related to travel (vehicle costs), Clark (1987) calculated the cost of time spent travelling, accommodation and food. The net benefit to visitors (consumer surplus) was calculated at 5.06 USD per visit or 35,400 USD per year in total. In our study, we conservatively decided to omit the two latter categories (accommodation and food), as it is believed that they may be associated with other 'goods' than birds.

Navrud and Mungatana (1994) combined TCM with contingent valuation of Lake Nakuru National Park (LNNP) in Kenya which owes its popularity to large numbers of flamingoes. The study was based on a random sample of 185 visitors in 1991 when the total number of visitors amounted to 178,881. For multiple visits, they estimated the recreational value of flamingo viewing as the part of the value of the overall visit to LNNP proportional to the percentage of time spent on flamingo viewing. Both zonal and individual observations were included in this study. According to its results, the total recreational value of visiting LNNP in 1991 was 13.7–15.1 million USD, of which the recreational value of flamingo viewing was estimated at 5.0–5.5 million USD.

Becker et al. (2010) combined TCM with contingent valuation of Griffon Vultures in two nature reserves in Israel to estimate the marginal value of a single bird for the purposes of evaluating the efficiency of its protection measures. In the TCM part of their study, Becker et al. (2010) also used a zonal approach and regression analysis with a semi-log functional form. The sample included 449 questionnaires. The total values of both reserves as sites for viewing vultures were estimated at 2.5 million USD and 9.84 million and 2.15 million USD respectively, as of end of April 2004.

Gürlük and Rehber (2008) estimated the economic value of Kuşcenneti National Park at Lake Manyas in Turkey as a recreational birdwatching site. They also followed zonal approach and performed a regression analysis, using data from 228 interviews and a census of park visitors. Gürlük and Rehber (2008) estimated the consumer surplus at 2.6–4.7 USD per person or a total of 103 million USD annually, indicating that this value far exceeds the annual investment and operation expenditures of the National Park.

One of the most recent studies (Edwards et al., 2011) adopted a negative-binomial count-data model, paying special attention to potential biases introduced by on-site sampling. Their study area was Delaware Bay where thousands of birds feed during their spring migration, attracting significant numbers of birdwatchers (5583 in the spring of 2008). The sample included 224 questionnaires and the focus was not on zones but individual households that visitors represented. Edwards et al. (2011) concentrated on day trips only and included both travel expenses and the cost of time, arriving at the average consumer surplus of 38 USD per trip per person. Extending their estimates to the whole population of spring birdwatchers, the authors estimated the birdwatching recreational use value of Delaware Bay at 215,000 USD.

TCM is sometimes used as one of tools that describe the socio-economic features of the participants of birdwatching-related events, such as in the case of the Grand Isle Migratory Bird Celebration in Louisiana (Isaacs and Chi, 2005). Apart from the TCM studies that focused on birds in general or specific bird species, others referred to sites important for the protection of birds but also used for different recreational purposes. These included a TCM study of the value of Cley Marshes in Norfolk (Klein and Bateman, 1998), the Montgomery and Lancaster Canals (Willis and Garrod, 1990) and the Apalachicola River region in Florida (Shrestha et al., 2007). Finally, some contingent valuation studies also attempt to estimate the value of a given locality to tourists as opposed to valuing a particular species (e.g. Hvenegaard et al., 1989; Amiry et al., 2009).

In this paper we present results of a single-site travel cost model using data from an on-site sample of recreational birdwatchers visiting Zywkowo, the best known 'stork village' in Poland. Using a negative-binomial count-data travel cost model we give special attention to potential biases introduced by on-site sampling – endogenous stratification (oversampling frequent visitors) and truncation (only observing visitors making at least one trip during the season). To the best of our knowledge, this is the first study of this kind for a stork village, and the first study related to the economic value of birds in Poland. The methods that we present can be used in many applications to offer important policy-relevant conclusions. Finally, estimating the economic value of White Storks may be crucial for discussing effective protection of the species in the context of the more general concept of ecosystem services.

2. Methods

A number of valuation techniques can be applied to estimate the social benefits of nature. Some of these techniques are based on stated preferences (Mitchell and Carson, 1993; Bateman et al., 2002; Hensher et al., 2005) and others on preferences revealed in a market (Freeman, 2003). Among the latter, the Travel Cost Method (TCM) is by far the most frequently used technique to estimate recreational use value. This method has been in use since 1947, when Harald Hotelling in his famous letter to Director of the National Park Service proposed it as a way of estimating benefits that national parks provide to society (Hotelling, 1947). Hotelling was the first to make a connection between the frequency of visits from a given zone and the average cost of the visit depending on how far the zone was from the park, and briefly described how the consumer surplus could be derived from these observations. This idea was later applied by Clawson (1959) and Clawson and Knetsch (1966) in the so-called Zonal Travel Cost Model.

With later development of econometrics, TCM was able to capture variations in cost and frequentation at individual level instead of relying on zonal averages, giving way to the individual travel cost method (Brown and Nawas, 1973). This required that the researcher addresses the problems of selection and truncation of the trips per user (Bockstael et al., 1987). The problem was solved with truncated normal distributions, or more conveniently with count data models (Smith, 1988). Thus, the number of individual visits per period is regressed against the cost of the visit and other explanatory co-variables. Then the average individual consumer surplus can be estimated (Creel and Loomis, 1990).

2.1. Econometric model

Individual travel cost method treats trips to a site as the quantity demanded whereas trip cost is treated as the price. These assumptions result in the demand function of the form:

$$r_n = f\left(p_n, \mathbf{p}_n^s, \mathbf{z}_n\right), \tag{1}$$

where r_n is a number of trips taken by person n to a given site during the season, p_n is the cost of reaching the site (which usually includes the cost of travel and alternative cost of time), represents a vector of costs of travel to substitute sites, and $\mathbf{z}_n$ is a vector of individual characteristics that are believed to influence the number of trips an individual takes.

In this setting the seasonal consumer surplus associated with accessing the site by an individual n is represented by:

$$CS_n = \int_{p_n^0}^{p_n^\bullet} f\left(p_n, \mathbf{p}_n^s, \mathbf{z}_n\right) dp_n \, , \tag{2}$$

where p_n^0 is the current trip cost to the site and $p_n^\bullet$ is the cost level at which the number of trips goes to zero, also called individual n's 'choke price'.

A standard practice is to derive single-site recreation demand functions with use of count data models. A theoretical basis for the use of count data to model recreational demand is presented in Hellerstein and Mendelsohn (1993).

The two most frequently used count models are Poisson and Negative Binomial. These models are flexible enough to handle truncation, large number of zero trips in the data, and preference heterogeneity. In the case of a Poisson model the probability of making y trips to the site is given by:

$$\Pr\left(Y = y\right) = \frac{e^{-\mu_n} \mu^y}{y!}, \quad y = 0,1,2..., \tag{3}$$

where μ_n is the expected number of trips taken by respondent n. This model can be extended to regression framework by parameterizing the relation between μ_n and a set of regressors $\mathbf{x}$. An exponential mean parameterization is commonly used: $\mu_n = \exp\left(\boldsymbol{\beta}'\mathbf{x}\right)$, where $\mathbf{x}$ corresponds to p_n, $\mathbf{p}_n^s$, and $\mathbf{z}_n$ defined previously. The vector of parameters ($\boldsymbol{\beta}$) is estimated using maximum likelihood technique, in which each person's probability of taking the observed number of trips is used as an entry in the likelihood function.

The Poisson model was our starting model. Its main advantage is its simplicity, however, it comes at a price of a property known as equidispersion – the first two moments of this distribution equal each other, i.e. $E\left(Y\right) = \mu = V\left(Y\right)$.

Since in the case of our dataset the assumption of equidispersion could not be justified, we turned to a Negative Binomial model which relaxes this constraint. A Negative Binomial and Poisson model are closely related. On any choice occasion, the decision whether to take a trip or not can be modeled with a binomial distribution. As the number of choices increases it asymptotically converges to a Poisson distribution. However when overdispersion is present, i.e. $V\left(Y\right) > E\left(Y\right)$, the parameter estimates are consistent but the standard errors are no longer valid.

Negative Binomial allows to relax the assumption of equidispersion, but it does not automatically account for the bias introduced by on-site sampling. Because of on-site sampling, the sample is endogenously stratified. This is because frequent visitors are more likely to be sampled, and so the likelihood of sampling observations is dependent on a choice made by the subject of study (dependent variable). The problem of choice-based sampling was first addressed for Poisson model by Shaw (1988). Englin and Shonkwiler (1995) extended their analysis with an application of the truncated and endogenously stratified negative binomial model.

In this paper we use a model proposed by Englin and Shonkwiler (1995) which accommodates three features of on-site samples dealing with count data: overdispersion, truncation at zero, and endogenous stratification due to oversampling of frequent users of the site. The model takes the following form:

$$Pr\left(x_i \mid x_i > 0\right) = x_i \frac{\Gamma\left(x_i + \alpha^{-1}\right)}{\Gamma\left(x_i + 1\right)\Gamma\left(\alpha^{-1}\right)}\left(\alpha^{x_i}\lambda_i^{x_i - 1}\right)\left(1 + \alpha\lambda_i\right)^{-\left(y_i + \alpha^{-1}\right)}, \quad x_i = 1, 2, \ldots, \tag{4}$$

where Γ represents the gamma function, the parameter α determines the degree of dispersion, and the expected number of trips taken by visitor n is given by $E\left(x_n\right)=\lambda_n=\exp\left(\beta' x_n\right)$. A special case of the negative binomial includes the Poisson ($\alpha=0$).

Finally, in most applications α is assumed to be the same for all respondents. This assumption is unrealistic, as it is equivalent of assuming homogeneity of respondents' preferences. Instead, we use a more flexible approach that allows the overdispersion parameter to be a function of characteristics of the visitors. This allows us to introduce preference heterogeneity in the model.

2.2. Study site

Zywkowo lays in the north-east of Poland, in the periphery of one of the most touristically attractive parts of the country, the Masurian Lake District, and thus is sometimes included into a visit to this area. However, it is not located close to any major tourist attraction and is relatively far from larger cities (the closest cities are: Olsztyn with 175,000 inhabitants, 80 kilometers away; Elblag – 125,000 inhabitants, 100 kilometers away; and Gdansk – 450,000 inhabitants, 160 kilometers away).

Even though Zywkowo is the best known stork village in Poland it attracts only about 2000–5000 tourists annually, many of who come from abroad. The village has about 20–40 White Stork nests and only about 10 households. To reach Zywkowo one has to come here purposefully to watch storks as there are no other attractions in this place. In our survey the average answer indicating why people came to Zywkowo was 9 on a 1–10 scale where 10 was 'storks only' and 1 – 'not related to storks'. The village has a stork-watching tower, a gift shop, and an exhibition that is used for educational purposes. Zywkowo can be reached by public transport although this is rather complicated and most people come by car (84% in our sample) or as part of an organized tour (13%), with some coming by bicycle (1%). Figure 1 presents the time distribution of visits to Zywkowo in 2011.

2.3. Survey and data

Tourists visiting Zywkowo were surveyed on site between April and September 2011, i.e. since the storks returned from their spring migration to when they left for autumn migration. Questionnaires were available to tourists visiting a small exhibition room. Tourists were prompted to take part in the study by local employees and, additionally, by interviewers who assisted the local staff at times when tourists were the most numerous. In 2011, 2850 tourists visited Zywkowo, of whom 583 agreed to complete the questionnaire, resulting in over 20% response rate.

Unfortunately the visitor statistics available in Zywkowo do not provide detailed information on the characteristics of visits (e.g. length of stay) nor on the socio-economic characteristics of visitors. Like in other similar studies (e.g. Navrud and Mungatana, 1994), we have no definite check on how representative our sample is but the random choice of respondents, the relatively large share of surveyed visitors, and the fact that we performed the interviews throughout the whole season suggests that the sample is representative.

In the questionnaire, we asked about the main reasons for visiting a given stork village and the perceived importance of storks on a 1 to 10 scale ('To what extent is your visit linked with large numbers of storks in the village?'). We asked where the tourists came from, distinguishing between their recent stop (if they visited more than one place during their trip) and the place of their residence. We also asked how long the travel took and what means of transportation were used. We then asked about the time spent in the stork village, including – separately – the time spent watching storks and stork-related attractions. Further questions referred to previous visits in the stork village and the number of people travelling in a party. Finally, respondents were asked socio-economic questions, providing information about their age, gender, income, level of education, and basic birdwatching preferences. Questionnaires were available in Polish, German and English.

3. Results

The expected number of trips taken by visitor n is given by: $\lambda_n = \exp\left(\beta_{TC} TC_n + \boldsymbol{\beta}'_z \mathbf{Z}_n\right)$ which serves as our travel cost recreation demand function. TC_n represents individual n's cost of reaching the site, and Z_n is a vector of individual-specific characteristics that are considered to influence the number of trips an individual takes. Since the majority of visitors did not specify any other site to be a good substitute for the stork village, a vector of trip cost substitute sites was not included in the recreation demand function. The trip cost was defined in two variants – with and without the cost of time; in both cases round trip was assumed. The average cost per kilometer was estimated to be 0.45 PLN; however, when calculating cost per person we took a travelling party size into account. The value of time depended on visitor's origin and was assumed to be 8 PLN/h for

Polish visitors and 16 PLN/h for foreigners (in both cases the value of time was assumed to be equal to 1/3 of average hourly wage rate, which is a common practice in TCM studies). The average vehicle speed was assumed to be 60 km/h, and the mean distance traveled was 109 km (one way). Figure 2 presents frequency of trips depending on distance traveled (one way).

The vector $\mathbf{Z}_n$ included respondents' characteristics which could be associated with his or her interest in birdwatching: the number of bird species that a person could recognize, declaring to be a frequent birdwatcher, and socio-economic characteristics including age, income, gender, and education. The summary statistics of variables used are presented in Table 1.

The estimation results of two models are shown in Table 2 – one assuming the alternative cost of time to be zero (Model 1) and the other assuming the alternative cost of time to be one-third of an hourly wage (Model 2). As expected, the coefficient of a trip cost was negative and statistically significant in both models. The two birdwatching intensity variables i.e. the number of species a person could recognize and how frequently the person observes birds had positive and significant coefficients. It turned out that income, age and whether a person has a university degree are good predictors in our recreation demand models. Our estimates suggest that *ceteris paribus* the older a person is and the higher income the person has the more visits he or she makes. It also turns out, that males and people with a university degree *ceteris paribus* make more visits. However, because of the distance, visitors from Germany and other foreigners make *ceteris paribus* fewer visits than birdwatchers from Poland. Our parameter estimates also suggest that our data have substantial over-dispersion that could be explained by dummy for university degree and age.

In Table 3 we report welfare estimates along with sensitivity analysis over opportunity cost of time. Using zero cost of time instead of the 1/3 wage resulted in welfare estimates (consumer surplus associated with average respondents' visits) that are 51% lower.

4. Conclusions and policy implications

The results of our study show that there are people who are willing to travel far to visit a stork village. The mean consumer surplus per visit was estimated to be nearly 200 PLN (60 USD), or 396 PLN (120 USD) when the opportunity cost of travel time was included. These results seem relatively high and illustrate the value some consumers derive from watching storks in a stork village. The total annual social benefit – annual recreational use value generated by Zywkowo – was therefore calculated to be 570,000–1,160,000 PLN (170,000–345,000 USD).

The above values are not directly related to what the local human communities living in stork villages can earn, as opposed to the approach practiced for example by the RSPB that calculates the tourists' contributions to local economies (RSPB, 2010; Molloy et al., 2011). However, the value we estimated can translate into direct benefits for local economies in at least two ways:

1. when local authorities or potential donors realize the importance of social benefits delivered by storks in stork villages and, as a result, make decisions that help local residents to cope with the storks' presence (e.g. through incentives to keep foraging grounds for storks or to improve roof structures); and
2. when local residents realize the potential that developing tourist infrastructure might bring and start or increase their own investment.

In both cases, the estimates could help to ensure that storks continue to deliver the public benefits that they have delivered so far.

The non-use value of storks might be very important for the Polish society in general, even if most of its members are unlikely to visit a stork village themselves. To obtain a broader picture of the value of storks, in some cases the TCM questions are combined with questions related to visitors' willingness to pay for preservation / improvements of an environmental good. However, previous studies that used combined TCM and contingent valuation format (Navrud and Mungatana, 1994; Becker et al., 2010) showed that recreational use values are often larger than non-use values. We note, however, that this result is likely to change if respondents are selected from general population, rather than the population of visitors only. In conclusion, we note that the recreational use value, estimated with the TCM is likely much smaller than total economic value. Nonetheless, it may be used as a lower bound and is based on conservative, i.e. less controversial assumptions.

The TCM estimates are often used as a basis for cost-benefit analyses (e.g. Clark, 1987; Gürlük and Rehber, 2008; Becker et al., 2010). In our case, comparing costs of creating and maintaining stork villages with the benefits provided to visitors would offer further interesting and policy relevant conclusions. In some countries 'stork villages' have been created artificially (e.g. Zegveld in the Netherlands), however, in Poland there are other stork colonies that can relatively easily be marketed as 'stork villages' to attract tourists. In these cases the costs of creating a stork village include primarily the costs of giving up intensive agricultural practices in the surrounding area and preventing secondary succession in this area. Additionally, the costs of marketing the village as a tourist attraction and creating tourist infrastructure need to be considered.

Valuation studies may also provide useful inputs into damage assessments. Zywkowo is currently experiencing problems related to the decay of traditional extensive agriculture. Reducing the village attractiveness to storks will also make it less attractive to tourists, diminishing the non-market benefits it now generates. Our analysis provides a new argument in the discussion on the local and country-level importance of this and similar sites. By being able to estimate monetary benefits associated with the opportunity to see storks in their natural environment, we provide a clear message to policy makers. Our study is also a demonstration of how applying the state-of-the-art valuation techniques can inform policy makers to be able to make rational choices.

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Table 1. Summary statistics of explanatory variables

Variable	Mean	Std. dev.	Min	Max
Visits in the last 12 months	1.307	2.309	1	50
Language – Polish	0.669	0.394	0	1
Language – English	0.038	0.181	0	1
Language – German	0.144	0.379	0	1
Distance travelled (one way)	108.898	153.268	0	1000*
Male	0.398	0.465	0	1
Age	40.684	14.757	15	82
University	0.435	0.478	0	1
Household income < 2500 PLN	0.398	0.477	0	1
Household income 2501–4499 PLN	0.133	0.336	0	1
Household income > 4500 PLN	0.263	0.438	0	1
Income not reported	0.189	0.391	0	1
Bird-watching – never	0.309	0.466	0	1
Bird-watching – sometimes	0.599	0.503	0	1
Bird-watching – frequent	0.094	0.297	0	1
Bird species recognized 0–20	0.608	0.513	0	1
Bird species recognized 21–50	0.347	0.494	0	1
Bird species recognized > 51	0.077	0.276	0	1

* Respondents declaring having travelled larger distances than 1000 km were considered outliers and removed from the sample.

Table 2. Estimation results of individual travel cost models

	Model 1 (without cost of time)		Model 2 (with cost of time)	
Variable	**Coefficient**	**Asympt. t-stat**	**Coefficient**	**Asympt. t-stat**
Cost	-0.005	-2.69	-0.003	-3.89
Birdwatching – sometimes	0.549	2.76	0.596	2.97
Birdwatching – frequent	1.554	5.66	1.691	6.13
Bird species recognized 21–50	0.494	2.81	0.537	3.05
Bird species recognized > 51	0.593	2.19	0.639	2.35
Male	1.145	7.13	1.169	7.27
University	0.394	2.25	0.365	2.08
Age	0.171	2.94	0.174	2.91
Household income 2501–4499 PLN	0.555	2.46	0.537	2.38
Household income > 4500 PLN	2.933	2.25	2.877	2.19
Income not reported	0.469	1.97	0.431	1.81
Language – German	-1.363	-4.04	-1.394	-4.11
Language – English	-1.238	-1.94	-1.230	-1.93
Constant	-17.645	-3.88	-15.731	-3.36
Covariates of α				
Age	-0.208	-3.54	-0.208	-3.53
University	-3.054	-2.26	-3.054	-2.28
Constant	16.141	3.52	16.141	3.49
Model characteristics				
Log-likelihood	520.32		512.14	
Observations	583		583	

Table 3. Welfare estimates associated with visiting the stork village

(consumer surplus per person per trip) [PLN]

Model 1 (without cost of time)			Model 2 (with cost of time)		
Mean	**Std. dev.**	**95% conf. int.**	**Mean**	**Std. dev.**	**95% conf. int.**
195.41	67.58	60.39–328.14	396.23	109.49	175.14–608.32

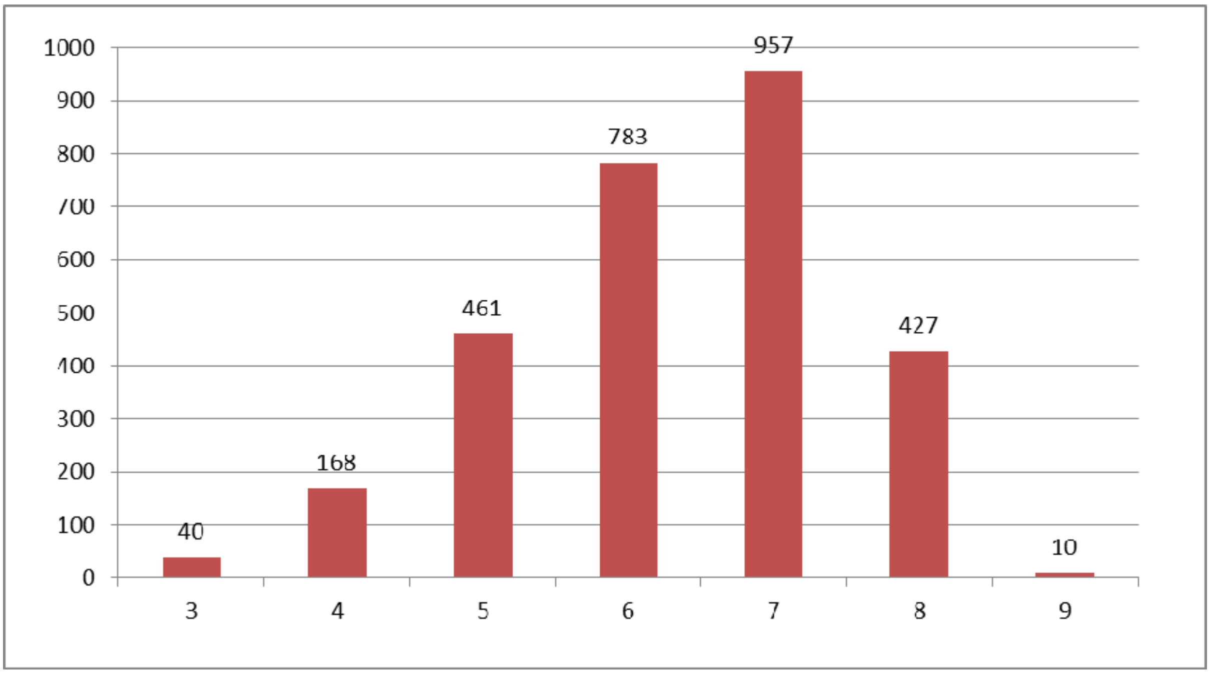

Figure 1. Number of tourists visiting Zywkowo in the consecutive months of 2011

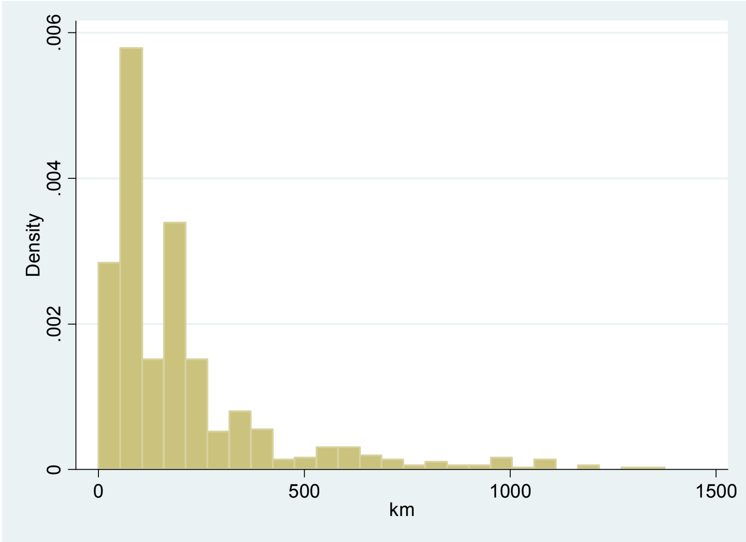

Figure 2. Frequency of trips depending on distance travelled (one way)

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