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Compensation due to land use restrictions: the case of limited use area in the vicinity of Polish airports

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Abstract

Research background: The economic benefits that arise with the development of airport infrastructure are accompanied by negative externalities. Legal, technical and institutional instruments are used to mitigate or limit these effects. It involves state intervention in the use of real estate located in the vicinity of the airport, and the cost of such an intervention. On the other hand, as a result of state interventions, real estate market mechanisms are distorted. The balance on the market, prices and as a result the number of transactions is changing.
Purpose of the article: The study evaluates adaptive efficiency, which is known as the ability of the real estate market system to adapt to the purpose of public intervention. The effectiveness of state intervention is measured as the difference between market transaction costs and costs after intervention. The former means the full coverage of all individual claims of property owners at market prices. However, after the intervention, these are costs of compensation and litigation

(judicial, expert opinions, provisions for payment of damages), as well as the risk of the airport's insolvency. The state intervention system is also assessed through the prism of the lack of a methodology for assessing damages and subjective claims of property owners. The article focuses on the effects of the negative impact of airport noise resulting in limitations to residential buildings' usability and depreciation of their market value. The study is based on the example of one regional airport.

Methods: The study evaluates the current compensation model related to the introduction of Limited Land Use Areas around airports in Poland, based on Poznan-Lawica airport case study. In the empirical part of the paper, we use regression analysis to examine the value of compensations for loss of property value ruled by courts, and duration analysis to explore court procedure duration time.

Findings & Value added: This research is one of the important basic research on socio-spatial connection near an airport in Poland. We argue that the current prac-tice related to compensation ruled by courts has substantial flaws (including the methodical error regarding the valuation of claims, where acoustic damage and value loss claims are treated as unrelated, thus both compensations are independently assessed). With the help of the Cox model, we demonstrate that the long distance from the airport and the location within the LUA increase the likelihood of court proceedings ending. The results are important due to the pending disputes and the costs threatening the functioning of airports in Poland.

Introduction

Nowadays, the conditions for the functioning and development of aviation are strongly influenced by the regulatory sphere, which results in various state interventions. One of the key areas of intervention is environmental issues, including the resolution of growing conflicts caused by externalities related to noise immission. For these purposes, various analyses and measurements are carried out in order to justify and shape interventions, assess their effects and measure the value of various types of damage. The publication deals with the key issue of intervention which shapes the ownership rights of residential properties in areas affected by the effects of noise immission from the airport. The consideration was narrowed down to resolving conflicts over negative noise externalities affecting residential houses, with the exception of the health effects on residents. The article focuses on the effects of the negative impact of airport noise, resulting in a reduction in the use and market value of residential buildings.

The globalization of the aviation industry results in the unification of technical and operational issues, also results in a kind of unification of noise immission in physical terms. However, at the social level, conflicts between the airport and the owners of residential properties in its vicinity are dealt with differently. Airports which are most often the focus of various real estate disputes are perceived from the perspective of public or quasi-public goods, which justifies various types of interventions in market relations (bilateral agreements) between the airport and homeowners in the

vicinity of airports. This has the effect of interfering in the operational conditions of the real estate market around airports and the introduction of tripartite agreements. The state becomes a third party to the transaction, which usually results in the limitation of the liability for damages of airports and shapes the ownership rights of real estate in this area.

At the theoretical and application level, not only the problems of damage valuation, but also the assessment of the effectiveness of the intervention tools used, becomes important. The publication deals with the impact assessment of a specific intervention to resolve the noise immission dispute through spatial planning tools of a local law nature. A restricted use area is introduced in the areas around the airport where noise standards are exceeded. Intervention leads to a change in the position of the parties to the conflict. Depending on how a dispute is resolved, the level of transaction costs changes, which affects the operational conditions of a market that adapts and balances itself after the impact of new factors triggered by intervention. This not only causes methodological problems with the objective measurement of damage, but also makes it difficult to assess the effectiveness of intervention, which should be measured by the reduction in social costs. The research problem is considered at the junction of issues of market adaptation efficiency, principles of damage estimation and methodology of social costs valuation in a situation when market conditions are adjusted as a result of factors caused by intervention. The effectiveness of an intervention is measured as the difference between the transaction costs before and after the intervention.

The results of research on one regional airport in Poland were presented. The study used unique original source data describing the structure of claims for compensation and actual transaction costs, as well as original results of our own research on the residential real estate market in the areas affected by noise from the airport under study. The research problems addressed are common in Poland and the research results indicate that they occur at the five largest national airports. The choice of a specific airport for the study was dictated by the large scale of the systemic error in intervention. It concerns the overcompensation of damages due to partial double-compensation of damages (more widely: Habdas & Konowalczuk, 2018, pp. 12–13). The first double-compensation was often awarded for improvement of acoustics) and then for the loss of property value which was also caused by acoustic damage.

Literature review

While addressing the issues of real estate market functioning in the context of changes in balance due to intervention, the methodological perspective of institutional economics was adopted in the publication, as markets should be seen as a (mixed) group of different institutions (North, 1990). As a consequence, an attempt to assess a specific effect on the market under institutional conditions requires the identification and interpretation of the appropriate institutional mix that shapes the real estate market. It is also important to distinguish between formal and informal institutional constraints (North, 1990, pp. 46–53). Assuming such an approach to the real estate market, it is justified to go beyond the limitations of the neoclassical demand and supply model. This is because it is of little use for analyses and assessments carried out in the study of complex and discrete aspects of changes and imperfections in the functioning of the market, mainly due to excessive simplification of reality (Agboola, 2015, pp. 413–414.). This applies to the measurement of both the effects of allocation and assessment of operating results, as we are dealing with functioning in conditions of lack or low information efficiency (Herath & Maier, 2015), which also applies to the single-family house market (Case & Shiller, 1989, pp. 135–136). This is due both to the physical characteristics of real estate, the type of operational activities carried out on them and the various effects of legal interventions. (Keogh & D'Arcy, 1999, pp. 2402–2405). Using the institutional approach, we should also share the criticism of D.C. North as to the "static" allocation efficiency according to V. Pareto, and this opens up the area of research on adaptive efficiency (De Soto, 2010, p. 35). From the dynamic point of view, we can distinguish between adaptive efficiency and innovative efficiency. Adaptive efficiency is then understood as the ability to gradually adapt to the environmental factors and as the ability to identify the essence of emerging problems and their proper solution (Acocella, 2002, p. 117). The criticism of the dynamic approach to efficiency concerns the lack of consideration in the assumptions of the key element concerning the nature and factors determining the initiation and course of the entrepreneurial process (Kirzner, 2010, p. 214 et seq.).

Research on efficiency, including adaptive efficiency, has a methodological aspect related to the possibility of conducting deliberations at the level of supporting creativity and the ability to adapt both to individuals and societies (North, 1990, p. 45). In order to organize these two methodological perspectives, the Posner's approach can be divided into normative and positive assessments. This makes it possible to distinguish two subjectively different, but methodically related, areas of analysis which may con-

cern: (1) the regulated phenomenon (e.g. changes in the functioning of the real estate market as regards the level and factors shaping market prices and intervention costs), (2) the regulatory behavior, e.g. the legal system shaping ownership rights and the principle of liability for damages (Posner, 2014, p. 285 et seq.). Contemporarily, the efficiency rationale of intervention, which is based on Coase's theory, is predominant (Coase, 2013). Its key methodological element is social and transaction costs and their comparison (Coase, 1960). These methodological solutions are criticized mainly because of the difficulty of their objectified measurement and the lack of interpersonal comparability of social costs with market transaction costs (Rothbard, 2009, pp. 137–138). At the same time, it is important that research requires prior analysis in which the nature and effects of the intervention are determined taking into account its legal specificity and only then can correct comparisons be made. It is also required to make additional assumptions and to establish the criteria and method of comparing the alternative cost (market or social mechanism) and to establish which is higher (Buchanan, 1969, p. 14 et seq.).

The research is conducted on a social and/or individual level and the analyses concern various types of goods affected by aviation. Depending on the adopted criteria, noise may be the most important or least important factor (Wolf *et al*., 2012, pp. 104–105). However, even if the cost of noise is considered less important than, for example, the cost of engine emissions (Mahashabde *et al*., 2011), there remains an argument of widespread and direct perceptibility of noise immissions.

Noise can be quite easily standardized in research (as a physical factor) and its immissions, in ceteris paribus terms, always lower the market prices of real estate, which are also standardized. This makes it possible to carry out comparative studies on a national and international scale, even in the case of legal systems which, in fact, shape the ownership rights and liability for damages of airports in a completely different way (Habdas & Konowalczuk, 2019). The literature points to numerous theoretical and empirical studies on the impact of airport and road noise on the value of real estate, including residential properties, meta-analyses of these studies have also been carried out, and various methods of valuation of non-market and environmental goods are well classified and described (Batóg *et al*., 2018). Indeed, due to the differences in legal systems, comparative studies on aviation damage for all aspects of immissions are limited (Wolf *et al.*, 2012, p. 105 et seq.), even for European airports (Lu & Morrell, 2006). In research conducted on the real estate market, the problem which remains is the methodological approach to the price, which can be treated descriptive-

ly as a studied economic parameter or can only be used to measure the value of real estate as a normative category (Sayce *et al.*, 2006, p. 10 and seq.).

The ways of resolving conflicts over capital protection for homeowners vary from country to country. This also applies to countries with similar economic systems (see: Batóg *et al.*, 2019, p. 22; Habdas & Konowalczuk, 2019). These differences are not eliminated by a uniform theoretical concept of compensation based on an effective theory of transaction costs. In the national literature the results of research on prices on the market of apartments and single-family houses are presented (Bień, 2011; Hermann & Kosmowski, 2007; Krajewska & Szopińska, 2014; Batóg *et al*., 2019; Trojanek & Huderek-Glapska, 2017), and only one of them additionally deals with the topic of calculating social costs of intervention (Trojanek & Huderek-Glapska, 2018, pp. 103–114). These studies relate to the overall impact of noise on the value of real estate and in this context social cost calculations according to market data are presented. They cannot, therefore, be equated with the actual social costs of this intervention, since no studies have been carried out taking into account the actual state of the claims, their structure and the actual social costs that occurred in resolving the dispute. In this respect, the research presented in this article uses market data on the actual costs of disputes.

Research methodology

Empirical data

The empirical objectives in the paper are twofold: (1) to investigate the value of compensation for loss of value due to the introduction of Limited Land Use Area; (2) to explore the duration of legal procedure.

The research is based on a sample of claims related to the introduction of Limited Land Use Area around Poznan-Ławica airport. Poznan-Ławica airport is located in the city of Poznan, in a densely populated and heavily urbanised area, approximately 7 km from the city center. The Limited Land Use Area around Poznan-Lawica airport was set up on 28 February 2012, and consist of two zones:

- the inner zone was created based on the noise level equal to LAeqD=60 and LAeqN=50dB;
- the outer zone was based on the LAeqD=55 and LAeqN=45dB noise levels.

The choice of the study area is not random. Firstly, due to its location there are significant social and economic conflict around externalities gen-

erated by the airport operation. The latter resulted in a relatively large number of claims for the loss of property value and acoustic improvements, and as a consequence a substantial financial burden for the airport due to compensation costs.

The dataset consists of 709 claims of residential property owners (buy out, loss of value, acoustic improvements or lost profit) that were brought to court, and resulted in court ruling the value of compensation. The individual cases were described by several variables: Total value of claim in PLN (X1), Loss of value claim in PLN (X2), Acoustic improvements claim in PLN (X3), Property value (X4), Loss of value ruled by court in PLN (X5), Loss of value ruled by court relative to property value (X6), Acoustic improvements ruled by court in PLN (X7), Compensation value (partial) in PLN (X8), Compensation value (final) in PLN (X9), End of court proceedings date (X10), Introduction of LUA date (X11), Proceedings duration X12), Number of house sales within 1km from subject residential property since the introduction of LUA (X13), Mean sales price in PLN (X14), Distance from the airport in km (X15), Location within LUA (0 if located in the inner zone, 1 if located in the outer zone) (X16).

Econometric methods

To estimate the impact of selected variables on the value of compensation ruled by court a stepwise multiple linear regression model was used (Mayers, 1990). Additionally, we explore the expected duration of court proceedings (*duration analysis*) and investigate the effect of several salient variables on survival time (survival analysis). Methodology stems from the work of Cox and Oakes (1984).

The subject of this study is the period of time between the start of the observation and the event which ends the observation but ,first of all, its likelihood in subsequent units of time. If the event does not happen by the end of the observation, the observation is terminated (a censored observation). Most commonly, it is right censoring because of the time of termination (Blossfeld e*t.al.*, 1989).

The time of an event incidence t is a random variable of non-negative values which can be described by means of a distribuant $F(t)$, a density function $f(t)$, a survival function $S(t)$, a hazard function $h(t)$ of randomly chosen non-negative values and a cumulative hazard function o $H(t)$ as well as a plausibility function (L). The measure of probability that in time $\langle 0; t\rangle$ the compensation will payment is a distribuant of a random variable t (continuous and non-negative) defined by the following formula:

$$F(t) = P(T \leq t) = \int_0^t f(z)dz, \tag{1}$$

where $F(t) \in \langle 0; 1 \rangle$. A probability density function:

$$f(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T < t + \Delta t)}{\Delta t}, \Delta t > 0 \tag{2}$$

allows to estimate the empirical distribution of events in the assumed duration intervals. The function of probability that by the time *t* the episode ending event has not happened and the process is being continued is described as the following survival function:

$$S(t) = P(T > t) = exp\left(-\int_0^t h(z)dz\right) \tag{3}$$

The transition intensity rate is a hazard function described as:

$$h(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T < t + \Delta t | T \geq t)}{\Delta t}, \Delta t > 0 \tag{4}$$

that provides information about failure levels. The cumulative hazard function is described by the following formula:

$$H(t) = \int_0^t h(z)dz \tag{5}$$

while the plausibility function used for single episodes is described by:

$$L = \prod_k h(t_k)^{\delta_k} \cdot S(t_{k)} \tag{6}$$

where δ_k – a censoring indicator is of value 1 if the event occurred in the time *t* or of value *0* when information has been censored.

Popular procedures of estimating theoretical survival function are grounded on the method of least squares and on the weighted least squares method. They are also based on fitting one of typical distributions of the exponential survival, hazard, Weibull or Gompertz functions to the empirical distribution (Bowers *et. al.*, 1986). One of the commonly used methods of estimating the survival (duration) function that do not require arbitrarily defined time variable intervals is the Kaplan-Meier method (Hosmer & Lemeshow, 1999, pp. 28–31).

Duration can be analyzed with many additional factors in view and by means of non-parametric regression. In the model for every group distinguished due to its feature that is independent of duration the survival function is estimated and pairs of the obtained functions are compared by means of non-parametric tests (survival times do not have normal distribution).

The impact of many features on the expected duration of an unknown survival function can be measured by means of semi parametric models, including the Cox proportional hazards model:

$$h\left(t: x_{1,} x_2 \ldots, x_n\right) = h_0(t) \cdot e^{\sum_{i=1}^{n} a_i x_i} \tag{7}$$

where $h\left(t: x_{1,} x_2 \ldots, x_n\right)$ the first element of the model, parametrically non-specified time function *t*, resultative hazard of given *n* – concomitant variables $x_{1,} x_2 \ldots, x_n$ and an adequate survival time and $h_0(t)$ the hazard function for which all the variables equal zero (base hazard). The second element of the model $e^{\sum_{i=1}^{n} a_i x_i}$ – a specified exponential function and a_i – model coefficients, *t* – observation time. The elementary method of estimating the model coefficients is the partial likelihood method, while in a popular Statistica software the Cox model coefficients are estimated by means of the maximum likelihood method.

Results

Compensation value analysis

In the paper, we investigated the values of compensation to the individual residential property owners related to the introduction of LUA around Poznan-Lawica airport ruled by courts. In this paper, we focused primarily on the compensations for loss of property value caused by the introduction of LUA and related nuisances. Mean value of compensation due to loss of property value ruled by courts was 53305 PLN (on average 8.8% of property value). Based on our sample, we conclude that compensations were higher in the case of inner LUA (more affected by airport operation) than outer LUA. The loss of property value ruled by court relative to property value was 10.7% in the former and 5.1% in the latter group. The distribution of the relative values of compensations for loss of value due to introduction of Poznan-Lawica LUA is presented in Figure 1.

Aside from location within different LUA, there are other factors that could affect the value of compensation ruled by courts. Among plausible

factors that could have an impact on the court procedure outcome is property value. One could argue that the relative impact (thus compensation) is higher for more expensive residential properties. The basic exploratory analysis does not provide strong empirical evidence supporting this particular hypothesis (see Figure 2).

To explore the impact of potential factors on the compensation for loss of property value due to LUA we used multiple regression analysis. We regressed the relative value of compensation for loss of value ruled by court (value of compensation divided by property value) on several independent variables using stepwise procedure. The estimation results are presented in the table (Table 1).

The model estimated on a subsample of 617 cases (initial sample was 709 observation, but some cases were removed due to missing information on key variables) has moderate fit to the empirical data (R^2 is 0.459, and adjusted R^2 is 0.456).

We have found three variables that significantly affect the relative value of compensations ruled by courts in case of Poznan-Ławica LUA. As noted before, the values of compensations were significantly lower for properties located inside outer LUA than those within inner LUA (X16) — by 5.5 percentage points, other stayed equal. Additionally, we have observed that the relative value of compensation decreased with the distance from the airport (by 0.2 percentage points controlling for other factors in the model). Last but not least, the relative value of compensation tended to decrease with the number of house sales recorded in the neighborhood (1 km distance band). The latter could suggest that the market information coming from property sales provided some anchor to loss of value claims, and potentially limit the compensation ruled by courts. This particular result, and related efficient market hypothesis, require further investigation, which is beyond the scope of this paper. We have not found the evidence that acoustic damages compensation has significant impact on compensation for loss of value. This may suggest that courts treat these two types of claims separately.

In the next section, we will investigate the duration of court procedure.

Court procedure duration analysis

In the case of court proceedings analyzed within this paper the duration analysis involves estimation of survival function, density function, and hazard function. Duration time is a period between the date of the introduction of LUA, triggering all related claims to be officially notified (initial date) and official date of court ruling the compensation (end date). The

cases not being finalized in court by 30 April 2018 have been censored (right hand). We can reasonably argue that these cases have also been resolved, but after the study period, thus their respective duration times could not be directly observed.

Estimation was based on four different distributions: exponential, Weibull, linear and Gompertz with different weights and maximum likelihood test (significant chi2) they do not allow to conclude that the adjusted distribution is not significantly different from the empirical distribution. Estimators from the life tables depend on the selection of the number and width of life time intervals. Estimators independent of data grouping are obtained using (continuous survival times) Kaplan–Meier method (Figure. 3).

Survival functions indicates the probability that a court procedure will last longer than a given time t. From Figure 3 we can deduct that with probability equal to 75% court proceedings will last longer than 4.4 years, additionally with probability equal to 25% the duration time will be longer than 5,6 years. Contrary, hazard function gives the probability of court procedure ending within given time t.

Additionally, we grouped all resolved cases based on the location of residential properties the claims were related to (based on X16 variable). First group consisted of properties located inside the inner LUA, and the second group consisted of properties located inside the outer LUA. For each group, we estimated two separate survival functions, and compared court procedure duration times. The null hypothesis H_0 is: $S_1(t)=S_2(t)$ for all *t*, that is no difference between two survival functions. In case of censored observations nonparametric test can be used — for example Wilcoxon test. In our case, where several observations were dropped (censored) generalization suggested Peto and Peto of Wilcoxon test was applied. Based upon test results (WW=-22.77, Sum=189.0, War=41.696, WP=-3.52687, p=0.00042) and p=0,01488 taken from normal distribution table (two-sided test) we reject null hypothesis that of no differences between survival functions (Figure 4).

Initially, the probability of staying in court was higher for procedures involving properties located inside the outer LUA. After 4.4 years the probability of case being unresolved was higher for all claims related to residential properties inside inner LUA.

To explore the procedure duration time in more detail, non-parametric methods like Cox proportional hazard models, can be applied. The method can be used to measure the impact of several variables (measured on different scales) on duration time. Cox proportional hazard model allows us to examine the risk that particular outcome (court proceedings end in our

case) occurs in time *t* for given set of predictors. We used several plausible factors that could potentially affect the duration of court procedure: *X6, X13, X15, X16.* We estimated two models, with or without grouping variable. The results are presented in the table (Table 2).

In both models, the court procedure duration time depended upon the distance of given property from the airport (*X15*). The distance from the airport may be treated (by all parties involved) as a rough measure of externalities generated by the airport (most importantly aircraft noise nuisance). Further distance from the airport increased the risk of ending of court procedure (to put it differently, the further the property was located from the airport the more likely was the procedure to end). In the second model, the risk of ending the court procedure is associated with the location within LUA (X16). Other independent variables (X6, X13) were not statistically significant, thus had limited explanatory value.

Estimation results must be treated with caution. Low model fit may suggest that multivariate survival analysis using Cox proportional-hazard model has limited value in explaining the effect of several factors upon the time of court procedure, especially in the case of currently available independent variables.

Discussion

The validity of the results obtained within the study reflects the quality of data available, especially regarding the limited information on characteristics of the real estate being the subject of the dispute and the preferences of property owners reporting damages. The prolonged duration of disputes is influenced by both the low information efficiency of the real estate market (uncertainty regarding transaction prices and asymmetric information), the fact of not incurring expenditure on acoustic revitalization (the subject of the dispute is the hypothetical value of outlays) as well as defects in the procedure and dispute resolution system (e.g. court proceedings). However, the results obtained are unique, as there are no prior studies directly investigating the compensations to the residential property owners related to the externalities generated by the airports.

The paper examines the current compensation model used to mitigate the conflicts arising from the operation of the airports in Poland, that involves the introduction of Limited Land Use Area. We argue that the current practice related to compensation ruled by courts has substantial flaws (including the methodical error regarding the valuation of claims, where acoustic damage and value loss claims are treated as unrelated, thus both

compensations are independently assessed). The interesting extension of the study would be to evaluate possible alternative compensation models: (i) compensation model without public intervention; (ii) compensation model with effective public intervention, where acoustic damages claim and value loss claim are related (and acoustic damages compensation is based on real acoustic revitalization costs incurred). The results could be compared with the current ineffective compensation model.

Low information efficiency of the real estate market (few transactions, under information of market participants, discrepancies in the expectations of property owners and market value) affect the length of compensation processes and the low level of out-of-court settlements.

The hitherto practice of settling the majority of disputes at the level of courts results in the extension of the compensation procedure over time, which in effect means losses on each side of the dispute. The owner of the property does not have the resources that he could spend on acoustic revitalization, and as a result, maintains the state of health exposure. The airport maintains a financial reserve for future payments, and at the same time, the prolonged litigation increases the value of compensation paid. In addition, frozen funds cannot be invested in the development of the enterprise, and the scale of claims often results in the risk of losing liquidity. This, in turn, contributes to social losses both on the local and community level. Airports are state-owned enterprises that meet the transport needs of the general public, and the inhibition of their development adversely affects local infrastructure and economic development.

Both literature studies and foreign experience point to socially justifiable compensation for acoustic damage, but closely correlated with the scope of real revitalization work. In other cases, the payment due to the State intervention objective is not socially justified.

Conclusions

In the article, we point to the negative impact of noise and the adverse effect of state intervention. We argue that the current practice regarding damages awarded by courts has significant flaws. We have shown that the distance from an airport can be considered by all parties involved as a rough measure of externalities generated by the airport (primarily the aircraft noise nuisance). With the help of the Cox model, we demonstrate that both the long distance from the airport and the location in the LUA increase the risk of court proceedings coming to an end. This is all the more disconcerting because the intention of the legislator to introduce LUA was to make it

increasingly easier for real estate owners to obtain compensation and not to prolong court proceedings.

The empirical study did not include the model of payment of damages in the model without intervention, due to the huge range of data difficult to obtain (estimating the value of potential claims for all properties located in the impact zone of aviation noise) and the model without error due to unidentified real estate in the area, eligible to such claims.

Future comparative research will focus on other airports in Poland and on the empirical verification of the other two scenarios: damage models without intervention, as well as interventions without error. In addition, the reactions of local markets will be analyzed for the creation of LUAs and distortion of real estate prices and market mechanisms as a result of State intervention.

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Annex

Table 1. Estimation results (dependent variable is loss of value ruled by court relative to property value - X6)

Variables	B	SE	t	P>t
Constant	0.116	0.003	34.720	0.000
X13	-0.001	0.000	-4.170	0.000
X15	-0.002	0.001	-2.160	0.031
X16	-0.055	0.003	-21.830	0.000

Table 2. Evaluation of Cox's proportional-hazards function parameters

Variable	B	SE	Chi-kwadrat	p–value	Hazard Ratio
Grouping variable X16					
X13	0.006	0.014	0.180	0.671	1.006
X15	0.078	0.031	6.184	0.013**	1.081
X6	-1.817	1.500	1.467	0.226	0.163
Without grouping variable					
X13	0.006	0.014	0.206	0.650	1.006
X15	0.079	0.032	6.202	0.013**	1.082
X6	-1.750	1.491	1.378	0.240	0.174
X16	-0.102	0.059	2.955	0.086*	0.815

Figure 1. The distribution of the relative values of compensations for loss of value

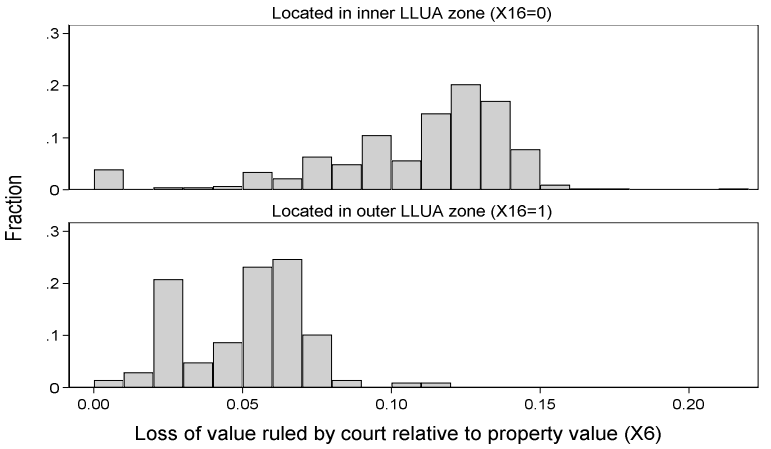

Figure 2. The impact of property value on compensations for loss of value ruled by court

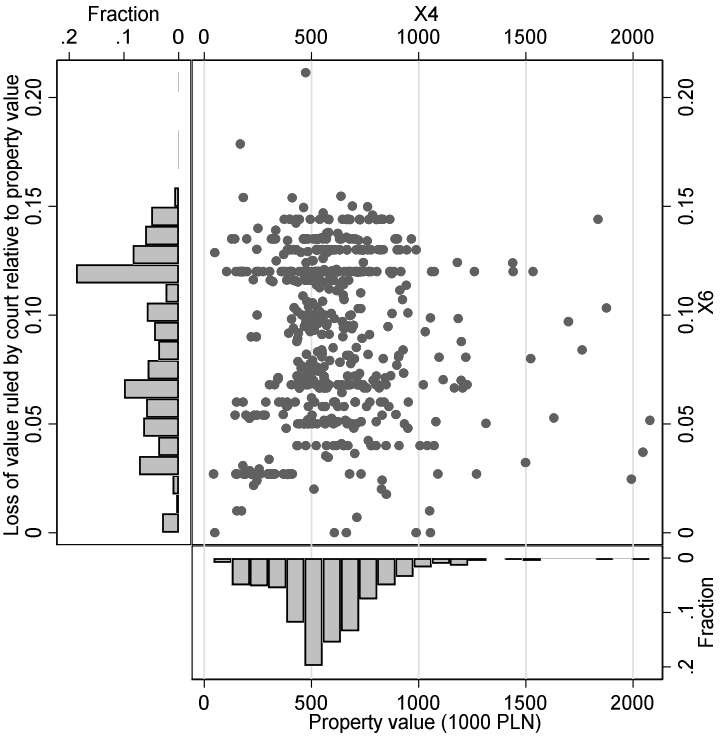

Figure 3. Survival function plot

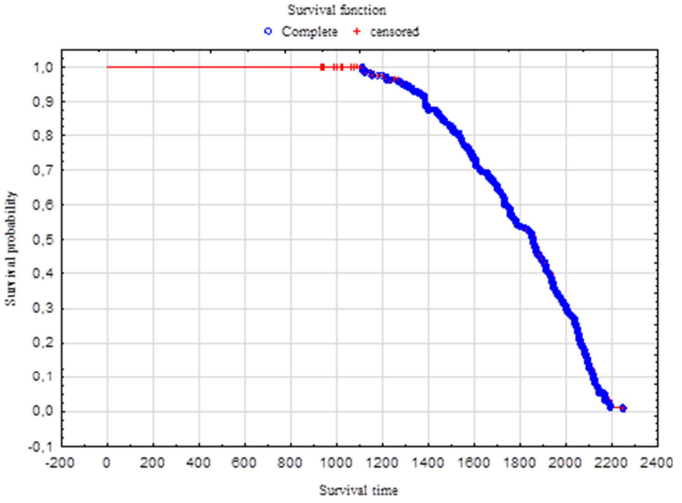

Figure 4. Survival functions for inner and outer LUA zones