Iwona **FORYŚ** • Michał **GŁUSZAK** • Magdalena **HABDAS** • Jan **KONOWALCZUK**

# TRANSACTION COSTS OF INEFFECTIVE LEGAL INTERVENTION RESTRICTING LAND OWNERSHIP IN THE VICINITY OF AIRPORTS: THE EXAMPLE OF THE POLISH COMPENSATION SCHEME IN THE CONTEXT OF ENVIRONMENTAL REGULATIONS

Iwona **Foryś** (ORCID: 0000-0002-2294-0672) – *University of Szczecin*
Michał **Głuszak** (ORCID: 0000-0001-7614-229X) – *Cracow University of Economics*
Magdalena **Habdas** (ORCID: 0000-0003-1905-5098) – *University of Silesia*
Jan **Konowalczuk** (ORCID: 0000-0001-5185-6624) – *Cracow University of Economics*

Correspondence address:
Mickiewicza Street 64, 71-101 Szczecin, Poland
e-mail: iwona.forys@usz.edu.pl

ABSTRACT: The goal of the paper is to assess the social implications of an ineffective legal intervention, which consists of introducing ownership restrictions concerning residential real estate located in the vicinity of airports. The paper evaluates Polish law in the context of the legislator's environmental aims and compares current regulations in Poland with solutions adopted in English law and American jurisdictions. The social and economic impact of ineffective legal intervention is calculated for the KTW airport case study with the use of information about the structure and value of filed and awarded claims for damages. With the use of this data, in the empirical part of the paper, we evaluate the factual transaction costs of public intervention for that airport, as well as ones which would occur if, instead of the Polish model, the American and the English models of compensation were applied. This allows us to explain the socio-economic consequences of adopting a given solution as well as to assess whether it fulfils desirable objectives. It also provides an opportunity to assess the models in the context of devising legally and economically justified compensation for landowners near airports affected by aircraft noise. The paper narrows the gap in the legal and economic knowledge related to the types and implications of ownership restrictions introduced in the vicinity of airports.

KEYWORDS: legal intervention, transaction costs, aircraft noise

## Introduction

After World War II, air transportation began growing rapidly and has since become a vital means of mobility for contemporary society. Flying has also become a fundamental element of the globalised world economy (McManners, 2012). Airport operations will invariably create externalities, both positive and negative, with areas in the vicinity of airports particularly susceptible to the culmination of economic, environmental and social impacts of air transportation, the latter usually associated with noise pollution and its negative reception by affected residents (Boons et al., 2010).

Concerns of residents affected by aircraft noise are connected with matters ranging from environmental and health issues through land use and planning matters, economic considerations, and compensation claims (Bełej et al., 2023). Over the years, the latter issue has been extensively discussed in the literature in the context of legal grounds that may or should find application in compensating homeowners affected by aircraft noise (e.g. Baxter & Lillian, 1972; Bennet, 1982; Falzone, 1999; Goulbourne, 2002; Pilsk, 2012; Berger, 2017). There is also considerable research regarding the influence of aircraft noise on land values and the applicable methods of valuations (e.g. McMillen, 2004; van Praag & Baarsma, 2005; van Praag & Ferrer-i-Carbonell, 2008; Cohen & Coughlin, 2009; Schreurs et al., 2011; Suksmith & Nitivattananon, 2014; Oppio & Mattia, 2015; Batóg et al., 2019). The element that is missing in the current literature on aircraft noise and its legal and economic consequences is an analysis of how the lawmaker has attempted to resolve the neighbour conflict between the airport and landowners, what exactly is being compensated, and whether the implemented solution finds socio-economic justification. For various historical, legal, and socio-economic reasons, lawmakers have adopted different legal measures in an effort to resolve the obvious neighbour conflict between the airport and landowners (see Habdas, 2024).

The main purpose of the article is to consider three different legal solutions aimed at resolving the airport-landowners neighbour conflict and to assess the adopted solution from an economic and social perspective, identifying provisions which do not achieve the objective of resolving the conflict and ones which do. Firstly, an overview of compensation schemes regarding aircraft noise in American and English jurisdictions is considered. The Polish model is subsequently presented, as it is a peculiar combination of the discussed models. It is argued that the Polish legislator's attempt to reconcile the interests of residents and airports has failed due to a defective application of the law. Secondly, the object, scope, principles and modes of compensating loss connected with aircraft noise in the analysed jurisdictions are considered. Finally, we examine the social implications of an ineffective legal intervention by Polish lawmakers with the application of Coase's transaction costs theory. The social and economic impact of ineffective legal intervention is calculated on the basis of collected data concerning the structure and value of filed and awarded claims for damages regarding the Katowice-Pyrzowice Regional Airport (KTW). With the use of this data, we evaluate the factual transaction costs of public intervention for that airport and, subsequently, ones which would occur if, instead of the Polish model, the American and the English models of compensation were applied. This allows us to assess the reasons for increased transaction costs in Poland and to establish whether they would decrease if the American or the English model of intervention were to be implemented.

The paper narrows the gap in knowledge related to public interventions on real estate markets and restrictions of property rights in areas affected by the operation of airports. To our knowledge, this is the first empirical attempt to compare the outcomes produced by the application of different legal frameworks to resolve the neighbour conflict. Empirical data regarding the structure and value of claims filed for the KTW airport allows us to calculate the level of compensation payments for that airport according to Polish, English and American laws. On that basis, conclusions as to regulations that will, in legal practice, ensure the reconciliation of the interests of homeowners, airports, and environmental protection requirements may be formulated. The Polish example will also show the difficulty in properly designing and implementing state intervention aimed at resolving a neighbour conflict with minimised transaction costs.

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## An overview of the literature – compensation schemes in the USA, England and Poland

American jurisdictions have extensive experience in aircraft noise litigation, reaching back to the first part of the XXth century, with two seminal post-World War II cases of United States v. Causby (Justia, 1946) and Griggs v. Allegheny County (Justia, 1962). The cases established inverse condemnation as the main cause of action for interferences caused by direct over flight of planes. This doctrine assumes that an avigation easement has been taken for a public purpose, and thus, compensation is due (Pilsk, 2012). The general rule of the airport's liability for damage to property caused by over flights has been consistently recognised in judicature and doctrine, but the causes of action, premises of liability, and scope of compensable loss differs across state courts as well as in federal courts (Berger, 2015). In addition, there is no consistency in what is being compensated: only economic loss (loss of property value), only non-economic loss (pain and suffering, inconvenience), or a mixture of the two. (North, 1977; Pilsk, 2012; Bennett, 1982).

The above complexities prompted American lawmakers to introduce the Part 150 Program and provide an alternative to solving the neighbour conflict through classical litigation. Firstly, under the Aviation Safety and Noise Abatement Act of 1979 (ASNA), formal standards for noise were established, and a single system for determining the exposure of individuals to aircraft noise was created. A standardised aircraft noise compatibility planning program was also devised. Secondly, in order to implement requirements established in ASNA, the Part 150 Program was introduced. The Program, based on Aircraft Noise Compatibility Planning, is voluntary. It was created under Title 14 (Aeronautics and Space) Part 150 of the U.S. Code of Federal Regulations. The essence of the program requires the participating airports to prepare noise exposure maps and, on their basis, develop a noise compatibility program (NCP) that identifies specific measures to reduce incompatible land uses. The NCP will usually include measures such as providing sound insulation of buildings, constructing noise barriers, and purchasing severely affected properties in order to convert them to uses compatible with the neighbouring airport. An important element of the regulation is that airports participating in the Part 150 Program are eligible to receive Airport Improvement Program funds (administered by the Federal Aviation Administration) to help with noise mitigation for non-compatible land uses and with sound insulation of buildings.

Last but not least, if the airport operator participating in the Part 150 Program prepares a noise exposure map in accordance with 49 U.S. Code § 47503, then pursuant to 49 U.S. Code § 47506, the availability of damages for value diminution caused by aircraft noise is limited. In order to claim such damages, the landowner has to show that after acquiring land, there was a significant change in the type or frequency of aircraft operations at the airport, a change in the airport layout, a change in flight patterns, or an increase in night-time operations and that damage is a result of such a change or increase. This provision has proven to have worked in practice and provided airports with immunity from various claims for aircraft noise damages, including inverse condemnation (Pilsk, 2012). Nevertheless, not all airports have signed up for the program, and significant changes in airport operations (see 49 U.S. Code § 47506) may still trigger liability.

In English law, an approach different to the American one has been devised. In s. 76 (1) of the Civil Aviation Act 1982 (Act, 1982), it is stipulated that: "*No action shall lie in respect of trespass or in respect of nuisance, by reason only of the flight of an aircraft over any property at a height above the ground which, having regard to wind, weather and all the circumstances of the case is reasonable, or the ordinary incidents of such flight, so long as the provisions of any Air Navigation Order and of any orders under section 62 above have been duly complied with*". In addition, pursuant to s. 77 (2): "*No action shall lie in respect of nuisance by reason only of the noise and vibration caused by aircraft on an aerodrome to which this subsection applies by virtue of an Air Navigation Order, as long as the provisions of any such Order are duly complied with*". This denotes that with respect to civil aviation, trespass and nuisance claims are unavailable as long as flights are performed according to the relevant regulations. The above exemption does not apply to military flights (Witting, 2015), in which case an action in nuisance may be directed towards obtaining damages or an injunction, the latter being at the discretion of the court, particularly when the defendant's activity has public significance or an injunction would be unduly oppressive (Elliot & Quinn, 2009).

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In the case of civil aviation, the English legislature does provide a legal basis for seeking damages for loss caused by aircraft noise, but only if the loss takes the form of property value diminution. Compensation is qualified as a consequence of injurious affection caused by the operation of newly constructed or altered public works. It is available only when emanations from their operation cause a reduction in property value (Lee, 2015). The compensation payable on any claim must be assessed by reference to prices current on the first claim day. The latter is the first day after the expiry of 12 months from the date on which public works were first used after completion, reconstruction, extension or another alteration. In the case of airports, the alterations that trigger liability must consist of runway or apron alterations. The LCA 1973 does not provide compensation claims for value diminution caused by an intensification of airport use if the latter is not connected directly with runway or apron alterations. One should note that programs for soundproofing buildings affected by aircraft noise are not centrally regulated, resulting in varying degrees of offered financial assistance in noise insulation as well as generally lower levels of support when compared to other countries (Butcher, 2017).

It should be indicated that the application of the described compensation scheme relies heavily on valuations of the affected properties, which should reflect how the market reacted (if at all) on the first claim day to the noise caused by commencing the use of a new airport or one where runway or apron alterations have been carried out. The difficulty lies in assessing how the market values have been affected by noise, but not any other factors, on the first claim day after beginning the use of a new or altered airport. In particular, in the case of altered airports, only the increase in noise caused by the alteration should be reflected in the valuation. The solution accepted with respect to civil aviation, unlike military flights, is based on statutory law, where a clear scope and premise of compensation have been formulated. This introduces clarity as to the events that trigger the necessity to compensate.

In Poland, airport externalities have been approached from the perspective of environmental protection in the Protection of Environment Act (2001). Accepting the fact that despite employing the available technical, technological and organisational solutions, it is currently impossible to contain increased noise levels within the boundaries of an airport, the lawmaker has allowed airports not to meet environmental protection standards regarding noise levels. However, only within the so-called restricted use areas (RUAs) (art. 135 s. 1 Act, 2001). Airports, as enterprises of public utility, are allowed not to observe environmental protection standards on the condition that they employ all available technologies and organisations in order to minimise their influence on the environment (Romańska-Ściseł, 2004).

The purpose of creating an RUA is to prescribe such current and future uses of land that reduce potential negative effects on human health caused by the activity of the neighbouring enterprise and allow for the development of sustainable land uses in the vicinity of airports (Jendrośka & Bar, 2005), or other enterprises expressly enumerated by the legislator in art. 135 s. 1 POE (2001). When delimiting an RUA, the legislator requires identifying: 1) restrictions on designating land for particular uses, 2) technical requirements for buildings, and 3) the permissible use of land (art. 135 s. 3a Act, 2001). The RUA may thus be viewed as a special land planning instrument (Miler, 2012). The restrictions introduced in airport RUAs consist of prohibitions on new residential developments or conversion to residential uses, as well as on new development or conversion of buildings into sensitive uses, i.e. hospitals, care homes, buildings serving as permanent or temporary residence of children and youth (e.g. kindergartens, schools, boarding schools). Thus, in practice, the implemented restrictions do not apply to all real estate located within an RUA; for example, they find no application for real estate utilised for retail, office, or industrial purposes. Within an RUA, different zones with varying prohibitions and requirements may be delimited (Gruszecki, 2019).

In light of the above, the Polish legislator has decided to compensate owners for the loss which has been caused by the restrictions introduced in an RUA. This solution is different from the American and English ones, where compensation is linked to loss of value caused by the inconvenience created by aircraft noise and not by administrative restrictions on the use of land. The relevant provisions of art. 129 s. 1 and s. 2 POE (2001) regulate the cause and extent of compensable loss and apply not only to RUAs, but also other special zones created pursuant to art. 130 POE (various nature protection areas) or art. 136a POE (2001) (industrial zones). In section 1 of art. 129 (Act, 2001) the legislator states that *if in connection with restricting the manner of the use of land, its use or the use of*

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*its part in a manner consistent with past use or past designation has become impossible or materially limited, the owner may demand that the land or its part be bought.* In art. 129 s. 2, the legislator provides*: in connection with restricting the manner of the use of land, its owner may demand compensation for the suffered loss; the loss also includes the decrease of the value of land*.

No compensatory claims arise out of the mere fact of creating an RUA and "stigmatising" land, the fact that noise levels are or potentially may be exceeded or the fact that the enjoyment of land located within an RUA is less comfortable than in areas not subjected to aircraft noise (Habdas & Konowalczuk, 2018). Furthermore, the legislator is not obliged to compensate for all effects of introducing a special zone because compensating the effects of legal activity of public authorities may be limited in scope and subject to modified principles (Supreme Court: 25 June 2015, III CSK 381/14) when compared to general rules on liability for loss as regulated in private law (Parchomiuk, 2007). Apart from compensation provided in art. 129 s. 2 POE (2001), owners within RUAs are entitled to the reimbursement of incurred costs (i.e. money actually spent) resulting from fulfilling technical requirements concerning buildings, introduced in a RUA (art. 136 s. 3 Act, 2001). Liability for these claims has been placed on airports (art. 136 s. 2 Act, 2001).

In practice, the Supreme Court has applied a very extensive interpretation of art. 129 s. 2 POE (2001) and has argued that 'legalising' increased noise levels within an RUA is a restriction of ownership and, consequently, of the use of land (Habdas, 2020). In effect, the court has arrived at a solution similar to the American (if Part 150 does not apply) and English approaches, where compensation is awarded for loss of value resulting from the inconvenience caused by noise externalities and not for administrative restrictions on future, non-compatible land development. This alternative interpretation of POE 2001 produces claims when no land use restrictions have been introduced and, surprisingly, even when standard noise levels have not been exceeded, as in the case of houses located in outer RUA zones, where noise levels are only exceeded for sensitive buildings (e.g. hospitals, care homes, schools).

## Research methods

Comparative legal studies and the search for a legal, economic and social justification of public intervention have been carried out using the deduction method and the dogmatic method, focused on a critical analysis of domestic and foreign literature. The three different models of compensation have been presented, namely: American (following the Part 150 Program), English, Polish as introduced by the legislator (correct application), and Polish as applied in practice (erroneous application). We argue that the Polish model, when applied in practice, leads to increased transaction costs, which contradicts the purpose of public intervention. In this research, we assume that an effective intervention should decrease transaction costs with the simultaneous achievement of social goals, such as improving the living conditions of residents in the vicinity of an airport. We utilise a table developed in order to compare legal systems for the purpose of comparative legal studies of public interventions regarding aircraft noise externalities (Habdas et al., 2020). In this paper, we concentrate on only one criterion, namely the scope of compensation, paying particular attention to the principles of compensating for the diminution of real estate value. It is this head of damage that has been the object of the major error in implementing the intervention in Poland (Klat-Górska & Ostapski, 2021; Pokrzywniak, 2021; Kamińska, 2022). Consequently, only 7 criteria have been selected for comparison, and they may be divided into two groups:

1) the formal group (criteria 1, 2, 3, 4, Table 1) regarding the type and role of public entities introducing and implementing the intervention and the sources of financing the main costs of the intervention, i.e. compensation payments,
2) the functional group (criteria 5, 6, 7, Table 1) regarding the types of entities responsible for compensation, the scope of compensable loss and the conditions for compensatory liability.

In Table 1, a descriptive summary of similarities and differences in the intervention is presented, with sub-criteria introduced for the scope of compensation.

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**Table 1.** A descriptive assessment of principles employed in interventions on the residential market in the vicinity of airports in the U.S.A., England and Poland (erroneous and correct application)

| | No. | Details | Poland erroneous application (Model IE) | Poland correct application (Model I) | USA Part 150 (Model II) | England (Model III) |
|---|---|---|---|---|---|---|
| FORMAL GROUP | 1 | Sources and types of provisions introducing public intervention | Constitution, Articles 21, 31 and 64 and the Protection of the Environment Act 2001 (Act, 2001) articles 129, 135, and 136 | | Title 14 (Aeronautics and Space) Part 150 of the U.S. Code of Federal Regulations. | the Civil Aviation Act 1982 (Act, 1982), s. 76 (1)(2) and Part I of the Land Compensation Act 1972 (Act, 1972) |
| | 2 | Public bodies introducing public intervention | Yes, provincial council (voivodship self-government) | | Yes (FAA) | No |
| | 3 | Public bodies implementing/ performing and monitoring public intervention | No | | Yes (FAA) | No |
| | 4 | Sources of financing compensation | private (airport) | | public and private (airport) | private (airport) |
| FUNCTIONAL GROUP | 5 | Entity paying compensation | private (airport) | | public and private (airport) | private (airport) |
| | 6 | Scope of compensation in case of allocation of property rights (delimiting legal damage) | | | | |
| | 6.a | Acoustic improvements – reimbursement of costs borne by the owner or performance of repairs by the obliged entity | yes | yes | yes | no (unless voluntary airport programs exist) |
| | 6.b | Reimbursement of costs in the absence of incurred acoustic expenses | yes | no | no | no |
| | 6.c | Value diminution caused by the intervention itself (e.g. introducing special legislation or zones) -market stigmatization | yes | no | no | no |
| | 6.d | Value diminution caused by introduced restrictions in land use | yes | yes | no | no |
| | 6.e | Value diminution caused by noise externalities | yes | no | no (but exceptionally possible) | yes |
| | 6.f | Lost profits | yes | yes | no | no |
| | 6.g | Buyout at the request of the landowner | yes | yes | yes | yes |
| | 6.h | Other – compensation for pain and suffering caused by noise | yes | no | no | no |
| | 6.i | Other – compensation for a less desirable location as perceived by the market | yes | no | no | no |
| | 7 | The event causing compensable loss | Location within a Restricted Use Ares | Introduction of restrictions in the use of land (e.g., new prohibitions on certain types of land development or permissible use of existing buildings) | N/A | Construction or significant alteration of airport causing increased noise and loss of amenity, resulting in loss of market value |

The above table shows differences among the jurisdictions considered in terms of intervention and available compensation claims. In the formal group, there is considerable variance in the adopted solutions, while in the functional group, uniformity only exists with respect to the homeowner's buy-out claim and the entity paying compensation. In all three systems, that entity is the airport; however,

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in the U.S.A., besides the airport, a public entity is involved in the compensation payments. Similarities regarding the scope of compensation do not occur with regard to acoustic renovation (in England, only voluntary programs implemented by airports). In each country, liability triggers for compensation for value diminution are different.

In the U.S.A., in the case of Part 150 programs, unless there is a significant change in airport operations, there is no claim for damages caused by market value diminution resulting from aircraft noise, but the Program offers acoustic renovation of buildings. If, however, this significant change does take place, the decrease in value may be compensated but will be adjusted for the positive effects of a building's acoustic renovation, in particular the exchange of widows and the installation of air conditioning, see example calculation for Ft. Lauderdale Airport (Bell, 2016).

In Poland, when the law is applied correctly, market value diminution is always compensated as long as restrictions in the use of land (e.g. a prohibition of new residential development) applicable to a given piece of real estate have been introduced. Simultaneously, if no such restrictions apply, there is no basis for compensation. In practice, no land use restrictions are introduced for land already developed with residential buildings. A social drawback of the intervention in Poland is the legislator's expectation that acoustic renovations will be carried out at the organisational and financial expense of the homeowner, with the airport only responsible for examining the correctness of the renovation and for reimbursing the justified expenses. Under the American Part 150 Program, homeowners are not burdened with the task of performing the renovations and the formally, organizationally and technically difficult process is performed by a specialised entity engaged by the airport and/or the municipality (FAA, 2019).

The English system is entirely focused on measuring loss, which consists of market value diminution. However, a claim exists, much like in the American Part 150 Program, only in cases of significant airport alterations. Therefore, social problems of persons living near airports at which operations have intensified, but no alterations of runways or aprons have occurred are not possible to resolve through such an intervention. Unlike the American Part 150 Program, the English system lacks a separate and definite claim to compensate for acoustic improvements. Acoustic improvement programs are not centrally regulated but may be voluntarily introduced by airports, so varying levels and rules of reimbursing the costs of acoustic renovation may exist. For the purpose of this paper, we assume that no such voluntary program exists. If it did, the influence of soundproofing works that have either been performed or are eligible for compensation is, like in the American model, to be taken into account when calculating market value diminution (s. 4(3) Act, 1972; Valuation Office Agency, 2018). This should be done so that the claimant does not benefit from any double counting of compensation claims (Shapiro et al., 2019). In England, but also in the American Part 150 Program, the compensation for loss of market value is extensive in its scope; however, it is only in relation to airports that have undergone significant alterations. This compensation will reflect all non-realized market losses (Schwarz, 2011), as there is no requirement to trade the affected property on the market.

In Poland, the scope of compensation when intervention is applied erroneously is the widest, and it includes all factual and virtual losses. Virtual acoustic repair losses are compensated because courts award damages, even when no acoustic renovation works have been undertaken, and there is no legal obligation to acoustically retrofit houses. Therefore, despite high payouts, the achieved environmental results are negligible. In addition, courts, unlike in the USA and England, do not account for sound insulation when calculating market value diminution caused by noise externalities, so double counting is not avoided.

The assessment of the intervention is performed using the efficiency criteria of the Coase Theorem, which assumes the reciprocal nature of externalities (Coase, 2013a; Coase, 2013b). External costs warrant public intervention unless transaction costs are low. This is possible if the structure and the level of compensation for transferred entitlements have been correctly devised. In the case of significant transaction costs, public intervention should be planned and implemented in a manner that lowers these costs. In the case of civil aviation airports, it should also take into account their importance in satisfying public needs.

In academic writings, transaction costs are defined as either the costs of establishing and preserving property rights (Allen, 1991) or the costs resulting from the transfer of property rights (Niehans, 1987). The latter definition, derived from neoclassical economics, is based on the costs of

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concluding agreements on the market, while the definition accepted in this paper concentrates on establishing and preserving property rights. We adopt a wide understanding of transaction costs in the context of the protection of property rights, which encompass all direct costs and costs resulting from the lack or low efficiency of the market, as well as from other factors which cause errors in resource allocation. In our research, these also include errors in compensation for loss. Protecting and preserving property rights is always connected with transaction costs (Allen, 1991). According to Coase (2013a), when there are no transaction costs, the allocation of resources is independent of the distribution of property rights (Williamson, 1998). When the latter are full and unrestricted, transaction costs are equal to zero. Alternatively, costs may be incurred in order to preserve property rights because the benefits exceed such costs, in which case, transaction costs are larger than zero.

In our calculations, transaction costs (TC) are the sum of administrative costs (Ca) and the costs of errors (Ce); thus, TC = Ca + Ce. In the case of Polish disputes resolved by courts (also see Cooter & Thomas, 2012) a lack of consistency between the theory of public intervention (based on the criterion of efficiency of an RUA) and the courts' systemic and functional interpretation of the law may be observed (Habdas, 2020). Also, in the case of out-of-court settlements, a similar composition of transaction costs exists. In both in and out-of-court compensation, errors may occur, creating costs for an erroneous contract conclusion or court decision.

Comparative studies are conducted in relation to Polish law, with different levels of transaction costs shown depending on how correct or erroneous the application of the law is. This allows us to identify three levels of transaction costs, starting with the highest and ending with the lowest. At level one, the application of Polish law is completely erroneous, while at level 3, it is completely correct. At Level 2, the application is erroneous. However, the error is decreased by the value of damages awarded for acoustic renovations that will most probably be performed:

Level 1. Transaction costs (TC1) are calculated assuming that compensation is awarded on the basis of individual utility decisions of homeowners, who independently assess the value of their claims. The amount of TC1 is thus equal to the amount specified in all filed claims regarding planned and borne costs of acoustic renovation (A) and value diminution (D). Liability is assumed to arise as a result of introducing an RUA.

Level 2. Transaction costs (TC2) are generated when public intervention is erroneously applied. Like at Level 1, they are calculated as the sum of compensation already paid and planned to be paid for costs of unperformed acoustic renovations (A) in all zones of the RUA (even ones where noise levels for residential homes have not been exceeded), compensation already paid and planned to be paid for market value diminution (D) even when no land use restrictions have been introduced. However, at this level, paid and planned amounts of compensating unperformed renovations are decreased by 20% because our previous analyses and estimates show that this amount is subsequently spent on factually performing acoustic insulation[1]. This is the maximum probable level of achieving environmental objectives (i.e. protection from noise indoors) if settlements or legal provisions do not impose the obligation to retrofit acoustically and contain no mechanisms of ensuring that awarded money is actually spent on acoustic repairs.

Level 3. Transaction costs (TC3) are calculated with the assumption that public intervention has been correctly implemented and environmental objectives are being achieved. They are the sum of compensations paid and planned to be paid for already executed acoustic renovations (A) in areas where noise levels are exceeded for residential buildings. Market value diminution claims (D) are awarded only in connection with introduced land use restrictions; however, in KTW, no such restrictions apply to already existing houses, so D claims are unfounded for owners of existing houses.

Our research focuses on calculating the amount by which transaction costs are increased as part of social costs. This is analysed with reference to administrative costs and costs of errors. In order to simplify calculations, we assume that the level of administrative costs (Ca) and costs of concluding a settlement, both at Level 2 and Level 3, are similar, although our research shows that administrative

[1] Such Studies were conducted until 2022 at three regional airports (KTW, GDN, POZ), where approximately 460 settlements have been concluded. Estimates compiled by airport officials managing sound insulation settlements indicate that in no more than 20% of the cases, sound insulation has been or will actually be carried out. Regarding POZ airport, this estimate is additionally supported by anectodal evidence complied on site by valuers. Since 2023, after the courts' have indicated that reimbursement relates only to already performed acoustic renovations, airports have discontinued concluding settlements regarding unperformed acoustic renovations.

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costs are, in fact, higher than settlement costs (Foryś et al., 2019). With such assumptions, increased transaction costs (ΔTC) of the intervention are calculated on two levels as the difference in TC, according to the following formulas:

$$\Delta TC1 = TC1 - TC3 \text{ or } \Delta TC2 = TC2 - TC3, \quad (1)$$

where:
ΔTC1, ΔTC2 – level of increased transaction costs,
TC1, TC2, TC3 – the transaction costs in each level.

The increase in transaction costs for Level 1 and Level 2 is based on the amount of factually filed claims and their structure (heads of damage). The increase in transaction costs for both levels is always made with reference to Level 3, where the intervention is correctly implemented. For claims regarding A, this denotes compensation for actually performed acoustic insulation works, and for claims D, this denotes compensation only if land use restrictions have been introduced.

## Empirical data

We calculate transaction costs of public intervention for the KTW airport according to the American, English and Polish models of compensation, and within each model, we distinguish three levels of compensation, namely, based on individual utility assessment (Level 1, completely erroneous application, Model IE), based on a partly erroneous application of the intervention (Level 2, assuming that some of the awarded damages are used to perform acoustic renovations), and based on a correct application of the intervention (Level 3, compensation awarded only for land use restrictions and costs of already performed acoustic renovations, Model I). As has already been explained, in the English and the American Part 150 model, compensation only applies if significant airport alterations have been executed and put into use. This condition determined the choice of KTW, where a new runway was built approximately 200 meters north of the old one and aprons were altered. The project was approved for use on 28 May 2015. Moving the runway caused a significant change in noise externalities. For some homeowners, it resulted in the improvement of their situation, but for others, it caused their exposure to higher noise levels. On 15 Sept 2016, a RUA was established. Its boundaries are determined by a noise contour based on forecasts of increased noise levels. The contour is set for the equivalent night-time noise level of LAeqN = 50 dB, and no variations are made within the RUA for households exposed to higher noise levels due to their location closer to the sources of noise (e.g. take-off and landing paths). Thus, the intervention for KTW is egalitarian in the sense that households are not differentiated from households exposed to different levels of noise due to their location within the RUA. It should be noted that in the analysed RUA, no formal restrictions regarding the use of land already occupied by residential buildings have been introduced.

Figure 1 shows the area of RUA in grey colour. The white area in the middle, with a dotted contour, shows the location of the airport and its facilities. The noise contours do not formally divide the RUA into zones, but we have marked them in order to show differences in exposure to noise. The contours are based on equivalent night-time noise levels LAeqN calculated for all nights in the months with the highest number of night-time operations, i.e. June, July and August. This data was compiled from the most recent report, which was based on the forecasted growth of KTW airport operations (Konowalczuk, 2020). Available data and site visits allowed us to delimit, for the purpose of this research, four zones within the RUA, namely C, B, A, and 0. Their external boundaries are formed by night-time noise contours of 61dB, 55dB, 51dB and 50dB, respectively. The latter contour is the legally binding border of the RUA.

Zones C, B, A and 0 allow us to analyse the area of public intervention for each of the considered models. The zones may also warrant different compensation levels since various noise levels result in different costs for acoustic renovation. The presented results are based on average compensation amounts for the entire RUA. Calculations based on average amounts proved to be sufficient in order to objectively show the differences among intervention models in the analysed countries. Data based on the average amount of compensation also allowed to reliably compare and assess the risk of increased transaction costs and to illustrate the differences among models by calculating compensa-

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tion amounts which are socially unjustified. The presented calculation of increased transaction costs in the case study of the KTW Airport is performed with the use of a database comprising amounts of all claims actually filed by owners of single-family houses located within the RUA. This type of residential area dominates the vicinity of airports located in suburban locations.

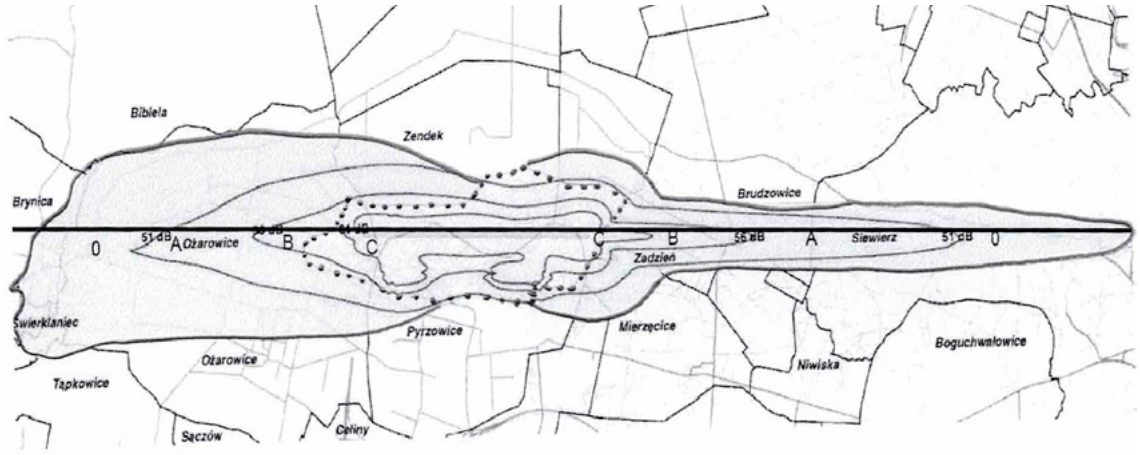


**Figure 1**. RUA for Katowice – Pyrzowice Airport

The public intervention regarding the KTW airport, according to the American Part 150 model (Model II), requires considering only acoustic renovation claims (A), which arise if noise levels have been exceeded. Although in the American Part 150 Model, compensation for real estate market value diminution is available if, after acquiring the property within an RUA, there was a significant change in airport layout, awarded damages for this diminution take into account the level by which value of real estate is increased by the available or performed acoustic renovation of the building. In KTW, the level of market value diminution is completely offset by the increase of market value caused by damages available for performed and unperformed acoustic renovation. This is supported by our analysis of the structure of filed claims. According to data in Table 2, the average value of the A claim is a few times larger than the D claim. This applies to both the average and median measures for Models I and II. Our research also supports this idea regarding the average price of houses in the KTW RUA. In the years 2008-2018, this price did not exceed 300 thousand PLN, and in the last year of the analysis (2018), it did not exceed 400 thousand PLN (Konowalczuk, 2020). According to court experts, the maximum level of market value diminution did not exceed 8 % of the unaffected value. However, some experts noted that there was no value diminution[2]. Consequently, the maximum amount of D claim for a typical house is 32 thousand PLN (400 000 * 8%). Meanwhile, the costs of acoustic renovation of a typical house in the KTW RUA is estimated at a cost ranging from 45 thousand to 100 thousand PLN depending on the required retrofitting works (Konowalczuk et al., 2021). Consequently, when applying the American model to the KTW airport, only the costs of acoustic renovation are considered. The acoustic renovation claims in Model II are effective only in zones A, B, and C, where night-time noise levels for residential buildings are exceeded.

The application of the English model (Model III) requires considering value diminution claims derived from the loss of comfort and amenities caused by noise associated with a significant alteration of the airport. Loss of value also reflects the decreased utility of a building that no longer meets noise insulation standards. We assume, based on valuations provided by homeowners filing for compensation, that in Zone 0, it is impossible to show market value diminution (D). This is caused by a very low informational efficiency of the local market of single-family houses, so the potential for decreased use and enjoyment is not reflected in prices (Konowalczuk, 2020). In Model III, houses with decreased use and enjoyment due to the completion and use of new infrastructure may be identified with reference to increased noise levels caused by moving the runway northwards. This area is located above the black line, as shown in Figure 1. Homeowners north of the black line would be

[2] See e.g. judgement (not yet final) of the District Court in Gliwice of 28 April 2023, X GC 437/19, unpublished.

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entitled to apply for compensation for value diminution in zones C, B, and A. In Model III, the existing or the forecasted noise level is not important because what matters is subjecting the property to noise or increased noise as a result of significantly altering an airport, assuming that this has caused market value diminution. In Model III, disputes concentrate on value diminution (D), and we assume that there are no voluntary programs covering the costs of acoustic renovation of buildings. When calculating the difference between models, losses in the form of lost profits (O) and buyouts (B) were not considered because these types of claims rarely occur in practice.

Claims in the models considered in this study should be taken into account only within the RUA; however, in Model IE zones 0, A, B, and C with, claims for A and D are to be considered, whereas in Models II and III zones A, B, and C for A claims and A, B, C above the black line for D claims (loss caused by a significant airport alteration) are to be taken into account. In Model I, D claims do not exist because no land use restrictions regarding existing houses have been introduced, and A claims are available in Zones A, B, C. Table 2 below presents descriptive statistics for A and D claims, with the amount divided between these heads of damage in cases where the applicant indicated the amount for each head. Additionally, descriptive statistics for two marketability indexes were provided, separately for A and D. The index denotes the quotient of the value assessed by an appraiser (real estate valuer or a construction expert) and the value of the filed claim.

**Table 2.** Descriptive statistics for filed claims regarding A and D in the analysed Models, expressed in PLN

| Descriptive statistics | Model I, II Claim (D) | Model I, II Claim (A) | Model III Claim (D) | Marketability index* (D) | Marketability index** (A) |
|---|---|---|---|---|---|
| Average | 268 224 | 111 699 | 277 651 | 0.275 | 0.630 |
| Median | 141 533 | 78 108 | 209 140 | 0.103 | 0.537 |
| Minimum | 6 000 | 7 349 | 30 000 | 0.021 | 0.104 |
| Maximum | 2 739 420 | 2 807 189 | 2 739 420 | 2.023 | 1.954 |
| Bottom quartile | 70 000 | 52 000 | 97 050 | 0.074 | 0.332 |
| Top quartile | 333 617 | 112 417 | 360 200 | 0.206 | 0.766 |
| Standard deviation | 355 556 | 197 053 | 338 028 | 0.428 | 0.398 |
| Skewness | 3.41 | 10.69 | 5.10 | 3.207 | 1.412 |
| Kurtosis | 15.50 | 135.41 | 34.47 | 11.836 | 1.809 |
| Claim amount | 93 878 500 | 31 052 264 | 23 322 683 | 6.867 | 73.098 |
| N | 350 | 278 | 84 | 25 | 116 |

* index obtained as a quotient of the value appraised by a real estate value and the amount of the filed claim for D.
** index obtained as a quotient of the value of the settlement and the amount of the filed claim for A.

Due to a series with missing data, imputation was used. The distribution of the filed claims for specified heads of damage (and the calculated indices) is extremely asymmetric, which justifies the imputation of missing data in order to calculate the marketisation of the median amounts. Table 3 contains descriptive statistics of the analysed amounts after the median imputation. The next step was to recalculate, with the use of the marketability index, claims A and D. The need to adjust for marketability results from large differences between the claim values identified by homeowners and ones assessed by real estate appraisers and acoustic/construction experts.

Further analysis will be based on the sum of value filed claims regarding A and D in each of the considered models (Table 3).

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**Table 3.** Descriptive statistics for filed claims regarding A and D after imputation and recalculation, expressed in PLN

| Descriptive statistics | Models I and II | | | | Model III | |
|---|---|---|---|---|---|---|
| | Claim (D) | Claim*(D) | Claim (D) | Claim*(A) | Claim (D) | Claim**(D) |
| Average | 232 212 | 23 918 | 104 637 | 56 190 | 262 426 | 27 030 |
| Median | 141 533 | 14 578 | 78 108 | 41 944 | 209 140 | 21 541 |
| Minimum | 6 000 | 618 | 7 349 | 3 946 | 30 000 | 3 090 |
| Maximum | 2 739 420 | 282 160 | 2 807 189 | 1 507 460 | 2 739 420 | 282 160 |
| Bottom quartil | 98 500 | 10 146 | 60 000 | 32 220 | 112 500 | 11 588 |
| Top quartil | 230 000 | 23 690 | 100 000 | 53 700 | 306 184 | 31 537 |
| Standard deviation | 306 077 | 31 526 | 175 589 | 94 291 | 299 087 | 30 806 |
| Skewness | 4.15 | 4.15 | 12.01 | 12.02 | 5.84 | 5.83 |
| Kurtosis | 22.88 | 22.88 | 171.42 | 171.42 | 44.93 | 44.93 |
| Claim amount | 113 551 587 | 11 695 813 | 36 832 256 | 19 778 922 | 28 342 043 | 2 919 230 |
| N | 489 | 489 | 352 | 352 | 108 | 108 |

* index 0.537, ** index 0.103 (see Table 1).

## Results of the research

Increased transaction costs have been calculated for heads of damage regarding A and D, according to previously identified models: Model I – the Polish model as applied correctly, Model II – the American Pat 150 model, and Model III – the English model (applicable in cases of significant airport alterations). The results are shown in Table 3 below. TC1 for each model are claim amounts from Table 2 (values after imputation), and TC2 are claim amounts after marketisation. TC2 equals 20% of the amount of TC1 since, as previously explained, that is the amount actually spent on acoustic renovation when money is awarded for planned and not performed renovations. No value is assigned to claim D in TC3 because no restrictions on the use of land for the considered types of real estate (single-family houses) have been introduced in the RUA for KTW.

After the imputation of missing data, it was established that the filed claims generated in Model I and Level 1 transaction costs (TC1) of over 150 million PLN. At Level 2, transaction costs (TC2) after marketisation are just short of 3.5 million PLN (Table 3). Increased transaction costs resulting from a systemic error in the implementation of the intervention by Polish courts (ΔTC2) are estimated at 25.18 million PLN. Increased transaction costs for Level 1 (ΔTC1) amount to just over 125 million PLN. This amount is a gauge of the institutional maturity of residential markets in the vicinity of airports, and it shows that maturity is very low in the analysed situation. Indeed, the low level of institutional maturity is a necessary condition for a systemic error in the implementation of the public intervention. Despite a clear and definite intervention by the state, residents are convinced that they are entitled to high amounts of compensation for the fact that their properties have a relatively less desirable location than other properties. Residents also expect to receive cash payments for future acoustic renovation of their homes, even though its performance is not mandatory, and the received money may, in fact, be spent on anything.

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**Table 4.** A calculation of increased social costs for the analysed models expressed in PLN

| Levels of social costs | Type of claim | Model I (PL) | Model II (USA) | Model III (UK) |
|---|---|---|---|---|
| TC1 – individual utility, completely erroneous application of law (claims after imputation) | A | 36 832 256 | 36 832 256 | N/A |
| | D | 113 551 587 | N/A | 28 342 043 |
| | Sum A+D for TC1 | 150 383 843 | 36 832 256 | 28 342 043 |
| TC2 – with error decreased by 20% (claims after imputation and marketization) | A | 19 778 922 | 19 778 922 | N/A |
| | D | 11 695 813 | N/A | 2 919 230 |
| | Sum A+D for TC2 | 31 474 735 | 19 778 922 | 2 919 230 |
| TC3=0.2*TC2 – implementation of the law without error | A | 6 294 947 | 3 955 784 | N/A |
| | D | 0,00 | N/A | 2 919 230 |
| | Sum A+D for TC3 | 6 294 947 | 3 955 784 | 2 919 230 |
| Increased transaction costs when intervention is implemented according to individual utility decisions, compared to a correct implementation of the intervention ΔTC1=TC1-TC3 | | 125 204 055 | 32 876 472 | 25 422 813 |
| Increased transaction costs when intervention is implemented not according to individual utility decisions, but with an error regarding the scope of compensation, compared to a correct implementation of the intervention ΔTC2=TC2-TC3 | | 25 179 788 | 15 823 138 | 0 |

In Model II, if the compensation were correctly awarded only for factually performed acoustic renovation of homes, the transaction costs (TC3) would amount to 3.96 million PLN. However, if this model is applied with a systemic error as experienced in Poland, the increased transaction costs (ΔTC2) equal to 15.82 million PLN. In Model III, transaction costs as individually assessed (TC1) are just over 28 million PLN. However, no increased transaction costs would arise at Level 2 (ΔTC2), and increased transaction costs for Level 1 amount to (ΔTC1) 25,4 million PLN. It should be noted that in Model II, increased transaction costs for Level 2 (ΔTC2) are 62.8% of increased transaction costs for Model I, i.e. the variant employed in current Polish practice. It should be emphasised that in all Models, transaction costs with a correct implementation of the intervention are within the range of 2.92 – 6.29 million PLN, with the highest financial efficiency of Model III. That model, however, does not achieve the environmental objectives (acoustic insulation of buildings aimed at the protection of human health) of Model II. In Models I (at Level 3) and II, the environmental objective adopted by the Polish legislator in POE is fulfilled. In Model III, the compensation awarded resembles damages for immaterial loss in the form of pain and suffering connected with reduced enjoyment of using one's real estate, which may lead to the loss of market value. The awarded compensation for D does not, however, directly translate into the acoustic renovation of buildings by their residents and the subsequent improvement of their living conditions.

## Discussion/Limitation and future research

Research has shown that when entitlements that are to be allocated under imposed rules between homeowners and the airport are not clearly defined, high transaction costs occur. A large difference between Levels 1 and 2 (ΔTC1 – ΔTC2) in Model I indicates a very low level of institutional maturity of that segment of the Polish real estate market in relation to the introduced public intervention. More important conclusions follow from comparing the application of foreign compensation models to the example of KTW. At Level 1, increased social costs (ΔTC1) do not occur in Model III. In Model

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II, they are relatively low because they constitute slightly over 50% of the totality of increased costs, whereas in Model I, they account for 80% of the increased social costs. This shows that Model III is formally best suited to the low institutional maturity of the real estate market in Poland. Devising intervention according to Model III allows us to avoid a situation, in a social dimension, provokes filing extensive compensation claims connected with noise externalities and their influence on real estate values.

In Model III, connecting compensation claims with a significant airport alteration and thus with "new" externalities excludes the possibility of claiming compensation for historic value loss caused by the declining attractiveness of the location as a result of civilisational development. This promotes desirable social attitudes by motivating citizens to carefully invest in the real estate market and take into account various risks connected with it. A significant drawback of Model III is that it does not ensure that environmental objectives are achieved in the form of acoustic renovation of buildings already influenced by aircraft noise. These objectives may be achieved without any errors through voluntary programs organised by airports. However, their willingness to implement them and their scope varies (Habdas, 2024). In Polish circumstances, organising the acoustic renovation process by the airports would also be possible since the current public intervention already obliges them to pay for this element and ownership control of companies managing airports belongs to public entities (local and governmental). When it comes to calculating value diminution, Model III is methodologically complicated and difficult to apply even in the mature English real estate market. It requires ascertaining value loss attributable to noise caused by commencing the use of newly built infrastructure, but not to the mere fact that new infrastructure has been built or to other factors, such as noise existent before the construction or alteration of the airport (Shapiro et al., 2019).

Model II assumes compensating only factually performed acoustic renovation, with funding from airport, local and governmental sources as well as value diminution of real estate, but only in cases of significant changes in the type or frequency of aircraft operations; the airport layout, flight patterns or in the case of an increase in night-time operations (49 United States Code § 47506). These rules seem to be well-adjusted to social expectations of property protection (Habdas, 2024). Conversely, in Model I, homeowners see the protection of property as insufficient because it is linked to a special planning instrument in the form of RUA, but only when it introduces definite restrictions in the use of real estate. In practice, when it comes to existing houses, such restrictions are not introduced, and no compensation claims for D arise. In this model, increased social costs for Level 2 (ΔTC2) should be interpreted as caused by methodological mistakes in the application of compensation principles prescribed by the law. The high level of ΔTC2 entices risky behaviour, in particular speculation. Neglecting to eliminate such behaviour increases the risk of erroneous court decisions, which perpetuate the faulty interpretation of the public intervention. Meanwhile, the latter defines the entitlements of opposing parties and should eliminate incomplete transacting and most costs of obtaining precise information, thus decreasing social costs.

Our research shows that an erroneous implementation of public intervention in Model I results in an increase of transaction costs by 25.18 million PLN, in Model II by 15.82 million PLN (ΔTC2), but in Model III, such costs do not occur because a significant airport alteration makes warrant D claims and A claims are not provided by the legislator.

## Conclusions

The research presented in the paper is the first empirical attempt to evaluate and compare transaction costs stemming from various legal frameworks regulating compensation to landowners subjected to increased aircraft noise. Performed comparative studies of increased transaction costs, which showed significant differences in their amount, depending on what legal model (Polish, English, or American) of public intervention was applied to the case of KTW. In all intervention models implemented without errors as to the object and scope of compensable loss, the level of TC3 is relatively low, ranging from 2.9 to 6.2 million PLN. The Polish and the American models, however, achieve environmental effects (acoustic renovation of buildings resulting in the protection of human health and quality of life improvement) that are not addressed in the English model. The latter provides for compensating value diminution, but without voluntary programs implemented by airports, no direct

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environmental result, in the form of acoustic insulation of homes, is achieved (Konowalczuk et al., 2021). The mentioned programs, particularly in markets with low institutional maturity, may have the advantage of being implemented without errors since payment of money for acoustic renovations is controlled by the airport however their scope may vary and not cover all necessary acoustic improvements. One should also note that a relatively low level of satisfying A claims in all three models at Level 3 (correct application of the intervention) raises doubts as to whether enough emphasis has been placed on the protection of human health, as opposed to the protection of capital (i.e. value of real estate). Consequently, a change in the legal approach in all three models should be recommended.

The research has some limitations. The empirical analysis is based on data from KTW airport. Thus, it is not certain whether the final conclusions may be directly generalised to Poland. More robust inference would be possible if compensation schemes for other regional airports were evaluated. Provided that the empirical data is available, expanding the scope of economic evaluation seems an obvious and promising direction for further research.

The research has significant policy implications. Important results concern the very high amount of increased transaction costs at Level 1 (ΔTC1). The research has thus shown the social inadequacy of public intervention because there is a great gap between individual expectations of the level of property protection and the actual protection afforded by the intervention. This conclusion also directs studies to areas described by Basu (2018), which require asking new research questions regarding the influence of law on people's behaviour and conditions for effective law enforcement. In this context, we must note that Polish laws on creating RUAs have not directed society to a point that could be viewed as equilibrium in game theory. However, having established that there is no justification for imitating foreign models in the considered neighbour conflict, it is important to continue research in order to ascertain whether and how to clarify or supplement Polish legal provisions in order to ensure their proper application by members of the society, experts and judges. We cannot exclude the need to recommend adopting a different approach to the matter by the Polish lawmaker in order to ensure that the public intervention is not only suited to the low institutional maturity of the analysed segment of the real estate market but also better fits social expectations and justified scope of property protection.

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## The contribution of the authors

Concept, M.H. – 40%, J.K. – 40%, I.F. – 10%, M.G. – 10%; literature review, M.H. – 50%, J.K. – 50%; acquisition of data, J.K. – 50%, I.F. – 40%, M.G. – 10%; analysis and interpretation of data, M.H. – 20%, J.K. – 40%, I.F. – 40%; conclusion and discussion, M.H. – 35%, J.K. – 35%, I.F. – 20%, M.G. – 10%.

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Iwona FORYŚ • Michał GŁUSZAK • Magdalena HABDAS • Jan KONOWALCZUK

# KOSZTY TRANSAKCYJNE NIESKUTECZNEJ INTERWENCJI PRAWNEJ OGRANICZAJĄCEJ WŁASNOŚĆ GRUNTÓW W SĄSIEDZTWIE LOTNISK: PRZYKŁAD POLSKIEGO SYSTEMU REKOMPENSAT W KONTEKŚCIE REGULACJI ŚRODOWISKOWYCH

STRESZCZENIE: Celem artykułu jest ocena skutków społecznych nieskutecznej interwencji prawnej polegającej na wprowadzeniu ograniczeń prawa własności nieruchomości mieszkalnych położonych w sąsiedztwie lotnisk. W artykule dokonano oceny prawa polskiego w kontekście celów środowiskowych ustawodawcy oraz porównano regulacje obowiązujące w Polsce z rozwiązaniami przyjętymi w prawie angielskim i jurysdykcjach amerykańskich. Społeczne i ekonomiczne skutki nieskutecznej interwencji prawnej obliczono dla studium przypadku lotniska KTW z wykorzystaniem informacji o strukturze i wartości zgłoszonych i zasądzonych roszczeń odszkodowawczych. Korzystając z tych danych, w części empirycznej artykułu oceniamy faktyczne koszty transakcyjne interwencji publicznej dla tego portu lotniczego, a także te, które powstałyby, gdyby zamiast modelu polskiego zastosowano amerykański i angielski model odszkodowawczy. Pozwala to wyjaśnić społeczno-ekonomiczne konsekwencje przyjęcia danego rozwiązania, a także ocenić, czy spełnia ono pożądane cele. Daje także możliwość oceny modeli w kontekście opracowania uzasadnionych prawnie i ekonomicznie odszkodowań dla właścicieli gruntów w pobliżu lotnisk dotkniętych hałasem lotniczym. Artykuł zawęża lukę w wiedzy prawno-ekonomicznej na temat rodzajów i skutków ograniczeń własności nieruchomości wprowadzanych w sąsiedztwie lotnisk.

SŁOWA KLUCZOWE: interwencja prawna, koszty transakcyjne, hałas lotniczy

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