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VALUING EXTERNALITIES OF OUTDOOR ADVERTISING IN AN URBAN SETTING – THE CASE OF WARSAW

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Valuing externalities of outdoor advertising in an urban setting – the case of Warsaw

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Abstract: Outdoor advertising produces externalities, such as visual pollution, that have to be considered in cityscape planning. In recent years, opposition to excessive outdoor advertising in Poland has grown, resulting in the enactment of new regulations in 2015: The Landscape Bill. It allows local authorities to limit outdoor advertising in their municipality. We present the results of a stated preference study aimed at estimating the value that people attach to the reductions of outdoor advertising in Warsaw, the capital of Poland. We considered two types of outdoor advertising mediums: free-standing ads and on-building ads, alongside five levels of advertising reduction. We find that inhabitants of Warsaw prefer regulating and limiting the amount of outdoor advertising and we quantify their willingness to pay for such a policy. The most preferred level of free-standing ads was a 75% reduction, for which the people of Warsaw are willing to pay 5.6 million EUR annually in the form of increased prices and rents to compensate owners' losses. For on-building ads, total ban was the most preferred, valued at 11.3 million EUR per year. Socio-demographic drivers of people's willingness to pay are explored. Overall, our study demonstrates how stated preference methods can be used for informing urban landscape policies and adds to the ongoing debate surrounding outdoor advertising.

Keywords: Outdoor advertising; public preferences; stated preference methods; discrete choice experiment; willingness to pay.

JEL codes: R52, D12, D62

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1. Introduction

Advertising became one of the characteristic elements of modern urban landscape.¹ Outdoor advertising (OA; also known as out of home advertising) reaches customers outside their homes – on the street, in public places and when travelling. Compared to other forms of media, OA has some advantages such as: wide reaching campaign, placement near the point of sale (if needed), twenty-four-hour presence, low cost of production and low cost per exposure (Gomez, 2013). While advertising plays important informative and marketing functions in modern society, it has a large visual impact on the environment – excess advertising may negatively influence surroundings, causing information noise and visual pollution.² In addition to its impact on the landscape, too much advertising can reduce its effectiveness (IGRZ, 2017). It is therefore an important task to find the socially optimal level of advertising.

Scenic amenities can have a substantial effect on property values, recreational demand and life satisfaction (Ambrey & Fleming, 2011). People attach value and they are willing to pay for a better view in their neighborhood (Iman & Tian, 2013). On the other hand, visual pollution caused by cell towers, windmills or OA signs were found to have a negative impact (Chmielewski, Lee, Tompalski, Chmielewski, & Wężyk, 2016; Nagle, 2012; Portella, 2016). In the case of a city, advertisements and shopfronts can influence its appearance both positively and negatively. While some individuals find that billboards provide useful information, many find billboards to be harmful to the landscape and a considerable group of people would prefer the removal of the billboards that are harmful to the scenic amenity (Elena, Cristian, & Suzana, 2011; Groothuis, Groothuis, & Whitehead, 2007; McDougall, 2002).

The externalities generated by OA call for government regulation of this market. National and local authorities worldwide have tried to solve this issue in various ways. One of the extremes is no specific policy. An example of such a case is Metro Manila in the Philippines, which because of the lack of regulations concerning advertising (and ineffective enforcement; Francisco, 2010) is strongly overwhelmed by outdoor advertisements and considered to be “one

¹ Advertising is a means of communicating with the users of a product or service. Advertisements are “Any communication, usually paid-for, specifically intended to inform and/or influence one or more people”(Bullmore, 2016; Bullmore & Waterson, 1983).

² The term visual pollution explains the effect of various objects such as telephone towers, windmills, billboards, signs, street furniture, building facades and other images that may negatively affect the landscape amenity (Nagle, 2012; Portella, 2016).

of the most visually displeasing metropolises in Southeast Asia” (Gomez, 2013).³ There are more cities struggling with extreme visual pollution – for example, 98% of citizens in West Bengal in India think there is visual pollution in this region and pinpointed billboards as the second most important cause (after garbage; Jana & De, 2015).

On the opposite side of the regulation scale is Sao Paulo, which nearly completely banned OA, including billboards, posters, advertising in public transport and on private vehicles, and the distribution of flyers in the city (NYC Global Partners 2011). In 2006, when the Clean City Act (Lei Cidade Limpa) was introduced, approximately fifteen thousand billboards and sixteen thousand signboards and trademarks were removed from the public space. According to the city office, the objective of the new regulation was to reduce visual pollution and to regain basic citizens’ legal right to live in a clean and tidy city with respect to public spaces, historical heritage and architectural integrity.⁴ With the exception of the aesthetic aspect, advertising in Sao Paulo was literally covering social problems such as favelas hidden in the middle of the city behind advertising grids. On the other hand, some highlighted billboards were illuminating the streets increasing the citizens’ feeling of safety. Nonetheless, over 70% of residents declared they were enjoying an OA-free city during a survey in 2007 (NYC Global Partners 2011). In 2012, the city office started to introduce small advertising mediums into the public space again; however, this is according to new, different rules. Signboards need to have a specified size and shape and some limited advertising is now allowed on new public clocks, alongside multimedia content and weather forecasts (IGRZ, 2016).

Finally, intermediate approaches can be found, such as the United States Highway Beautification Act that has been in place since 1965. The Act bans advertising along interstate roads with exceptions for limited stretches. Additionally, along scenic roads, the state authorities are allowed to ban ads or impose other restrictions (Szoeg, Sobolewska, & Szoeg, 2005). It is at the discretion of states’ governments to enforce the restriction; consequently, billboards are banned in four states⁵ (Farihah, 2014; Francisco, 2010). Instead of removing advertisements, the city of Toronto, Canada put an additional tax on advertisements in 2010 (“Third Party Sign Tax”). The annual flat tax rate range between \$1,235 - \$24,768 per sign structure depending on the class of the sign⁶, with a net revenue of over \$11 million per year

³ The problem with billboards in this city is not only aesthetic – a monsoon climate means that every couple of years strong winds break the billboards causing a threat to the life and health of the inhabitants.

⁴ http://www9.prefeitura.sp.gov.br/cidadelimpa/conheca_lei/conheca_lei.html

⁵ Vermont, Maine, Hawaii, Alaska.

⁶ Five classes with different sizes and structures are considered; the tax rate increases on an annual basis.

based on approximately 2,000 signs (Committee Planning and Growth Management, 2017). Another example of reducing advertising is Grenoble, France. In 2015, the city council removed over 320 billboards and advertising signs across the city. According to advertising companies, this costs the city more than €600,000 a year in opportunity costs. A few years before Grenoble, Paris reduced OA by one third in 2011 (IGRZ, 2016; Mulholland, 2014).⁷ Substantial restrictions are also prevalent in Beijing, where a special commission reviews the advertising layout of each street and sets out its potentially polluting role, of the rate of harmonization with the urban area and the potential distraction to drivers in heavily trafficked areas (Elena et al., 2011).

Despite various approaches to regulation of OA, none of them are based on a proper benefit-cost analysis that would allow for establishing the socially optimal level of advertising (or the Pigouvian tax level). This is mainly because the quantitative estimates of the external costs of OE are missing. This poses a non-trivial task, as economic trade-offs revealing consumers' preferences with respect to scenic resources are not directly observed in the market. However, the value of such non-market goods can be measured using stated preference techniques (Hanley and Czajkowski, 2019), in which respondents are asked to make preferred choices in carefully prepared and designed hypothetical situations. If these situations are framed in an incentive-compatible way, such as participating in an advisory referendum on a policy that would lead to limiting OA at a given cost for a respondent, the observed choices can be used to model public preferences and willingness to pay (WTP) associated with such policies (Vossler, Doyon and Rondeau, 2012). In this study, we demonstrate how the economic value of the visual impact of OA on the urban environment can be estimated using stated preference methods, using the case of Warsaw, the capital of Poland. Our results feed directly into the policy problem faced by the local government, which has been designing new regulations according to the prerogatives provided by the 'landscape bill' passed by the Polish government in 2015.

The rest of the paper is structured as follows. Section 2 provides an overview of earlier studies of public preferences for landscape amenities and OE. In section 3, the case study is presented, followed by the description of stated preference study and a brief description of the econometric framework used for data analysis. Section 4 presents the results, in terms of the estimated WTP and its socio-demographic drivers. The next section provides the discussion of

⁷ <https://www.theguardian.com/cities/2015/.../can-cities-kick-ads-ban-urban-billboards>

the results and their implication for public policy. A summary and conclusions are provided at the end.

2. Prior studies on preferences in visual pollution and advertising

The aesthetic quality of a view and how it is perceived by humans is not easy to measure and has been the subject of numerous research studies in various disciplines. Despite subjective perception of sceneries, the health and social benefits associated with the aesthetic enjoyment of landscapes can and should be accounted for in the evaluation of the societal qualities of life and ecological sustainability (Kerebel, G  linas, D  ry, Voigt, & Munson, 2019). For this reason, growing attention has been paid to assessing the human perception and impact of various elements such as windmills, powerlines, roads and infrastructure on the landscape (Arnberger et al., 2018; Jensen, Panduro, & Lundhede, 2015; Tsoutsos, Tsouchlaraki, Tsiropoulos, & Serpetsidakis, 2009; Wagtendonk & Vermaat, 2014).

There are several noteworthy examples of scholars and local planners examining the value that people attach to the quality of a landscape. Campbell (2007) used a Discrete Choice Experiment (DCE; Carson and Czajkowski, 2014) method to estimate participants' WTP for rural landscape improvements in Ireland. He showed that the benefits from improving four elements of the rural landscape – mountain land, stonewalls, farmyard tidiness and cultural heritage – were considerable, valued at 25 to 85 EUR per person annually, depending on the attribute of the landscape and the level of action. Tempesta et al. (2014) used a DCE to estimate the landscape benefits of the burial of power lines in five rural areas and parks in Italy. Three levels were considered: a 50%, 25% and 0% reduction of the visible cables. They found that about 40% of the interviewees were not willing to pay for a reduction in the number of power lines. Despite this, in some areas the social benefits exceed the costs of burying power lines. Average households' WTP was between 28 and 45 EUR for 1,000 km of power lines, depending on the type of landscape.

Another stream of research uses hedonic price models (Mendelsohn, 2019) to estimate the monetary value of scenic amenity through its impact on home-buying behavior. One of the earliest hedonic price studies was Gillard (1981), who found that a dummy variable for a view lot had a positive and significant effect on the value of real estate in Los Angeles. In many later studies, this conclusion was extended. Benson et al. (1998) introduced a differentiation of the view amenity by type and quality. Apartments with scenic views of the ocean or a lake achieved higher prices, whereas mountain views did not affect prices. The distance of a house from natural landscapes could suppress the quality and quantity of the view, hence their amenity

value. The negative perception of street view induced a price reduction. It is worth mentioning that the specific amenity elements that significantly influence house prices and their magnitude of effect are different from one case to another and need to be determined empirically (Iman & Tian, 2013; Jim & Chen, 2009).

Jensen et al. (2015) examined the external effect of wind turbines' noise and visual pollution on property prices. Wind turbines have a significant negative effect on the price schedule of neighboring residential properties; visual pollution, on the other hand, reduces residential sales price by up to about 3%; finally, noise pollution reduces the price between 3% and 7%.

A more recent method that can be used to evaluate environmental amenities is the life satisfaction approach (Frey, Luechinger, & Stutzer, 2010). Ambrey and Fleming (2011) examined the influence of scenic amenity on the life satisfaction of residents of South East Queensland in Australia and their WTP for improved landscape views. The authors found that, on average, the respondents were willing to pay 14,000 AUD in annual household income tax increase to obtain a one-unit improvement in scenic amenity, where scenic amenity was measured on a 10-point scale. In the case of cityscapes, Kim and Jin (2018) used this method to estimate the monetary value of urban parks in Seoul. The results demonstrated that a 100 m² increase in urban park increases an average person's stated happiness by an amount equal to a 110 USD increase in monthly household income.

Although there is a substantial amount of literature devoted to the valuation of natural views, there seems to be a gap regarding people's preferences on other, less pleasant views – such as advertising and billboards, which the inhabitants of most cities encounter on a daily basis. McDougall (2002) conducted research in Melbourne, Australia, using the Contingent Valuation method (Boyle, 2017). The respondents were asked about their opinion and WTP to take down specific billboards in the city. The study shows that the community may not place a high value on restoring the landscape to its pre-signage condition. The vast majority – 85% of respondents – did not want to participate in the cost of reducing the advertising. Despite this, the results indicated the average WTP was approximately 1 – 3 AUD for the removal of billboards depending on the respondent type, sign location and sign size. Conversely, Groothuis et al. (2007) used the contingent valuation method to measure the amount citizens were willing to pay to improve the scenic mountain-view amenities through the removal of billboards in Watauga County, North Carolina. The results indicated that the majority of households supported the improvement of the mountain-view amenity through the removal of billboards. The median WTP estimate was in the 25 – 48 USD range, depending on the model

specification. The results also suggested that diverse demographic groups had heterogeneous preferences. Finally, the authors estimated that households were willing to compensate land owners up to 2,810 USD per billboard for their removal to improve mountain views. Fransico (2010) used the contingent valuation method to estimate the average WTP for removing billboards in Metro Manila, Philippines. The results ranged from 29 to 32 USD per household. Moreover, the measure of income elasticity indicated that higher incomes more than proportionally increase the WTP for landscape improvements (cf. Barbier, Czajkowski and Hanley, 2017). Furthermore, those who said they notice billboards were more likely to be in favor of the removal of such billboards, while those who said billboards are useful in making consumer decisions were less likely to be in favor of their removal.

There is also concern that roadside advertisements may distract drivers and cause and increase crash risks; this is especially dangerous in congested city roads. This topic is described by Vlakveld and Helman (2018). There is evidence that some billboards attract driver attention (Hudák & Madleňák, 2017), negatively affecting drivers' ability to stay in their lane, and producing shorter headways and later breaking reactions. Nonetheless, only a few studies have investigated the before-and-after impact of ads on car crashes and only one of them found a statistically significant increase in crashes near the billboards (Vlakveld & Helman, 2018).

In Poland, where our empirical study is conducted, Szoegé et al. (2005) studied travelers' WTP for removing all of the billboards along a particular road (between Janki and Grójec). The average WTP for removing one billboard was estimated at 2.6 EUR; however, the majority would rather not pay to remove the billboards. The results were different for diverse groups – respondents' sensitivity to the billboards decreased in line with their age and the income of the household, except for the wealthiest; it also increased with their level of education. Additionally, women appeared to be more sensitive to outdoor advertisements than men. Chmielewski et al. (2016) proposed a universal impact factor to measure the effect of OA on visual pollution and the quality of public spaces in Lublin, Poland. The authors combined the spatial properties of outdoor advertisements such as location, shape and size to measure pollution exposure and correlated it with the public's opinion of OA. This method can be used to measure and quantify the visual intrusion of billboards on the surrounding area; it may, therefore, become another way to support city policy decisions. Chmielewski et al. (2018) also developed a WebGIS application using citizen science to evaluate visual pollution.

To summarize, there is a number of studies devoted to exploring public preferences, including WTP to improve scenic amenities; however, not many exist investigating advertising as visual pollutant itself. The choice of optimal policy could vary from place to place depending

on public preferences, and institutional and cultural framework. An economic analysis is, therefore, required to shed light on the issue. In the next section, we describe the case study of Warsaw, where a new policy is to be implemented and where we investigated the preferences of citizens regarding future levels of OA.

3. Data and methods

3.1. Context – outdoor advertising in Poland

The debate about OA in Poland has been particularly lively. According to a questionnaire from 2013 (TNS Polska, 2013), 82% of Poles agreed that the landscape in their neighborhood matters, whilst 37% said that the landscape in the cities and villages is chaotic. Respondents agreed that well-designed advertising can be attractive and look good in the environment, but it is usually unsightly. Furthermore, the majority of respondents supported introducing or improving landscaping regulations that would improve order in public places, reduce the volume of advertising and increase the influence of a city's authorities on the localization, size and shape of the ads. On the other hand, the majority of respondents were willing to allow the placement of ads for mineral water on their houses for one month if they had received monetary compensation. Keeping in mind the prospective of income, they were ready for some compromise with their aesthetic values (assuming that the advertisement did not improve the aesthetic value of their house).

OA has been in the spotlight after the 'Landscape Bill' was passed by the Polish government in 2015. The bill redefines many important concepts such as advertising, billboard, signboard and other street furniture (such as benches, trash cans, lamps, etc.).⁸ However, one substantial change is that it allows local governments to impose local laws on advertising – the 'landscape resolution'. In this resolution, municipal councils can establish rules for OE, determining the acceptable shape, size, standards for quality, localization and quantity of advertising and street furniture. It is not mandatory for local governments to prepare such a resolution; it is, however, an important tool to improve the quality of public spaces (Fogel, 2017).

⁸ According to Polish law, there are two definitions of advertising. In the Public Roads Act, advertising is defined as a board or a device placed in the field of view of the user of the road or any other informative medium that is not a road sign and is not information about local facilities, a way of protecting monuments or nature placed by a local municipality. Per contra, according to the Act on Planning and Spatial Development, advertising is described as a popularization of information about a person, company, products, services, events or social movement in any form. An advertising board is a plain object with exposure space, together with fastening elements used to expose the advertisement, especially banners, advertisement in windows or advertisements placed on scaffolding.

Our empirical investigation concerns the preferences of the citizens of Warsaw, the capital city of Poland, where the local government has been planning to impose new OA regulation. As a result, in addition to demonstrating the applicability of stated preference methods to examine public preferences on advertising in cityscapes, insights from this study constitute an excellent starting point for designing future policies in introducing new limits on OA in Warsaw. Current regulations for OA in Warsaw are complicated and not strictly imposed. According to these regulations, Warsaw is divided into four zones that differ with respect to the allowed size of the advertising mediums (from 3m², 9 m², 18m²), however there are many exceptions for approved locations in the urban and suburban zones and separate standards of billboard density along the roads and minimum distances from crossroads. The advertising expositions on the elevations of the buildings (other than at the time of reparation) cannot cover windows, architectonic details and other characteristic elements of the building and is only allowed if the form and size of the advertising medium is well integrated into the wall and considers the character and purpose of the building. This regulation is currently often got around by reparation of buildings that goes on for years. The new landscape resolution gives a chance for better enforcement, due to more comprehensible resolutions and higher penalties (Fogel 2017; Municipal Government of Warsaw 2018).

3.2. Empirical study design and implementation

Our study aimed at investigating the citizens of Warsaw preferences and WTP for changes in the OA regulations. The public good and non-market nature of advertising in the landscape favors the use of the stated preference methodology, where choices are observed in a survey setting. The most flexible of these methods, and currently the most widely applied, is the contingent valuation method, combined with elicitation questions in the form of a DCE. In this method, respondents have to make a choice in a multidimensional choice situation (Carson, 2012; Carson & Czajkowski, 2014). As a result, it is possible to estimate consumer welfare in the case of the implementation of a particular scenario (e.g., providing a new public good).

We focused on two types of OA – free-standing and on-building advertising. Free-standing advertising includes billboards – a flat surface or a board on which large advertisements or notices are posted. Other types of free-standing OA are advertising columns, small tables and city lights, which are relatively small (up to 3m²), as well as backlighted boards (e.g., on bus stops, in galleries and along passages). This kind of advertising is becoming more popular, especially because it encourages public-private partnerships between public authorities and outdoor media companies for the provision and maintenance of street

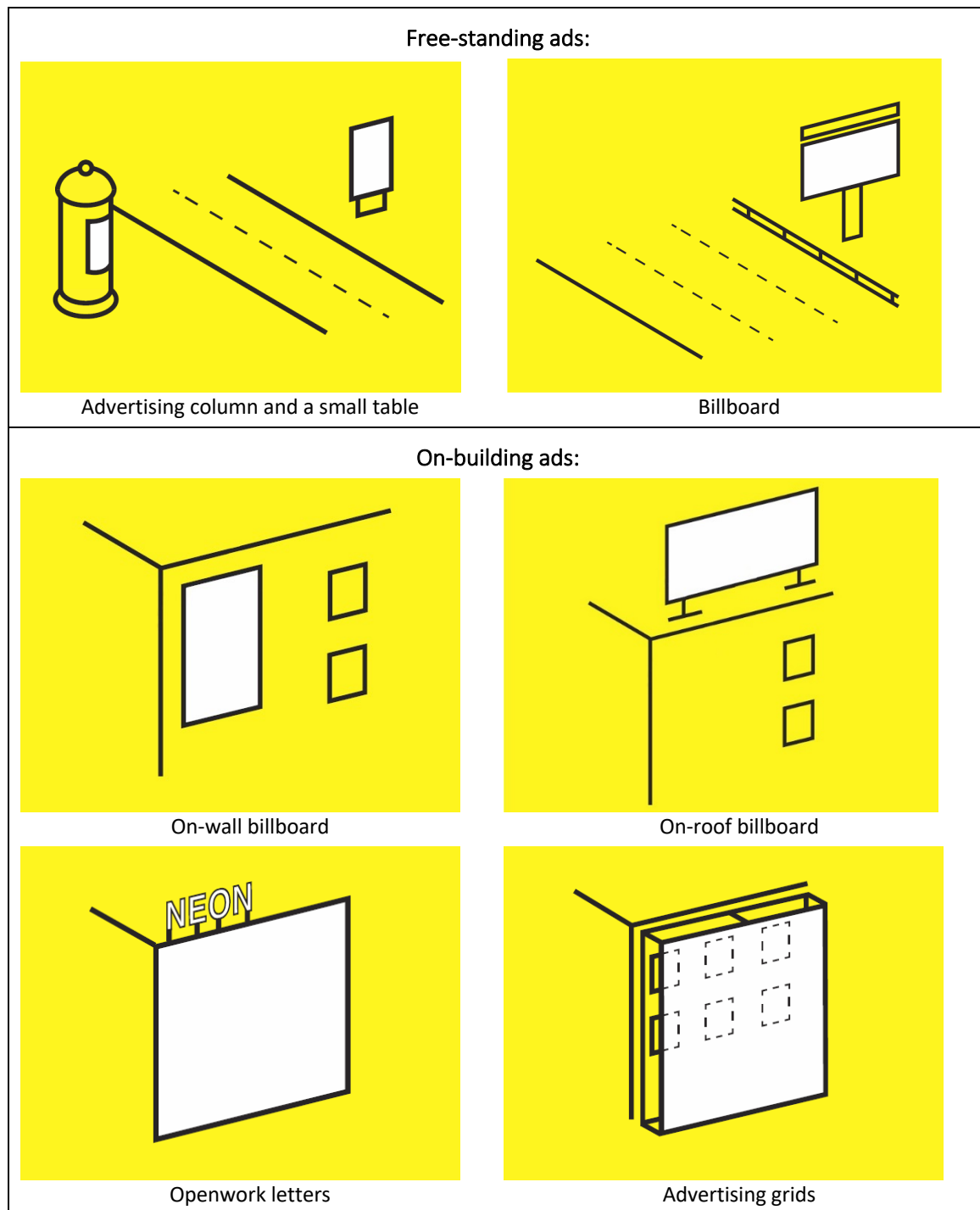
infrastructure, for instance bus stops, roads and street furniture such as benches, garbage disposal units and public toilets (Iveson, 2012).⁹ Another type of OA is on-building advertising, for example, billboards fixed to buildings (on walls and roofs), advertising grids covering a building elevation¹⁰, openwork letters and signs on the roofs and walls of buildings. These are valuable to advertisers due to their position near central and crowded areas and large format. Examples of both types are provided in **Error! Not a valid bookmark self-reference..**

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⁹ For instance, JCDecaux, one of the biggest advertising companies in the world, holds contracts for the provision of street furniture in more than 1,500 cities across 40 countries with over 350,000 advertising panels (Iveson, 2012). In Warsaw, 1,580 bus stops were replaced and are maintained by a marketing consortium that has received advertising space in these bus stops in exchange.

¹⁰ Advertisements on buildings can be used for collecting money for the refurbishment of the building. A good example of this are the advertisements on the monuments in the old town of Venice that cover the mounting bills incurred by the restoration of historical monuments (Iveson, 2012). However, in Poland this purpose is often abused with simulated renovations work (Springer, 2013). The problem with these types of advertisements is that they often impact the aesthetic environment due to their large format and tendency to cover the architectural details of the buildings (Mikosz, 2010).

¹¹ There are also other types of outdoor advertising, such as advertising on and inside public transport, LCD screens and leaflets; our study did not consider these types of OE.

Figure 1. Illustrated examples of outdoor advertising presented in the survey

Source: own work, based on Fogel (2017).

The survey informed the respondents about the roles of OE and provided definitions of various types of OA. Next, their preferences were elicited with respect to limiting advertising in Warsaw, relative to the current level. The possible restriction levels varied from no change (100% of the current level), through 75%, 50% and 25% reduction, to the total ban (0% of the

current level) and referred separately to free-standing and on-building OA. Additionally, there was a monetary attribute labelled ‘annual cost for your household’, which represented the expected cost of a particular policy associated with a given set of new regulations. The survey script explained that the additional cost to respondent’s household can arise from higher prices, rents or other increases in the cost of living associated with the new regulations. Extensive qualitative pretesting of the survey helped refine the descriptions of attributes and confirmed that they were clear and credible for respondents.

An example choice task for choosing participants’ preferred levels of OA restrictions is presented in

Figure 2. Each choice task included a status quo scenario where no change was made and the cost of such an alternative was 0 PLN. To avoid biases related to the order of the attributes and alternatives, a few versions of the questionnaire were developed. The experimental design consisted of 12 choice tasks per respondent, and each task had 2, 3 or 4 alternatives. The order of the attributes in the choice tasks was randomly varied across respondents.

Figure 2. Example of a choice card (translation)

Choice situation 1	Alternative A (Status quo)	Alternative B	Alternative C
Free-standing advertising	100% (no change)	50% (medium reduction)	75% (small reduction)
On-buildings advertising	100% (no change)	0% (ban)	25% (large reduction)
Annual cost for your household	0 PLN (no change)	20 PLN	50 PLN
<u>Your choice:</u>	☐	☐	☐

The survey followed state-of-the-art guidelines for stated preference studies (Freeman, Herriges and Kling, 2014; Champ, Boyle and Brown, 2017; Johnston et al., 2017). The structure of the survey was the following: we first checked if the respondent was living in Warsaw. Subsequently, the attitudes of the respondents to OA and its regulation was collected. The survey explained that respondents’ responses could influence the future regulation (consequentiality), as the results of the public opinion poll was to be presented to policy makers. In the next part of the survey, the choice tasks were presented. The questionnaire ended with eliciting the socio-demographic characteristics of the respondents.

The survey was administered as a computer assisted personal interview (CAPI) in 2017. Respondents were selected using the stratified quota sampling method to assure the representativeness of the sample for the target population. In total, we collected usable responses from a representative sample of 1,250 Warsaw residents.¹²

3.3. Econometric framework

The econometric foundation for the quantitative modelling of consumer preferences is based on the random utility theory (McFadden, 1974). In this model, the utility of the individual i resulting from choosing alternative j in situation t can be expressed as:

$$U_{ijt} = \mathbf{X}_{ijt} \boldsymbol{\beta} + e_{ijt} \quad (1)$$

Where $\mathbf{X}_{ijt}$ is a vector of the observed attributes of the alternative j , with the corresponding vector of parameters, $\boldsymbol{\beta}$, and e_{ijt} is a random error component that represents unobserved portion of the utility.

The researcher does not observe e_{ijt} , however, they are able to assume its distribution, $f(e)$. Depending on this assumption, the model can be transformed into different classes of choice models. Assuming that the stochastic component e_{ijt} follows an independent and identically distributed extreme value (type I) distribution,¹³ it leads to the familiar logit probability specification, used in simple conditional logistic regressions, with a probability of choosing alternative j from a set of J available alternatives given as:

$$P_{ijt}(\boldsymbol{\beta}) = \frac{\exp(\mathbf{X}_{ijt} \boldsymbol{\beta})}{\sum_{k=1}^J \exp(\mathbf{X}_{ikt} \boldsymbol{\beta})} \quad (2)$$

An inconvenient assumption of this simple (multinomial logit, MNL) model is the independence and identical distribution of the error term for all of the alternatives and respondents, as well as identical preferences of different respondents – the same coefficients

¹² In the supplementary material to this paper, available at <http://czaj.org/research/supplementary-materials>, we provide the transcript of the survey, collected data, software codes and detailed results accompanying our study.

¹³ The density for this distribution is given by: $f(\varepsilon_{ij}) = e^{-\varepsilon_{ij}} e^{-e^{-\varepsilon_{ij}}}$, and the distribution is $F(\varepsilon_{ij}) = e^{-e^{-\varepsilon_{ij}}}$. The variance is constant and equal $\sigma = \pi^2/6$. Since the scale of utility is irrelevant to behavior, without changing the results utility can be divided by σ . The mean is not zero; however, in estimation we take into account the differences between two elements with the same expected value, so the distribution of the difference of two

extreme values $\varepsilon_{ijk}^* = \varepsilon_{ij} - \varepsilon_{ik}$ is logistic with cumulative distribution $F(e_{ij}) = \frac{\exp(e_{ij})}{1 + \exp(e_{ij})}$.

β in utility function for all individuals. One way to relax these assumptions is to use a Mixed Logit Model (MXL). It overcomes the three limitations mentioned above by allowing for some level of (unobserved) preference heterogeneity, in addition to correlations between the alternatives and choice tasks. In MXL, probability of making given choices in a set of T situations, is a weighted average of standard logit probabilities with parameters β coming from a distribution specified a priori by a modeler. It can be presented as:

$$P_i(\theta) = \int \left(\prod_t \sum_j I_{ijt} P_{ijt}(\beta) \right) f(\beta | \theta) d\beta, \quad (3)$$

where I_{ijt} equals 1 if individual has chosen alternative j, and it equals 0 otherwise. The utility function for respondents is analogical to an MNL model, except for the fact that the vector of the parameters β_i can vary for different respondents. Consequently, utility can be written as: $U_{ijt} = \mathbf{X}_{ijt} \beta_i + e_{ijt}$, where the density of vector β_i is given by function $f(\beta | \theta)$ where θ are the parameters of the β distribution.

The model is estimated using the maximum likelihood method for the utility function parameters, conditional on individuals' observed choices and attribute levels associated with choice alternatives. Estimating the MXL model requires the use of simulation methods because the integral in (3) does not have a closed form. We can thus apply a simulation procedure in which β_r is drawn from $f(\beta | \theta)$ and, for each β_r the logit formula is calculated. The simulated probability is given by the average over R draws:

$$\hat{P}_i(\theta) = \frac{1}{R} \sum_{r=1}^R \left(\prod_t \sum_j I_{ijt} P_{ijt}(\beta_r) \right). \quad (4)$$

$\hat{P}_i(\theta)$ is an unbiased estimator of $P_i(\theta)$ by construction. The simulated probabilities can then be used in a log-likelihood function (Hensher, 2014; McFadden & Train, 2000). In the simulation, we used 10,000 scrambled Sobol draws (Czajkowski and Budziński, 2019).

Finally, given that we are interested in the marginal rates of substitution with respect to the monetary attribute P_{ijt} , it is convenient to introduce the following modification of (1), which is equivalent to using a money-metric utility function (in our case, it means estimating the parameters in WTP space; Train and Weeks 2005):

$$U_{ijt} = a_i \left(p_{ijt} + \mathbf{Y}_{ijt} \frac{\mathbf{b}_i}{a_i} \right) + e_{ijt} = a_i \left(p_{ijt} + \mathbf{Y}_{ijt} \boldsymbol{\lambda}_i \right) + e_{ijt} \quad (5)$$

In this specification (rescaling the utility function), the vector of parameters, $\boldsymbol{\lambda}_i = \frac{\mathbf{b}_i}{a_i}$ can be directly interpreted as a vector of the implicit prices (marginal WTPs) for the non-monetary attributes, $\mathbf{Y}_{ijt}$ facilitating an interpretation of the results.¹⁴

4. Results

Public opinion in Warsaw is generally in favor of introducing new regulations for OA, with over 43% respondents saying they definitely agree and an additional 40% who ‘rather agree’. At the same time, over 62% of respondents agreed that some form of OA in public spaces is needed. Most of respondents believe that the new regulations should vary with respect to the city zones (central, sub-urban, etc.) and that OA along the main communications arteries should be treated differently. These results are summarized in **Error! Reference source not found..**

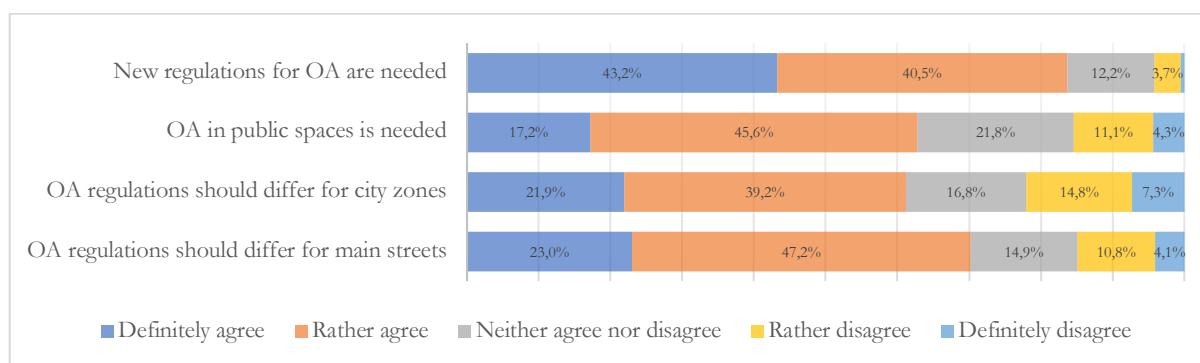


Figure 3. Summary of general attitudes towards OA and its regulation in Warsaw

General attitudes also vary with respect to advertising media – the summary of opinions towards changing the total amount of specific mediums is presented in Figure 4. The respondents were the most positive towards advertising columns and small tablets, with nearly 40% declaring that they do not think they should be limited relative to the current level. Openwork letters placed and on-wall billboards were also relatively accepted, with only approximately 10% of respondents in favor of banning them. On the contrary, advertising grids

¹⁴ The models presented in this paper were estimated using a DCE package developed in Matlab and available from github.com/czaj/DCE.

covering buildings and large billboards received the least support, with almost 30% of respondents in favor of total ban of advertising grids.

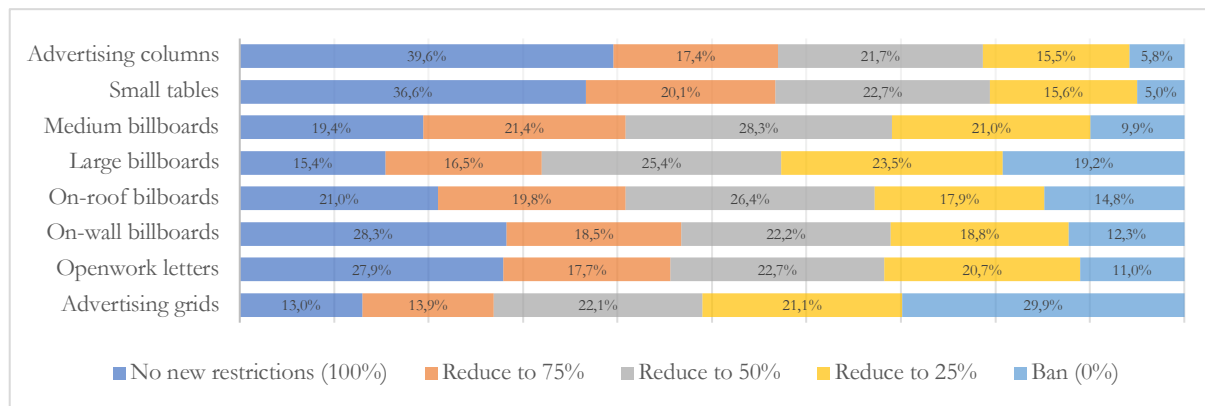


Figure 4. Summary of opinions towards changing the total amount of different advertising media

Considering the results above, we conclude that the citizens of Warsaw are proponents of improving existing regulations and have heterogeneous views with respect to limiting free-standing and on-building ads. However, how much would they be willing to pay for the reductions in OA in Warsaw? This question can be answered based on the stated trade-offs that they made with respect to future OA policies and the associated cost.

Table 1 presents the estimated utility function parameters associated with dummy-coded changes in the amount of free-standing and on-building ads in Warsaw derived from the MXL model. Since the model was estimated in WTP-space, all coefficients can readily be interpreted as means and standard deviations of WTP distributions (in EUR per household per year) for including specific attributes in the new policy.

The results show that the citizens of Warsaw are generally willing to pay more for restrictions on on-building ads, than free-standing ads. The largest mean WTP (14.61 EUR per household per year) is associated with total ban of on-building ads, followed by a large reduction (to 25% of the current level; mean WTP of 13 EUR), a medium reduction (50%; 12.45 EUR) and a small reduction (75%; 7.20 EUR). The respective mean WTP for reductions in free-standing ads was the highest for large reduction (to 75% of the current level; 7.28 EUR), which was preferred to total ban of free-standing ads (5.95 EUR). Medium reduction was on average valued at 5.48 EUR, and a small reduction – at 3.90 EUR per household per year. In addition, respondents' choices implied a negative mean WTP of 10.61 EUR associated with keeping the current regulations. This means that a new policy introducing new regulations was

worth approximately 10 EUR, irrespectively of the benefits (and WTP) for specific changes in OA levels it imposed.

Table 1. The result of MXL model in WTP space, representing the estimated means and standard deviations of the distributions of respondents' WTP for the attributes of the new policy [EUR / household / year]

	Mean (st. err.)	St. deviation (st. err.)
Status quo (alternative specific constant)	-10.61*** (0.52)	16.07*** (0.95)
Free-standing ads – small reduction (75%)	3.90*** (0.40)	7.58*** (0.72)
Free-standing ads – medium reduction (50%)	5.48*** (0.44)	10.90*** (0.79)
Free-standing ads – large reduction (25%)	7.28*** (0.43)	14.84*** (0.79)
Free-standing ads – total ban (0%)	5.95*** (0.46)	15.53*** (0.83)
On-building ads - small reduction (75%)	7.20*** (0.47)	9.01*** (0.76)
On-building ads - medium reduction (50%)	12.45*** (0.58)	16.99*** (0.96)
On-building ads - large reduction (25%)	13.02*** (0.64)	19.82*** (1.13)
On-building ads - total ban (0%)	14.61*** (0.74)	24.31*** (1.28)
Model diagnostics		
LL at convergence	-10,063.75	
LL at constant(s) only	-15,932.04	
McFadden's pseudo-R ²	0.3683	
Ben-Akiva-Lerman's pseudo-R ²	0.5536	
AIC/ <i>n</i>	1.3505	
BIC/ <i>n</i>	1.3835	
<i>n</i> (observations)	15,000	
<i>r</i> (respondents)	1,250	
<i>k</i> (parameters)	65	

Notes: ***, **, * represent significance at 1%, 5%, 10% level, respectively. All utility function parameters are modelled as random, correlated and normally distributed (except for the cost parameter, which is assumed to follow a log-normal distribution). The estimates of the *Cost* parameter are provided in the supplementary materials available online, as they do not have direct interpretation (the parameter for the monetary attribute, marginal utility of money, serves as a common denominator in WTP for all non-monetary attributes). Similarly, although we accounted for the correlations of all random parameters in the model and hence also allowed for correlations between alternatives giving the model more flexibility, the interpretation of the estimated coefficients is not straightforward (Mariel and Meyerhoff, 2018) and therefore the estimated elements of Cholesky matrix are only given in the online supplement.

Next, we note that in addition to significant estimates of mean WTP, we find that there is considerable level of preference heterogeneity among respondents, as indicated by significant and relatively large estimates of the standard deviations of WTP distributions. These estimates are relatively larger for extreme levels of restrictions, which is consistent with the results of the analysis of respondents' attitudes showing that while they are generally in favor of new regulations and restricting the level of OA in Warsaw, their opinions vary considerably between respondents and between specific types and placements of OA.

A somewhat related observation is that, according to our results, the preferences for free-standing ads are not monotonic. This means, that more restrictions are not necessarily considered better, on average. This result is further illustrated in **Figure 5. Mean WTP for annual advertising reductions per household (bars indicate 95% confidence intervals of the estimates)**Figure 5.

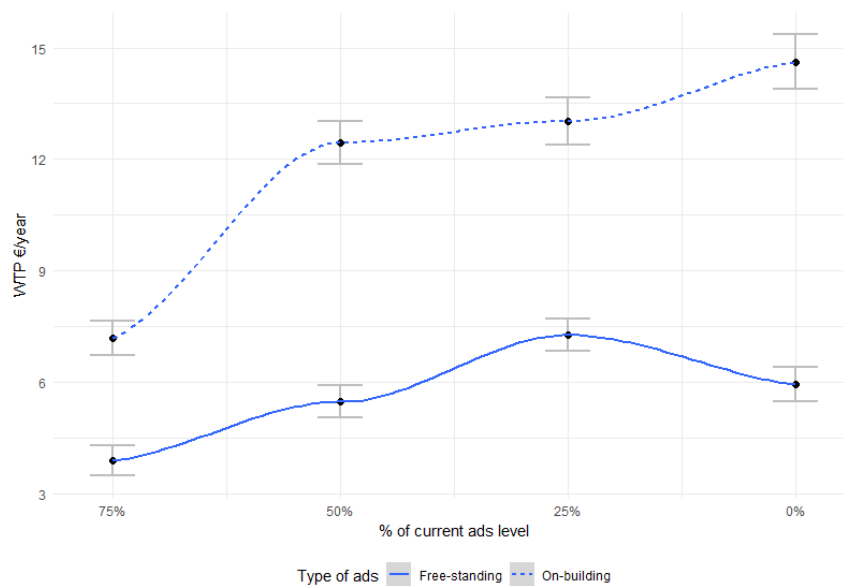


Figure 5. Mean WTP for annual advertising reductions per household (bars indicate 95% confidence intervals of the estimates)

4.1. Socio-demographic drivers of WTP for OA reductions

Previous studies have revealed that the WTP for landscape features and OA is correlated with a number of socio-demographic variables and other respondent characteristics (Campbell, 2007; Francisco, 2010; Schlöpfer & Hanley, 2003). To investigate this relationship in the case of preferences for new OA regulations in Warsaw, we estimated a separate MXL model in which means of the distributions of parameters are interacted with socio-demographic variables. This allows us to observe correlations between respondents' characteristics and their preferences for specific attributes of the new policy. The results are presented in Table 2.

First, we note that the model with socio-demographic interactions has a better fit than our baseline model (Table 1), however, this comes at a cost of many additional parameters that need to be estimated. As a result, the fit measures that take the number of parameters into account (AIC, BIC) indicate that the baseline model is preferred. In addition, the estimates of means are now more difficult to interpret, as they need to be evaluated jointly with all the

interactions. Nonetheless, the model presented in Table 2 serves a different purpose – it allows an additional insight into potential socio-demographic drivers of preferences.

The significance and sign of the interaction coefficients indicate whether these socio-demographic variables are correlated with respondents' preferences for specific attributes. We find that respondents who are older are less favorable towards new regulations that limit on-building ads. This result is consistent with Szoegé et al. (2005), where sensitivity to this type of landscape pollution decreased with the age of the respondent. On the other hand, respondents with medium (rather than primary) education are more positive towards limiting on-building ads, and additionally even more in favor of introducing the new program, as indicated by significant and negative coefficient for the alternative specific constant associated with the status quo alternative. Interestingly, higher education does not result in even stronger effects in preferences – the only significant effect is observed for somewhat stronger preferences for complete banning of free-standing ads. For comparison, Szoegé et al. (2005) and Groothuis et al. (2007) found that education has a small but positive impact on WTP for billboard removal, while Francisco's (2010) results for education were not significant but suggest that an awareness of the importance of urban aesthetics does not require a higher education.

Respondents' gender did not seem to be linked to major differences in their preferences, with an exception of female respondents being less supportive for the total ban of on-building ads. Similar results were reported by Szoegé et al. (2005), we also found that males are not significantly different than females. Respondents whose households are larger were less negative towards the status quo, and less positive towards the total ban of on-building ads. At the same time those whose households have more children displayed the opposite correlations with their preferences.

Respondents with higher levels of household income were generally WTP more for limiting the free-standing OA, and WTP more for the total ban on on-building ads. This result is in concordance with previous studies, where a higher income increased the WTP (Groothuis et al., 2007) and its size (Francisco, 2010). Another factor that turned out to be significant was the amount of time the respondent had been living in Warsaw. We found that it was significantly correlated with less positive preferences for on-building and free-standing ads. It is possible, that those who live in the city longer get used to OA and are less bothered by it.

We found that respondents who own their apartments, houses or live in social accommodation valued programs that limited on-building ads more, relative to those who rent. At the same time, those who own apartments were less negative towards the status quo. Finally, we observe that respondents who say that there are currently free-standing ads on their house

lots were less negative towards the status quo, valued high levels of free-standing OA limitations less, and were WTP for restricting on-building ads more. Conversely, those who say that there are billboards on their buildings were even less positive towards the status quo, more favorable towards limiting free-standing ads, and WTP less for total ban of on-building ads. Perhaps respondents who have ads on their property feel they profit from having them, therefore they have a lower WTP for the reduction of such forms of advertising.

To summarize, the results suggest that most respondents are willing to pay positive amounts of money for new regulations and limiting OA levels; the amount, however, depends on a number of the respondent's socio-demographic characteristics. Furthermore, the consistency of the results in terms of the respondents' declared preferences is in favor of the reliability of the results.

Table 2. The result of MXL model in WTP space with socio-demographic interactions, representing the estimated means and standard deviations of the distributions of respondents' WTP for the attributes of the new policy and its socio-demographic drivers [EUR / household / year]

	Mean (st. err.)	St. dev. (st. err.)	Age	Education - medium	Education - higher	Female	Househ old size	Househ old children	Househ old income	Years in Warsaw	Apartment - owned	Apartment - social	House - owned	Billboards on lot	Billboards on building
Status quo	-1.18***	1.71***	-0.03	-0.19***	-0.01	0.05	0.09***	-0.05**	-0.01	0.02	0.11***	-0.03	-0.01	0.12***	-0.09**
(alternative specific constant)	(0.07)	(0.08)	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.04)	(0.07)	(0.10)	(0.04)	(0.04)
Free-standing ads –	0.31***	0.78***	-0.03	0.01	0.05	0.04	-0.04	-0.03	0.05***	-0.03	0.06	0.02	0.19*	-0.09**	0.08**
small reduction (75%)	(0.07)	(0.07)	(0.02)	(0.05)	(0.05)	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)	(0.04)	(0.08)	(0.11)	(0.04)	(0.04)
Free-standing ads –	0.53***	1.12***	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	0.07***	-0.06***	0.03	-0.09	0.06	-0.06	0.06
medium reduction (50%)	(0.07)	(0.08)	(0.02)	(0.05)	(0.05)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.07)	(0.10)	(0.04)	(0.04)
Free-standing ads –	0.78***	1.49***	0.01	-0.05	-0.03	-0.05*	-0.01	-0.03	0.10***	-0.07***	0.02	-0.14**	0.09	-0.11**	0.14***
large reduction (25%)	(0.07)	(0.08)	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.07)	(0.09)	(0.04)	(0.03)
Free-standing ads –	0.54***	1.63***	0.01	0.01	0.10**	-0.06*	0.01	0.01	0.13***	-0.04	0.08*	-0.11	0.17*	-0.18***	0.17***
total ban (0%)	(0.08)	(0.08)	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.04)	(0.08)	(0.09)	(0.05)	(0.03)
On-building ads –	0.58***	0.94***	-0.02	0.03	0.01	0.00	0.00	0.02	-0.03*	-0.04*	0.09***	0.17**	0.03	0.18***	-0.04
small reduction (75%)	(0.06)	(0.05)	(0.02)	(0.05)	(0.05)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.07)	(0.07)	(0.04)	(0.03)
On-building ads –	1.06***	1.75***	-0.07***	0.12***	0.02	-0.05*	-0.04	0.01	-0.02	-0.01	0.12***	0.12**	0.23***	0.13***	-0.01
medium reduction (50%)	(0.07)	(0.08)	(0.02)	(0.04)	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.06)	(0.07)	(0.04)	(0.04)
On-building ads –	1.19***	2.04***	-0.06***	0.20***	0.07	-0.06*	-0.02	0.05*	0.03	-0.05**	0.03	-0.08	0.03	0.17***	-0.05
large reduction (25%)	(0.08)	(0.08)	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.04)	(0.08)	(0.07)	(0.04)	(0.04)
On-building ads –	1.43***	2.56***	-0.06**	0.13***	0.02	-0.11***	-0.07**	0.06**	0.04**	-0.11***	0.10**	0.15**	0.21**	0.12***	-0.13***
total ban (0%)	(0.07)	(0.09)	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.05)	(0.07)	(0.08)	(0.04)	(0.04)
Model diagnostics															
LL at convergence	-9,982.49														
LL at constant(s) only	-15,932.04														
McFadden's pseudo-R ²	0.3734														
Ben-Akiva-Lerman's pseudo-R ²	0.5568														
AIC/ <i>n</i>	1.3553														
BIC/ <i>n</i>	1.4477														
<i>n</i> (observations)	15,000														
<i>r</i> (respondents)	1,250														
<i>k</i> (parameters)	182														

Notes: as per Table 1.

5. Discussion and conclusions

OA with billboards, signboards and city-lights are an integral part of the cityscape. It provides useful information but influences scenic amenities and may produce externalities like visual pollution that have to be considered in landscape planning. We present one of the very first studies that have tried to estimate the value that people attach to the landscape damage caused by advertising signs. With the use of stated preference methods, the WTP of the citizens of Warsaw to reduce OA in Warsaw has been estimated. We considered two types of OA mediums: free-standing ads and on-building ads and five levels of advertising reduction.

The results suggest that people are aware of the benefits of OA, however, they desire some regulation of the advertising market. Most individuals admit that some advertising is needed; nonetheless, they are willing to pay a considerable amount of 20 to 30 EUR per year for the new program of limiting OA in Warsaw, depending on its scope. The majority are in favor of zoning – different regulations with respect to different parts of the city and along main roads.

Our results demonstrate broad support for the regulation of OA and that most citizens support a strong reduction in OA and are willing to pay for the total ban or strong reduction of on-building ads, and less so, albeit still a significant amount, for a reduction in free-standing ads in Warsaw. In total, the people of Warsaw were willing to pay from 3 to 5.6 million EUR per year for limiting the number of free-standing ads and 5.6 – 11.3 million EUR per year for limiting of advertising on buildings. The most preferred combination was a 75% reduction of free-standing ads and a total ban of on-building ads. At the same time, we estimated a constant component of respondents' WTP associated with the introducing the program irrespective of the OA reductions it incorporates at 8.2 million EUR per year. We observed considerable heterogeneity of respondents' preferences/WTP, part which could be associated with their socio-demographic characteristics.

Comparing the benefits of a new regulation of OE with its costs is not an easy task. Considering that there are about 21.5 thousand legal free-standing ads in Warsaw (IGRZ 2013), the aggregated WTP of the residents of Warsaw¹⁵ corresponds to 1,100 EUR – 3,100 EUR per ad per year, depending on the scope of the reduction. This is well in the range of the average price charged by the OA companies in Warsaw, with the average price for a 12 m² free-

¹⁵ In 2018 there were 774,611 households in Warsaw, according to the statistical office (<https://warszawa.stat.gov.pl>).

standing billboard at 130 EUR per month, or 1,500 EUR per year.¹⁶ Another way to look at the scale of the benefits and costs of a new regulation is to compare the aggregated 17-24 million EUR of annual WTP for limiting the amount of OA in Warsaw with the revenues of the OA market in Warsaw, estimated at approximately 50 million EUR (IGRZ, 2017).

While the valuation of visual intrusion caused by OA may not be enough to fully compensate the forgone revenues of advertising companies, it is likely to compensate for their profits. Bear in mind that each free-standing or on-building ad is associated with private costs, arising from the capital cost of installing the infrastructure for displaying the media, and labor cost of posting new ads. Since the posted prices of billboards and the revenues of the advertising companies in Warsaw need to cover these private costs, taking the external costs associated with visual pollution into account is likely to tip the balance and make considerable number of outdoor ads in Warsaw unprofitable.

In other words, the estimated WTP should be considered a measure of external cost caused by OA. These externalities are currently not internalized, and since the advertising companies do not take these costs into account, there are too many ads in public places relative to the social optimum. The new Landscape Bill makes it possible to correct this situation by using command-and-control measures or using market-based solutions – such as introducing a tax on OA. If such a tax was introduced at the level of external cost (Pigouvian tax) it would allow the market to reach a new equilibrium, with a lower socially optimal level of OA. Our study is the first to offer insights with respect to the rate of such a tax for different advertising media.

There are several limitations of our study that need to be acknowledged. First, we note that our study only focused on legal free-standing and on-building ads. This means that we did not take advertising on and inside public transport, LCD screens, leaflets and other means of advertising into account. Perhaps even more importantly, our study did not consider illegal advertisements. According to the Warsaw public roads administration, about 15% of the 8476 OA in public spaces (not including those on private plots) controlled in 2017 were illegal, and thus removed (28% of 5221 in 2016; Zarząd Dróg Miejskich 2016, 2017). While some regulations are already in place, in practice they are sometimes disobeyed. The procedure to remove illegally placed OA is complex and time-consuming. The penalties for illegal advertising are not clear and require a long penalty procedure, including cases in court. It may last more than a year (much longer than most marketing campaigns) and end up with remission

¹⁶ Based on the price list of AMS – the largest OA company in Warsaw (<http://ams.com.pl/oferta/cennik>)

or a fine that is not equal to the gains from the campaign (Springer, 2013). Strong institutions and the strict execution of regulations are necessary in order to effectively manage the ads. The new regulations and competences introduced by the Landscape Bill offer an improvement in this respect. It may be one of the reasons why we observe a large WTP for introducing the program itself (negative coefficient associated with the alternative specific constant for the status quo), irrespective of its specific attribute levels (Czajkowski and Hanley, 2009).

An important issue not covered by this paper is the content of advertising and the way it is presented. Similarly, there is an issue with administrative negligence when local public administration has little to no control over what is placed in public space or has a problem with executing such regulations. This relies on the institutional strength of the regulating authority and is beyond the scope of this paper. It is likely that the external cost of OA can be minimized by following good practices on the quality and placement of ads in public spaces. The goal of spatial planning should be to create a good framework for proper investments in the specified area, aligned with a long-term strategy of development and the needs of the local communities. Making decisions in this area requires some trade-offs between the interests of different groups. Nonetheless, the consensus between city government, advertising companies and citizens is that OA requires some regulation and limitations. Our study provides inputs for designing these new regulations.

Overall, our study demonstrates how the economic value of the visual impact of OA on the urban environment can be estimated using stated preference methods, using the case of Warsaw, the capital of Poland as a case study. Our results feed directly into the policy problem faced by the local government, which is currently designing new regulations. In particular, we argue that the estimated WTP can be used as measures of external costs generated by OA and should be used for designing market-based instruments (e.g., Pigouvian tax) to adjust the amount of advertising to socially optimal level. Our results do not necessarily mean that people are against any advertising; they are, however, an important indicator that OA in urban settings should be limited. Finally, the results suggest that the citizens of Warsaw consider advertising in public spaces to be an issue and value it so highly that it should certainly not be overlooked by local planners and governments.

References

- Ambrey, C. L., & Fleming, C. M. (2011). Valuing scenic amenity using life satisfaction data. *Ecological Economics*, 72, 106–115. <https://doi.org/10.1016/j.ecolecon.2011.09.011>
- Arnberger, A., Ebenberger, M., Eder, R., Alex, B., Husslein, M., & Preisel, H. (2018). Trade-offs between wind energy, recreational, and bark-beetle impacts on visual preferences of national park visitors. *Land Use Policy*, 76(May), 166–177. <https://doi.org/10.1016/j.landusepol.2018.05.007>
- Barbier, E. B., Czajkowski, M., and Hanley, N., 2017. Is the income elasticity of the willingness to pay for pollution control constant? *Environmental and Resource Economics*, 68(3):663–682.
- Benson, E., L. Hansen, J., Schwartz Jr, A., & Smersh, G. (1998). Pricing Residential Amenities: The Value of a View. *The Journal of Real Estate Finance and Economics*, 16, 55–73. <https://doi.org/10.1023/A:1007785315925>
- Boyle, K. J., 2017. Contingent Valuation in Practice. In: *A Primer on Nonmarket Valuation*, P. A. Champ, K. J. Boyle, and T. C. Brown, eds., Springer, Amsterdam.
- Bullmore, J. (2016). What is advertising? Retrieved from <http://www.adassoc.org.uk/publications/what-is-advertising/>
- Bullmore, J., & Waterson, M. J. (1983). *The Advertising Association Handbook*. (Advertising Association, Ed.). Holt, Rinehart & Winston with the Advertising Association. Retrieved from https://books.google.pl/books?id=Tp_IJQAACAAJ
- Campbell, D. (2007). Willingness to pay for rural landscape improvements: Combining mixed logit and random-effects model. *Journal of Agricultural Economics*, 58(3), 467–483. <https://doi.org/10.1111/j.1477-9552.2007.00117.x>
- Carson, R. T. (2012). Contingent Valuation: A Practical Alternative when Prices Aren't Available. *Journal of Economic Perspectives*, 26(4), 27–42. <https://doi.org/10.1257/jep.26.4.27>
- Carson, R. T., & Czajkowski, M. (2014). The discrete choice experiment approach to environmental contingent valuation. In S. Hess & A. Daly (Eds.), *Handbook of Choice Modelling* (pp. 202–235). Northampton, MA: Edward Elgar. <https://doi.org/10.4337/9781781003152.00015>
- Carson, R., and Czajkowski, M., 2014. *The discrete choice experiment approach to environmental contingent valuation*. Edward Elgar Publishing.

- Champ, P. A., Boyle, K. J., and Brown, T. C., 2017. A Primer on Nonmarket Valuation. Springer, Amsterdam.
- Chmielewski, S., Lee, D. J., Tompalski, P., Chmielewski, T. J., & Wężyk, P. (2016). Measuring visual pollution by outdoor advertisements in an urban street using intervisibility analysis and public surveys. *International Journal of Geographical Information Science*, 30(4), 801–818. <https://doi.org/10.1080/13658816.2015.1104316>
- Chmielewski, S., Samulowska, M., Lupa, M., Lee, D., & Zagajewski, B. (2018). Citizen science and WebGIS for outdoor advertisement visual pollution assessment. *Computers, Environment and Urban Systems*, 67, 97–109. <https://doi.org/10.1016/j.compenvurbsys.2017.09.001>
- Committee Planning and Growth Management. (2017). Status Update : Third Party Sign Tax, 1–8.
- Czajkowski, M., and Budziński, W., 2019. Simulation error in maximum likelihood estimation of discrete choice models. *Journal of Choice Modelling*, 31:73-85.
- Czajkowski, M., and Hanley, N., 2009. Using Labels to Investigate Scope Effects in Stated Preference Methods. *Environmental and Resource Economics*, 44(4):521–535.
- Elena, E., Cristian, M., & Suzana, P. (2011). Visual Pollution: A New Axiological Dimension Of Marketing? *European Integration-New Challenges*, 1836.
- Farihah, N. (2014). Issue of Rise of Illegal Billboards : Case Study of Petaling Jaya, (December).
- Fogel, A. (2017). Uchwała reklamowa, przewodnik dla gmin. Warszawa. Retrieved from http://krajobrazmojegomiasta.pl/download/content/page_modules/51/29/a-fogel-uchwala-reklamowa-przewodnik-dla-gmin.pdf
- Francisco, J. P. S. . (2010). Are the Rich Willing to Pay for Beautiful Cities?: Income Effects on the Willingness to Pay for Aesthetic Improvements. *Australasian Journal of Regional Studies*, The, 16(2), 233–252.
- Freeman, A. M., Herriges, J. A., and Kling, C. L., 2014. The measurement of environmental and resource values: theory and methods. Routledge.
- Frey, B. S., Luechinger, S., & Stutzer, A. (2010). The Life Satisfaction Approach to Environmental Valuation. SSRN. <https://doi.org/10.1146/annurev.resource.012809.103926>
- Gillard, Q. (1981). The effect of environmental amenities on house values: The example of a view lot. *Professional Geographer*, 33(2), 216–220. <https://doi.org/10.1111/j.0033-0124.1981.00216.x>

- Gomez, J. E. A. (2013). The Billboardization of Metro Manila. *International Journal of Urban and Regional Research*, 37(1), 186–214. <https://doi.org/10.1111/j.1468-2427.2011.01098.x>
- Groothuis, P. A., Groothuis, J. D., & Whitehead, J. C. (2007). The willingness to pay to remove billboards and improve scenic amenities. *Journal of Environmental Management*, 85, 1094–1100. <https://doi.org/10.1016/j.jenvman.2006.11.007>
- Hanley, N., and Czajkowski, M., 2019. The Role of Stated Preference Valuation Methods in Understanding Choices and Informing Policy. *Review of Environmental Economics and Policy*, 13(2):248-266.
- Hensher, D. A. (2014). Attribute processing as a behavioural strategy in choice making. *Handbook of Choice Modelling*, (November), 268–289. <https://doi.org/10.4337/9781781003152.00019>
- Hudák, M., & Madleňák, R. (2017). The Research of Driver Distraction by Visual Smog on Selected Road Stretch in Slovakia. *Procedia Engineering*, 178(June), 472–479. <https://doi.org/10.1016/j.proeng.2017.01.090>
- IGRZ. (2016). OOH Advertising in Poland, report 2016. Retrieved from [http://igrz.home.pl/RAPORT IGRZ OOH 2016.pdf](http://igrz.home.pl/RAPORT%20IGRZ%20OOH%202016.pdf)
- IGRZ. (2017). OOH Advertising in Poland, report 2017. Retrieved from <http://www.igrz.com.pl/raporty>
- Iman, A. H. M., & Tian, T. Y. (2013). How Does Environmental Amenity Influence Property Values? A Malaysian Case. *International Journal of Real Estate Studies*, 8(2), 1–15. Retrieved from <http://www.utm.my/intrest/files/2013/08/HOW-DOES-ENVIRONMENTAL-AMENITY-INFLUENCE-PROPERTY-VALUES-A-MALAYSIAN-CASE.pdf>
- Iveson, K. (2012). Branded cities: Outdoor advertising, urban governance, and the outdoor media landscape. *Antipode*, 44(1), 151–174. <https://doi.org/10.1111/j.1467-8330.2011.00849.x>
- Jana, M. K., & De, T. (2015). Visual Pollution Can Have a Deep Degrading Effect on Urban and Sub- Urban Community : a Study in Few Places of Bengal , India , With Special Reference To Unorganized Billboards. *European Scientific Journal*, 7881(June), 1–14.
- Jensen, C. U., Panduro, T. E., & Lundhede, T. H. (2015). The Vindication of Don Quixote: The Impact of Noise and Visual Pollution from Wind Turbines. *Land Economics*, 90(4), 668–682. <https://doi.org/10.3368/le.90.4.668>

- Jim, C. Y., & Chen, W. Y. (2009). Value of scenic views: Hedonic assessment of private housing in Hong Kong. *Landscape and Urban Planning*, 91(4), 226–234. <https://doi.org/10.1016/j.landurbplan.2009.01.009>
- Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., Hanemann, W. M., Hanley, N., Ryan, M., Scarpa, R., Tourangeau, R., and Vossler, C. A., 2017. Contemporary Guidance for Stated Preference Studies. *Journal of the Association of Environmental and Resource Economists*, 4(2):319-405.
- Kerebel, A., Gélinas, N., Déry, S., Voigt, B., & Munson, A. (2019). Landscape aesthetic modelling using Bayesian networks: Conceptual framework and participatory indicator weighting. *Landscape and Urban Planning*, 185(January), 258–271. <https://doi.org/10.1016/j.landurbplan.2019.02.001>
- Kim, D., & Jin, J. (2018). Does happiness data say urban parks are worth it? *Landscape and Urban Planning*, 178(May), 1–11. <https://doi.org/10.1016/j.landurbplan.2018.05.010>
- Mariel, P., and Meyerhoff, J., 2018. A More Flexible Model or Simply More Effort? On the Use of Correlated Random Parameters in Applied Choice Studies. *Ecological Economics*, 154:419-429.
- McDougall, A. (2002). Valuing the amenity impacts of outdoor advertising signs. *Australian Planner*, 39(4), 179–185. <https://doi.org/10.1080/07293682.2002.9982317>
- McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior. <https://doi.org/10.1080/07373937.2014.997882>
- McFadden, D., & Train, K. (2000). Mixed MNL models for discrete response. *Journal of Applied Econometrics*, 15(5), 447–470. [https://doi.org/10.1002/1099-1255\(200009/10\)15:5<447::AID-JAE570>3.3.CO;2-T](https://doi.org/10.1002/1099-1255(200009/10)15:5<447::AID-JAE570>3.3.CO;2-T)
- Mendelsohn, R., 2019. An Examination of Recent Revealed Preference Valuation Methods and Results. *Review of Environmental Economics and Policy*, 13(2):267-282.
- Mikosz, J. (2010). Formy reklamy zewnętrznej. *Kultura-Media-Teologia*, 3(3), 44–58. Retrieved from https://kmt.uksw.edu.pl/media/pdf/kmt3_mikosz.pdf
- Mulholland, R. (2014). Grenoble to replace street advertising with trees and “community spaces.” Retrieved from <https://www.telegraph.co.uk/news/worldnews/europe/france/11250670/Grenoble-to-replace-street-advertising-with-trees-and-community-spaces.html>
- Municipal government of Warsaw. (2018). Projekt uchwały krajobrazowej dla Warszawy przewodnik po projekcie. Warszawa. Retrieved from

- http://konsultacje.um.warszawa.pl/sites/konsultacje.um.warszawa.pl/files/zw_uk_broszura_internet.pdf
- Nagle, J. C. (2012). Cell Phone Towers as Visual Pollution. Symposium on the Environment Article, 23(2), 1–1. Retrieved from <http://scholarship.law.nd.edu/ndjlepp/vol23/iss2/7>
- NYC Global Partners. (2011). Best Practice: Clean City Act REPORT, (April 2011), 1–4. Retrieved from <http://www.construction21.org/espana/articles/es/como-realizar-una-auditoria-energetica-y-no-perderse.html>
- Portella, A. (2016). Visual Pollution: Advertising, Signage and Environmental Quality. Taylor & Francis. Retrieved from <https://books.google.pl/books?id=AweOCwAAQBAJ>
- Schläpfer, F., & Hanley, N. (2003). Do Local Landscape Patterns Affect the Demand for Landscape Amenities Protection? Journal of Agricultural Economics, 54(1), 21–34. <https://doi.org/10.1111/j.1477-9552.2003.tb00046.x>
- Springer, F. (2013). Wanna z kolumnada. Reportaże o polskiej przestrzeni, Wydawnictwo Czarne, Wołowiec. Wołowiec: Wydawnictwo Czarne.
- Szoege, H. M., Sobolewska, A., & Szoege, W. M. (2005). Valuing protection of the rural landscape in the public opinion. Retrieved from <http://www.ejpau.media.pl/volume8/issue2/art-19.html>
- Tempesta, T., Vecchiato, D., & Girardi, P. (2014). The landscape benefits of the burial of high voltage power lines: A study in rural areas of Italy. Landscape and Urban Planning, 126, 53–64. <https://doi.org/10.1016/j.landurbplan.2014.03.003>
- TNS Polska. (2013). Reklama w przestrzeni publicznej. Retrieved from www.tnsglobal.pl/207metrowraportu
- Train, K., & Weeks, M. (2005). DISCRETE CHOICE MODELS IN PREFERENCE SPACE AND WILLINGNESS-TO-PAY SPACE. In A. Alberini & R. Scarpa (Eds.), Applications of Simulation Methods in Environmental Resource Economics (pp. 1–17). Boston/Dordrecht/London: Kluwer Academic Publishers.
- Tsoutsos, T., Tsouchlaraki, A., Tsiropoulos, M., & Serpetsidakis, M. (2009). Visual impact evaluation of a wind park in a Greek island. Applied Energy, 86(4), 546–553. <https://doi.org/10.1016/j.apenergy.2008.08.013>
- Vlakveld, W., & Helman, S. (2018). The safety effects of (digital) roadside advertising : an overview of the literature CEDR Call 2016. Retrieved from <https://www.cedr-adverts.eu/storage/minisites/adverts-d1-2-executive-summary-final.pdf>

- Vossler, C. A., Doyon, M., and Rondeau, D., 2012. Truth in Consequentiality: Theory and Field Evidence on Discrete Choice Experiments. *American Economic Journal: Microeconomics*, 4(4):145-171.
- Wagtendonk, A. J., & Vermaat, J. E. (2014). Visual perception of cluttering in landscapes: Developing a low resolution GIS-evaluation method. *Landscape and Urban Planning*, 124, 85–92. <https://doi.org/10.1016/j.landurbplan.2014.01.006>
- Zarząd Dróg Miejskich. (2016). Raport roczny 2016. Retrieved from www.zdm.waw.pl
- Zarząd Dróg Miejskich. (2017). Raport roczny 2017. Retrieved from www.zdm.waw.pl



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