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The influence of characteristics of estate developer's apartments on the chance of selling them

Arkadiusz Kuświk*, Łukasz Mach†, Łukasz Mikołajczyk‡, Marian Drymluch§

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Abstract

This article examines the influence of characteristics of new apartments in Opole on the chance of selling them within 83 days following putting them up for sale. The proposed period of the apartments' availability on offer was determined as the lower quartile of their selling time. The research was conducted on a sample of 520 transactions concluded in Opole on the market of estate developer's apartments in the years 2018–2019. In order to accomplish the goal, properties of logistic regression were used. Out of all the variables used, three quantitative features proved statistically significant: unit price of the apartment, price of one square metre and time necessary to cover the distance from the apartment to the city centre (the Town Hall). None of the qualitative variables used in the modelling, despite their significance for preferences on the part of purchasers, satisfies the assumptions on the level of significance. Although the quantitative and qualitative characteristics that were not included in the model are not specified, they find their reflection in the transaction price of one square metre.

Keywords: housing market, estate developer's market, logistic regression, TOM (time on market)

JEL: C13, C35, R21, R3

* WSB University in Wrocław; Narodowy Bank Polski, Regional Branch in Opole; e-mail: arkadiusz.kuswik@gmail.com.
† Opole University of Technology, Faculty of Economics Management; Narodowy Bank Polski, Regional Branch in Opole; e-mail: l.mach@po.edu.pl.
‡ WSB University in Wrocław; Narodowy Bank Polski, Regional Branch in Opole; e-mail: lukasz.mikolajczyk@wsb.wroclaw.pl.
§ University of Opole, e-mail: marian.drymluch@gmail.com.

1 Introduction

The fast rising turnover on the housing market in Poland in recent years, including that on the estate developer's market, inspires economists to make detailed analyses of dependences following in this area. The continuing high demand that surpasses the supply (NBP 2019, 2020a) can lead to a situation where future consumers will not have the possibility of real verification of a property being purchased. The premises behind buying one are not determined solely by hard measurable data, such as the price or floor space, but are also based on volatile subjective feelings that can change over time. Intuition, existing trends and economic cycles are not without significance in this respect, either (Ahir et al. 2020; Mach et al. 2020). Due to the considerable interest in new apartments, they are sold at successive stages of raising the buildings. Which stage they are sold at is to a great extent a derivative of individual features of the places and their surroundings. The beginnings of sales are characterized by a greater interest on the part of buyers due to a broader offer of apartments and – at the same time – by an increase in the developer's chances to adjust the offer to the expectations of the purchasers.

The lack of balance between the supply of new apartments on the market and the buyers' interest can be influenced by a number of factors, like wage earning migrations, change in the income structure and people's tastes, and low flexibility of supply of apartments (Kucharska-Stasiak 2016). What also matters is alternative forms of investment, including those connected with the level of interest rates (Guasoni, Wang 2019). In consequence, in the conditions of a shortage of apartments on the market, buyers must reckon with the fact that they will have to make a choice of the apartment on the primary market already at the stage of planning to erect the building. For the buyers this is a difficult situation inasmuch as at the moment of making the financial commitment (concluding the reservation, developer's or credit agreements), they do not possess the whole picture of the real estate they have purchased. Thus, purchasers are not able to make a physical verification of the apartment; what is more, the features can eventually differ to a certain degree from the accepted assumptions. An example of such a disparity can be the size of the apartment. The developer's agreement can admit relative differences between the plan of the apartment and the final execution of it. In certain respects purchasers must rely on their own spatial imagination and intuition. The above-mentioned limitations should be treated as a risk typical of contract decisions that the buyers give their consent to.

Persons deciding to purchase an apartment from the developer often make a choice between larger apartments located on the outskirts of the city and smaller ones situated in highly desired districts closer to the centre (Brzezicka et al. 2019). On the customer's demand the developer is obliged to present the information prospectus compliant with the agreement form found in the real estate developer's act.[1]

On the basis of the prospectus, the buyer obtains a good deal of information on the real estate developer, the apartment and the building (Figure 1). From the point of view of the purchaser, the individual part of the prospectus that contains the information on the following, seems the most interesting:[2]

a) price of one square metre of the apartment and its total price,

b) number of floors in the building,

c) the construction technology used,

[1] Act of 16 September 2011 on the protection of the rights of buyers of a dwelling or a single-family house (Journal of Laws No. 232, item 1377).

[2] Ibidem.

d) standard of finishing works,
e) number of apartments in the building,
f) number of garages and parking places,
g) available media and accessibility of public roads,
h) location of the apartment in the building,
i) size of the apartment and arrangement of the rooms, also determining the standard of finishing works.

The developer's act came into force on 29 April 2012. Until then the transactions on the developer's market had been burdened with a greater risk than nowadays, while the rights of purchasers were protected to a smaller degree. The standardization of the transaction process lowered the purchaser's worries, which contributed to the development of this sector of the market (Antczak-Stępniak 2019).

The superior goal of this article is to identify the features which significantly impact on the chance of selling new apartments within a given period of time. The ratio of the probability of concluding the transaction to the probability that the transaction will not be concluded should be understood as a chance. The selling time, in the understanding of this article, is the period measured from releasing the offer to the day of entering into the transaction. The assumption was accepted that apartments, the transactions of which are the fastest to conclude, possess characteristics that decide about the success of the sale by the developer. Therefore, these features will be of key importance to purchasers in the process of their decisions concerning the purchase of an apartment. In the publication, the properties of logistic regression were used as methods allowing to indicate the chance of achieving a success. In this study, success is understood to be the sale of an apartment within the assumed period of time. The research hypothesis was formulated that characteristics of apartments, in particular those connected with the height of the selling price, influence the formation of the chance to enter into a transaction relatively quickly. The research was conducted on a sample of transactions of developer's apartments concluded in Opole in the years 2018–2019.

2 Literature review

The real estate market has become the object of interest of many authors, which results not only from the rank that it holds in shaping the economy, but also due to the fact of satisfying the basic needs of members of society. The decision to purchase an apartment is one of the most important decisions in life. Apartments are connected not only with material value, but also with an emotional state which forms along with the time of living in it. Undeniably, on the estate market economic and social dimensions intertwine which are frequently of individual character and remain connected with a concrete purchaser or seller.

The time of exposing a property on sale offer has been dealt with by authors in a variety of aspects. In their work, Glower, Haurin and Hendershott (1998) studied the influence of sellers' motivation on the selling time and selling price. On the basis of a questionnaire survey run among sellers of houses, they drew conclusions as to the non-uniform structure of motivation to enter into a transaction. The authors observed that sellers who had already planned the date of moving out were inclined to make greater concessions regarding the price in return for shortening the sale time. The research results suggest that highly determined owners are able to reduce the time of exposition of the house to

about 30%; on the other hand, in order to achieve this they must be willing to make price concessions. It was proved that untypical houses, offered at a higher price, take longer to sell on average.

Knight (2002), in his publication, raised the important question of manipulating prices during the time of the property being on offer and the impact on the selling time. Information on changes in the price are often unavailable, especially when it concerns raising the base amount. The author observes that houses undergoing big relative changes in prices, while remaining on offer, need a longer time to sell and ultimately are bought at a lower price. As the cause of fluctuations of the offer price, Knight points to, among others, overstating the original price of the estate due of its wrong pricing, the amount requiring corrections with time. Works of other researchers confirm the fact that the degree of overstating of the original price translates directly into prolongation of the time of waiting to sell the estate (Cirman, Pahor, Verbic 2015; de Wit, Van der Klaauw 2013). Analogous conclusions were drawn with regard to the German market of rental with reference to the height of rental rates (Cajias 2018).

Smith, Gibler and Zahirovic-Herbert (2015) showed an interest in sellers' behaviour in the case of failing to realize the sale goals within the assumed time. They note that properties that stay on offer for a longer time are perceived negatively by potential buyers, who start treating them with suspicion or distrust, and the very investment itself becomes unattractive in their evaluation. They pointed out that in such a situation the owner of the dwelling has a few options. First, they have to decide if they still want to make the sale offer available, or to again immediately put it up for sale as a new item with the same or another estate agent. Another possibility is to withdraw the offer from the market for some time, before once again putting it up for sale. According to these authors, in order to achieve the maximum profit, it is advisable to again put the property up for sale with the same estate agent.

Anglin, Rutherford and Springer (2003) analysed the relation between the price featuring in the offer, the selling price and the time of the property remaining on offer. In their work, they state that it is not possible to point to a direct compromise between the selling price and the time of exposing the property in the offer. The researchers emphasize further that the models that are formed are to a great extent dependent on the accepted research methodology and the quality of data.

Filippova and Fu (2011) and Filippova and Rehm (2014), in their works, focused on the time of waiting for the property to be sold in the context of surrounding external conditions. In one of their publications, they analysed the time of exposition of the offer as a derivative of the currently existing economic cycle. The results indicate that the situation in the market impacts, to a considerable degree, on the time of availability of the offer. In the conditions of a favourable economic cycle, the price of properties that are not sold for a longer period is lowered as a result of "being branded" (see Smith, Gibler, Zahirovic-Herbert 2015). On the other hand, within the period of an economic slump, the long time of waiting does not substantially translate into a drop in prices. Analogous conclusions were drawn with reference to opposing markets: dynamically developing and slowing down. Again it was confirmed that the prolonged time without entering into a transaction results in a lowering of the price.

An important issue raised by Li and Chau (2019) is an analysis of the sale process of new apartments from the point of view of securing developer's interests. On the basis of the primary market of apartments based in Hong Kong, these authors analysed factors which influence the decision by the developer concerning the advanced sale of the apartments. It turned out that developers – in the first place – make use of properties of the pre-sale system as a form of security in fear of future fluctuations in prices. On the other hand, revenues from advance sales allowed smaller estate developers to partially finance successive investments. For obvious reasons this problem did not concern the major actors on the market.

A study which comes close to the one presented in this publication was conducted in the secondary market in Warsaw (Batóg, Foryś 2011). Then, the variables that impact on the tempo of sale in a vital way proved to be the following: the unit price of the apartment and its space (square footage). The researchers concluded that the above testifies to the weak financial condition of purchasers. The study did not take into consideration the factor of evaluation of the standard of apartments on offer, a variable which is subjective and is customarily presented on the ordering scale. However, attention needs to be paid to the fact that in the developer's market, the standard of an apartment is not as differentiated as in the secondary market and, at the same time, does not play such a vital role in the decision-making process. All-accessible Internet portals dealing with the turnover of property, including real estate agents, enhance a better and more effective evaluation of the technical state of dwellings (visual assessment: in photos or directly on the spot).

The majority of the above-mentioned publications refer to the expected time of exposition of apartments understood as the time measured from the date of putting the estate up for sale (releasing the offer) to the date of its sale. In this study the authors do not concentrate on the foreseen time of exposition, but on indicating opportunities of selling within a defined period of time. What is more, none of the studies referred to above concerned the sale of new developers' apartments. The characteristics of the sale of a developer's investments is considerably different, since it concerns a set of apartments sold at the same time and in the same locality, most often presenting the same standard of finishing works and a similar price of one square meter. The authors of this study abstract from the marketing issues relating to the sale of apartments and focus strictly on their individual characteristics as variables impacting on the chance of selling them. The unique property of the research is the analysis of the regional developers' market in Opole.

3 The socio-political environment of the developers' market in Opole – the utilitarian aspect of placing the research

While examining the transactions connected with the sale of apartments in the developers' market, the time series for Opole in the years 2018–2019 were used. Opole is the capital city of Opole Voivodeship, the smallest province in Poland. At the end of 2019, the number of inhabitants in Opole exceeded 128 thousand, which is the effect of extending the city's administrative boundaries at the beginning of 2017, consisting in incorporation of five neighbouring communes.[3] Simultaneously, the number of residents grew by over 9 thousand people and the area of the city increased from 97 square kilometres to 149 square kilometres.[4] Since 2000, the number of residents has been steadily dropping in favour of suburban areas, which have become the city's 'bedroom' districts. The decline in the population was also influenced by other factors, including a declining birth rate and wage-earning migration abroad (Kubiciel-Lodzińska 2020). The expansion of the city's area augmented interest in new land on the part of local estate developers. Among all of the analysed transactions in the empirical part, around 12% were concluded with reference to newly-incorporated areas. In 2019, aiming to implement organizational improvements, the number of districts of the city was reduced from 29 to 13.

[3] The application to have the boundaries of the City of Opole changed, The City Council, Opole 31 March 2016.
[4] Local Data Bank, Chief Statistical Office, https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica, accessed: 19 September 2020.

Average earnings obtained by Opole residents in the years 2018–2019 were among the highest in the whole province. In 2018, average wages amounted to PLN 4,797 (before tax) and one year later they increased by 7%, reaching the level of PLN 5,148 (before tax). At the same time, the core inflation rate grew by 2.3% (YOY) within the examined period, which means a real growth in residents' earnings. The increase in average wages was accompanied by a drop in registered unemployment, which amounted to 3.2% and 2.7% for the years 2018 and 2019, respectively.[5] In the period under analysis, the mean transaction price of one square metre in the developers' market was rising more slowly than wages, which translated into a rise in the availability of offered apartments, measured as a relation of the average monthly wages to the mean price of one square metre of floor area. In 2018, Opole residents were able to purchase on average 0.93 square metres of floor area for their average wages, whereas the following year that was about 0.96 square metres.

High indexes of economic cycles, with the maintenance of low interest rates,[6] augmented the activity of developers, who came to offer an alternative form of allocation of financial resources. Relatively low rates of return from bank deposits as well as Treasury bonds kept up a high rate of developers' activity in the real estate sector. In both the primary and secondary housing market in Opole, some of the properties were purchased with the aim of making an investment or securing the value of the capital. The purchase of a property intended to let creates an opportunity to obtain continuous streams of income in the form of rents, irrespective of the market value of the property changing over time (Gołąbeska 2018). At the same time, properties were bought with the intention of quickly re-selling and obtaining an income as a result. In the case of the secondary market, it is most often connected with refreshing the apartment prior to the re-sale, whereas as regards the primary market, the standard of the property is prepared for living in it.

In the years 2018–2019, residential construction in Opole reached record values both as regards the number of issued building permits and that of apartments which had been commissioned. The volume of permits issued rose by 71.1% (YOY), reaching the record number for Opole of 1,415 building permits intended for sale or rent. Also, the number of commissioned apartments remained at a very high level and increased in 2019 in comparison with the preceding year by 84.7%, i.e. from the level of 569 to 1,051 apartments.[7] High demand indexes provided income to developers at the level of about 20%. In this way, they managed to transfer, to a great extent, the rapidly rising costs of construction onto their clients (NBP 2020a).

From the beginning of 2018, banks noted continuing growth in interest in home loans, with demand for this type of loan being the highest in 10 years in the first quarter of 2018. The chief reason for the rise in demand for loans in this period was the release by Bank Gospodarstwa Krajowego of the last portion of financing within the state-run support programme 'Mieszkanie dla młodych' [Home for the Young][8] (NBP 2018a). As part of the prudential policy in the third quarter of 2018, the criteria of granting loans were tightened by banks, with the simultaneous lowering of the margin income (NBP 2018b). The tightening of the requirements of granting loans continued until the end of 2019. In the meantime, the terms of loan agreements for new borrowers changed slightly, while in the fourth quarter of 2019 the mean level of the margin was substantially raised (NBP 2020c). The average real

[5] Ibidem.
[6] In the years 2018–2019, the reference rate of Narodowy Bank Polski stayed at the level of 1.5%.
[7] Local Data Bank, Chief Statistical Office, https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica, accessed: 19 September 2020.
[8] The state programme launched by way of the Act of 27 September 2013 on state aid in the purchase of the first flat by young people.

interest rate of new home loans granted in the years 2018–2019 fluctuated between 4.56% and 4.82%.[9] According to the assessment made by Narodowy Bank Polski, in 2019, about 30% of the transactions of purchase of new apartments were financed from bank loans (NBP 2020a).

State-run programmes are of marginal significance in the Opole real estate market, which results from the barrier posed by the requirements as regards the height of the transaction price for one square metre of an apartment. From the launch of the 'Home for the Young' programme in 2014 until its termination in 2018, the assessments of the replacement cost of one square metre of usable floor space established in individual quarters did not exceed the median of transaction prices of one square metre in the primary market (NBP 2020b). The requirement to obtain support in the framework of the project did not exceed the fixed value of the replacement cost of one square metre. Differences between transaction prices and fixed thresholds testify to a negligible possibility of participation in the programme of Opole-based purchasers of apartments. A similar situation concerns the programme 'Mieszkanie na start' [Housing for the Start], functioning since 2019. In the case of this programme, residents can apply for support in the financing of the rent in a new building. The level of the support depends on the replacement cost of one square metre of the usable floor space and the size of the household. The state-offered support can be used solely in communes which have signed an agreement with Bank Gospodarstwa Krajowego on application of supplementary payments.[10] As regards Opole, such an agreement was concluded in July 2020. The above-described form of aid is poorly developed, chiefly due to the lack of investors willing to realize investments with a long-term pay-back period. It can be supposed that property developers prefer the "try out and sell" business model with a relatively quick revenue in comparison with profits obtained from a collection of rents.

4 Research methodology

In the decision-making process behind the purchase of an apartment, the purchasers take into consideration the features of apartments that are described in the work (Mach 2014). Those of a physical, economic, legal and environmental nature were adapted by the author for the dimensions of macro-, micro- as well as ultra-characteristics. The above-mentioned aspects, in a direct or indirect way, impact on the pricing of a property and also the purchasers' motivations. It needs underlining that the above dimensions are characterized by a varying force of influence on the attractiveness and value of apartments, and – at the same time – the degree of purchasers' interest. In the present article, it is the ultra-characteristics of property, that is ones determining the specifics of a concrete apartment, which have been concentrated on.

The source of data used in this study is Narodowy Bank Polski's own database, gathered and updated by local analysts.[11] The calculations were made on the basis of 520 transactions which were entered into in the developers' market in Opole in the years 2018–2019. All in all, the transactions

[9] https://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/oprocentowanie.html, accessed: 29 September 2020.

[10] Detailed information was defined in the Act of 20 July 2018 on state aid in incurring housing expenditures during the first years of renting an apartment.

[11] On the basis of Art. 30 of the Act of 29 June 1995 on public statistics and the Decision of the Council of Ministers, concerning the programme of statistical research within public statistics for the given year, property developers submit to relevant branches of Narodowy Bank Polski filled in questionnaires NBP-NM/RP, which are available at: https://www.nbp.pl/home.aspx?f=/publikacje/rynek_nieruchomosci/ankieta.html, accessed: 28 September 2020.

used make up about 1/3 of all the agreements concluded in Opole in the primary market in the examined period. Basing on the model of logistic regression (Formula 1) for the dichotomous variable Y (dependent), the assumption was accepted with the following values:

1 – for 25% of apartments which were sold the fastest (the lower quartile of selling time),

0 – for apartments, the selling time of which took longer than the 25% fastest transactions.

The exposed quartile was chosen on the basis of distribution of the frequency counts. It was accepted that it represents a relatively short selling time against the background of all the transactions concluded in the analysed period. The variable Y, before taking the binary form, was calculated as the difference between the date of entering into the transaction and the date of commencing the sale by the developer (the value counted by days). As the date of entering into the transaction one needs to understand the date of concluding the developer's agreement or the agreement of isolating the apartment and transferring the property; a reservation agreement does not constitute a sale agreement.

$$P(Y=1 \mid x_1, x_2, \ldots, x_k) = \frac{e^{\beta_0} + \sum_{i=1}^{k} \beta_i \cdot x_i}{1 + e^{\beta_0} + \sum_{i=1}^{k} \beta_i \cdot x_i} \tag{1}$$

where:

β_i, $i = 0, \ldots, k$ are regression indexes,

$x_1, x_2, \ldots, x_k$ – dependent variables of a measurable or qualitative character.

In order to assess the regression indexes and the best fit of the model to observation, the method of maximum likelihood (MML) (Rossi 2018) was used. Approximation by means of the method of least squares (MLS), applied for linear multiple regression models, is not possible to use due to the assumption of constancy of variance (Permai, Tanty 2018; Pitarch, Sala, De Prada 2019), which – in the case of the dichotomous variable Y – is not satisfied. The main aim of the MML is to have values for which the reliability is the highest (likelihood of occurrence of the incident), and – at the same time – fitting the model to observation is best accepted as estimations of the assessed parameters (Mach 2010; Stanisz 2016).

The assessed values of the model should be subjected to substantive and statistical verification. The former means compliance of signs at the parameters of the model with expert knowledge. In the situation in which we know that the rise in the value of the independent variable causes an increase in the value of the dependent variable, one ought to expect a positive sign at the parameter; in the opposite situation, we can suspect inconformity of the model with output assumptions (Stanisz 2016). One of the most important parameters of statistical estimation is satisfying the condition of significance of variables in compliance with the accepted assumptions of trust (in economic research trust is accepted at the level of 95%). As part of the statistical verification an assessment of the level of fit of the model to observation needs to be conducted, as well as the quality of prediction on its basis. To evaluate the fit of the model, a good number of measures can be used, including those of Pseudo R^2 proposed by: Delle Site et al. (2019); McFadden (1973), Cox, Snell (1989), Hemmert et al. (2018), Nagelkerke (1991), or Pseudo R^2 counting (Kasprzyk 2018). In the study, the following indexes were applied: Pseudo R^2 counting, Cox-Snell and Nagelkerke.

A significant measure interpreted in logistic regression is the odds ratio (Formula 2), which should be understood as a ratio of the chance of occurrence of the incident in the given group and the chance of occurrence of the same incidence in the control group.

$$OR_{AxB} = \frac{P(A)}{1-P(A)} : \frac{P(B)}{1-P(B)} \tag{2}$$

5 Preparation of the research material

The collected input data contained 520 records of transactions relating to property which was concluded in the primary market in Opole in the years 2018–2019. The analysis covered solely the apartments that appeared on the offer of sale not earlier than at the beginning of 2018. Out of all the transactions, two were entered into before the official commencement of the sale (Figure 2). These cases were treated as untypical and were not included in the further research process.

There were 19 transactions which were removed from the input data, since they did not satisfy the assumptions behind the appropriateness and completeness of data. In the next step of the preparation of research material, applying formal criteria of identification of outlier transactions, the diagram shown in Figure 3 was drawn. The non-outlier range of prices of one square metre remained within the range between PLN 4,349.65 and PLN 6,125.08. Twelve observations remaining below the lower threshold and 20 cases beyond the upper one were removed. An identical verification was carried out for the unit price of an apartment and usable floor space, as a result of which all the observations for which the unit price exceeded PLN 452,000 (6 observations), as well as those of the usable floor space greater than 83.18 square metres (2 observations) were removed.

Eventually, the foundation of the conducted assessments was a database consisting of 459 transactions concluded in Opole in the years 2018–2019, out of which the following explanatory variables were isolated:

a) quantitative:
- X1 – unit transaction price of the apartment in PLN,
- X2 – transaction price of one square metre of the apartment in PLN,
- X3 – price of a storage area assigned to the apartment in PLN,
- X4 – price of the garage in PLN,
- X5 – usable floor space of the apartment in PLN,
- X6 – external space in square metres (balcony, terrace, loggia),
- X7 – storey on which the apartment is situated,
- X8 – number of rooms,
- X9 – number of stories in the building,
- X10 – distance from the townhall in kilometres,
- X11 – time necessary to reach the townhall in minutes;

b) qualitative:
- X12 – type of kitchen (open kitchen, light kitchen),
- X13 – garage or parking space, if assigned to the apartment – YES, otherwise – NO,
- X14 – storage area, if assigned to the apartment – YES, otherwise – NO,
- X15 – garden, if assigned to the apartment – YES, otherwise – NO,

X16 – evaluation of the location of the apartment in the building (of little attraction, average, attractive),[12]

X17 – escalator, if there is one in the building – YES, otherwise – NO.

The dependent binary variable takes the value of 1 for 25% of the apartments which sold the fastest, the remaining ones taking the value of 0. The sale time of the 25% of the fastest transactions did not exceed 83 days (Q1). The histogram in the division into 22 classes (counted as a rounded results of the element of the number of observations) is presented in Figure 4.

The database included the variable determining the evaluation of location in which the investment is sited (little favourable, average or favourable) due to the fact that all the developers evaluated the locality as favourable (the developers' subjective assessment), the authors decided to replace this variable by two quantitative variables: the distance from the townhall in kilometres and the time taken to reach the townhall in minutes (X10 and X11).

The variable Y, before transforming into the dichotomous one, was characterized by the average time of entering into transaction at the level of 205 days. It took 8 days for the fastest apartment to be sold, whereas the longest exposed apartment stayed on offer for 578 days. Almost 1/3 of the apartments (32.1%) sold within the first 100 days after putting them up for sale, while slightly over half of the apartments (52.9%) took 200 days. Every fourth apartment remained on offer longer than 300 days. A more detailed division of the numerousness of the dependent variable is presented in Table 1. The histogram and the statistics of the amount of time necessary for concluding transactions became the premise for the authors to determine the lower quartile of sale time of apartments as a variable of success (1) for the transformed variable Y.

Due to the obvious connection between variables X1 (the unit transaction price of the apartment in PLN), X2 (the transaction price of one square metre of the apartment) and X5 (the usable floor space in square metres), the authors decided to remove variable X5 from the modelling. This variable was eliminated because of the high value of the Pearson correlation index (Afyouni, Smith, Nichols 2019; Maddala 2013) with the number of rooms (X8) and the price of the apartment (X1). The independence index amounted to 76% and 94%, respectively (Table 2). Additionally, in the modelling, the price of storage area assigned to the apartment (X3) was not used, since its values were given only in the case of 63 observations, the number being too low to maintain the satisfying quality of the model. The unit transaction price and the price of one square metre in the market of apartments in new buildings are characterized by a low level of interdependence. This is caused by including in the price of one square metre some hidden values that raise the standard of apartments. The varied price of one square metre can be a derivative of the area of terraces or gardens, a garage included in the price of the apartment, extra modifications ordered by the purchaser, access to culture and recreation centres, etc.

The analysis of Pearson correlation indexes between the non-transformed dependent variable Y and the quantitative independent variables was carried out, as well as between these explanatory variables (Table 2). In the process of verification, the variables which did not satisfy the conditions of collinearity were removed. Ultimately, of the quantitative variables the following were taken into account for the needs of modelling:

X1 – unit transaction price of the apartment in PLN,

X2 – transaction price of one square metre of the apartment in PLN,

[12] The evaluation of the location of the apartment, which was declared by the estate developers, is primarily of a subjective character.

X4 – price of the garage in PLN,
X11 – time necessary to reach the townhall in minutes.

The qualitative variables were characterized by a high structural imbalance. For variable X12, proportions of answers amounted to 97.6% to 2.4% for the open kitchen, which is understandable due to the existing trends in housing construction industry nowadays. Around 90% of apartments have access to a lift; the same number of apartments were purchased together with a parking space or a garage, which is also typical of new buildings. Substantial shortage of data occurred with reference to information on the residents' storage spaces assigned to the apartment or gardens (X14, X15), 85 and 307 lacking items, respectively. In view of the lack of variability of qualitative features and severe shortage of data, it was decided to resign from taking these variables into account in the further process of modelling.

6 Results of logistic regression

Variable X4 did not fulfil the assumptions of significance (p = 0.11) and was removed from the model. The results of estimation for the remaining variables X1, X2, X11 were presented in Table 3. The final model takes the form expressed by Formula 3:

$$P(\mathrm{Y}=1 \mid \mathrm{X1},\ \mathrm{X2},\ \mathrm{X11}) = \frac{e^{9.954118 - 0.000011 \cdot \mathrm{X1} - 0.001806 \cdot \mathrm{X2} + 0.145999 \cdot \mathrm{X11}}}{1 + e^{9.954118 - 0.000011 \cdot \mathrm{X1} - 0.001806 \cdot \mathrm{X2} + 0.145999 \cdot \mathrm{X11}}} \tag{3}$$

where:
X1 – unit transaction price of the apartment in PLN,
X2 – transaction price of one square metre in PLN,
X11 – time necessary to reach the townhall in minutes.

The value of statistic p for the whole model amounted to below 0.05, which confirms the justifiability of making use of applied variables in the modelling, in comparison with the very absolute term itself. On the basis of the signs at the parameters, we conclude that in the case of a rise in both the unit price of the apartment (X1) and that of one square metre (X2), the chances of concluding the transaction within 83 days decrease; conversely, the longer time to reach the townhall (X11) raises the chance of a quicker sale.

The value of probability p for the Hosmer-Lameshow test of goodness of fit amounted to 0.135; since the value is greater than 0.05, there is no foundation to reject the zero hypothesis that says that there do not occur differences between the observed and predicted values for variable Y (Hosmer, Lameshow 2000; Qiu et al. 2019). The model is adjusted to the observation on the accepted level.

Table 4 shows comparisons between the observed and predicted values. On the basis of this classification, the values of Pseudo R^2 counting were determined on the level of 68%. The odds ratio of right classifications in proportion to the wrong ones amounted to 2.92, a result over 1 meaning that the calculated values of the classifications are better than those which can be expected by chance. The values of Pseudo R^2 of Cox-Snell and Nagelkerke amounted to 13.38% and 18.59%, respectively.

Values of the unit odds ratio nearing 1 testify to only a slight impact of a rise in the values of the variable by a unit on the probability of occurrence of an incident for which Y assumes the value of 1. The results of the estimation are substantively compliant. The interpretation that a rise in the price of the apartment or in the price of one square metre by PLN 1 should not considerably decrease the chance for the apartment to be sold within the first 83 days is justified. For a better illustration of the influence of a change in the price of the apartment and in that of one square metre, the authors decided to accept new units for the variables, namely for X1 – the unit of PLN 10,000, for X2 – PLN 100, X11 – left without changing the unit (in minutes). The repeated assessment of the value of the parameter of the variables and the odds ratio are presented in Table 5, while the other elements of the statistics have been retained unchanged.

On the basis of the odds ratio in Table 5, we are able to infer about the force of impact of an increase or decrease by a unit of independent variables on the dependent variable, taking the assumption of stability of the remaining variables (ceteris paribus). According to the assessed model parameters, a drop in the price of the apartment by PLN 10,000 raises the chance of its sale within 83 days by approx. 12%. The simulation of a change in the price to the benefit of the purchaser by PLN 60,000 raises this chance by twice as much, whereas the same assumption for PLN 100,000 does so by approx. three times as much in comparison with the chance of selling the apartment without changing the price. We come to deal with the opposite situation in the case of an increase in price. Raising the price of the apartment by PLN 10,000 decreases the chance of sale within the time for which Y = 1 by approx. 10%, a rise in the price by PLN 60,000 and PLN 100,000 decreases this chance by approx. 50% and approx. 66%, respectively. Interpreting the data presented in Table 5, we can note that a drop in the price has a greater impact on increasing the chance of entering into a transaction than a rise in the price has of diminishing the chance of sale. The above testifies to the fact that a drop in the price generates a stronger stimulus in the decision-making process to buy an apartment rather than a rise in the price discourages from buying one. The values proposed in the prognosis are selected examples which display the cross-section of differences in the price of a real estate for quite extreme results (a change in price between PLN 10,000 and PLN 100,000). On the basis of the model, the interested parties can assess the values of chances with reference to their own needs. The authors' study confirms the theses to date on the influence of the price on the time of exposition of apartments on offer; still, the time of exposition is not estimated, the chance of selling the apartment in a given period being indicated only.

Interpreting the obtained results for variable X2, we can conclude that a drop in the price of one square metre by one unit raises the chance of concluding the transaction within 83 days beginning with the day of putting the estate up for sale by about 20%. A drop in the price of one square metre by PLN 400 increases doubles the chance for the transaction, while the chance for the transaction is six times greater in the case of a decrease in the price by PLN 1,000. In the examined period, apartments of smaller sizes achieved higher prices, which confirms the negative result of the correlation between usable floor area and the price of one square metre (-0.202). Purchasers are inclined to accept higher prices of one square metre in the case of smaller apartments because of the lower total price of the apartment. Choosing apartments of a smaller usable floor area, to a certain degree, can be caused by limited financial means on the part of purchasers or the lack of availability of a necessary housing loan. Apartments of smaller metric areas are more willingly chosen by investors, especially if they are located close to academic centres and the target tenant are students. Similarly, as in the case of the unit

price of the apartment, a drop in the price of one square metre is characterized by a stronger influence than a rise in the price of one square metre on the relation selling price – selling time.

The isolated variable X11 (time necessary to reach the townhall in minutes) was adapted by the authors as an averaging of the evaluation of location, a variable which could not be used in the modelling due to the homogeneity of this characteristic. On the basis of the estimation of the parameters in the model, we can conclude that a rise in the time to reach the townhall from a unit raises the chance of a relatively quick sale by approx. 16%. In the case of 5 minutes, the chance is twice as high. In compliance with the assessed parameters, the shorter the time necessary to get to the centre, the lower the chance of selling the estate within 83 days, which is undoubtedly connected with higher prices of estates localized nearer the centre.

The presented results cannot serve the purpose of estimating the chances of selling apartments in any markets because of limitations in the sample and the regional characteristics of Opole. This confirms that the structural property of the real estate market is its local character. However, the usability of the indicated chances should be considered in the context of comparisons with other local estate markets and their specifics. Thus, the study presented here can provide a useful reference point for developers who diversify the risk through realization of investments in different regions of Poland.

7 Conclusions

The aim of the article was to identify those characteristics of apartments, which – to a significant degree – impact on the sale of property developer's apartments within a relatively quick time. The goal was successfully achieved: the research hypothesis was confirmed, in compliance with which it is the price that is one of the most vital variables influencing the chance of selling the property. The research was conducted on a sample of 520 transactions relating to new apartments, which were concluded in Opole in the years 2018–2019. Out of the seventeen variables used, three were qualified as significantly impacting on the examined variable. The unit price of the apartment, transaction price of one square metre and the time necessary to reach the centre proved to be key variables. There is no doubt, however, that they are not the sole features that reflect purchasers' preferences, yet – as the only ones examined with the use of logistic regression – they were qualified to build the model. There are several factors that can cause such a situation, one of them being the characteristic of the developer's market in which the standards of constructing apartments do not significantly differ from one another in different investments. Then, purchasers perceive potential apartments chiefly through the prism of their price. Another reason which the research results point to is the low quality of non-measurable data that do not reflect the purchasers' subjective evaluation. The best example of this situation is the developers' assessment of the location of apartments, regarding which, the majority of developers unanimously point to the favourable location of their investments.

From the point of view of the model, the values of the chances obtained for the increases/decreases in the prices in the empirical part are correct. Still, it is justifiable to take into account other questions that had an influence on the concluded transactions. First, the analysed data are defective as they lack information on the difference between the base price and the transaction price, and also on the heights of individual changes in the price and the time of their occurrence. There exists a significant

difference depending on whether the base price was lowered after the first month of its exposition in the offer or after a year, or if any change followed at all. In some of the cases, the price could be raised with respect to the initial value. In his research on changes in prices, Knight points to the fact that around 40% of transactions involving houses are concluded at a price other than the initial one, which is the effect of negotiation or a change in the price featuring in the offer. In his studies, transactions entered into at lower prices obtained an average income on the level of 3% in comparison with the expected 12%, which testifies to the time-price dependence. The prices of houses were lowered, on average, after 105 days following putting the property up for sale and then were sold, on average, after around 45 days (Knight 2002). The conducted research confirms Knight's and other authors' (Anglin, Rutherford, Springer 2003; Batóg, Foryś 2011; Filippova, Fu 2011; Filippova, Rehm 2014; Glower, Haurin, Hendershott 1998) conclusions on the significant impact of the price on the selling time. Naturally, for the developer lowering the price equals a drop in the profit margin, therefore the reasonableness of this action should be considered as an individual investor's decision-making process. Additionally, in the process of deciding on the purchase of a property, one needs to take into consideration the psychological aspect on the part of purchasers who – having followed the available offers on the market – are relatively well-aware of changes in the price of the real estate which they are interested in (Cajias 2018; Cirman, Pahor, Verbic 2015; de Wit, Van der Klaauw 2013). The drop in the expected price of the apartment impacts on the purchasers' perception. In connection with the above, the process of lowering the price can be considered in the context of the law of diminishing marginal utility. Up to a certain price level the lowering is satisfactory for the customer; nevertheless, after exceeding an individual price limit, the effect is adverse: a too large decrease in the price featuring in the offer causes the interested party to become distrustful and suspicious of the real value of the property (standard of finishing, surroundings, a latent defect, etc.). The influence of this happening can substantially extend the sale process and most frequently occurs in the case of a considerable inflation of the primary price. The research accomplished in the present publication confirms the theses to date on the influence of price on the time of exposition of the apartment in the offer; however, it does not estimate the selling time, pointing only to the chances of selling new apartments within a specified period of time.

The characteristic introduced by the authors, which measures the time necessary to cover the distance from the place of investment to the centre of Opole, turned out to be not without significance. This variable, due to its character, was to represent the averaged evaluation of the location of the investment in the structure of the city. It should be borne in mind that the authors defined only one place (the townhall) as the point of reference. Such an assumption could be accepted because of the relatively small area of the city itself. In the event that the relevant research is carried out in larger cities, agglomerations or metropolises, a greater number of places of key importance to the residents should be marked out. Taking into account in the model the variable measuring the time necessary to reach the townhall expands the investigation (Batóg, Foryś 2011), in which the impact of features of apartments on offer in the Warsaw secondary housing market on the tempos of selling them was checked, while the variables of vital nature proved to be the size of the apartment and the price of one square metre. In compliance with the results of assessed parameters, the longer time taken to reach the centre increases the chance of selling the apartment within 83 days following it being put up for sale in the sale offer. This contradiction ought to be interpreted in two aspects: firstly, the lower price of apartments located on the outskirts of the city; secondly, the aspect of preferences of purchasers who

want to get away from the bustle of the city centre and are looking for an alternative on the outskirts. Also, investments which are sited in newly-incorporated areas of cities influence the characteristic, although the distance to the centre grows longer.

The results confirmed the fact that it is the price that plays the deciding role in the decision--making process on the part of the purchaser. Simultaneously, it was possible to assess the impact of an additional variable, that is the distance of the investment from the city centre, on the issue under analysis. Unfortunately, none of the examined qualitative characteristics, chiefly as a result of the shortage of data or a lack of changeability of the feature, was qualified to the building of the model. It is vital that qualitative characteristics are reflected in the transaction price of one square metre in a direct way. Additional information on apartments, which concerns such aspects as a garden, storage space assigned to the apartment, external space (balcony, terrace, loggia, etc.) translate into different transaction prices of a square metre with reference to apartments of a similar standard of finishing. In the prospective research to be developed, special emphasis should be laid on a rise in usability of qualitative characteristics and also on isolating other features that can explain increases or decreases in the chance of entering into transaction as regards apartments in the property developers' market.

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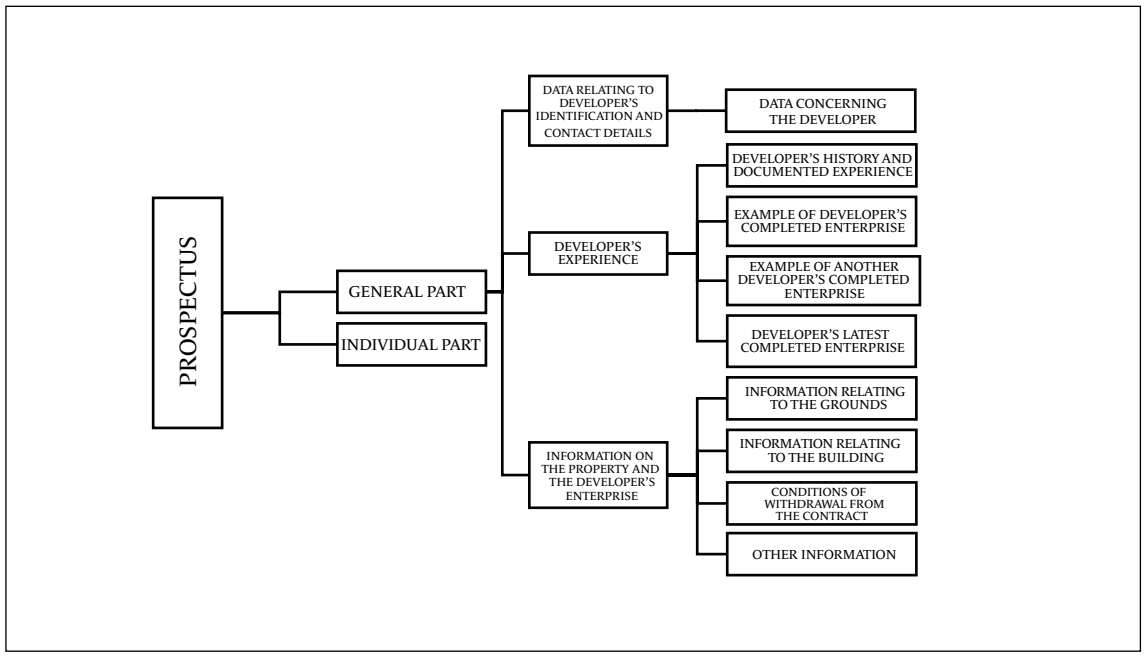
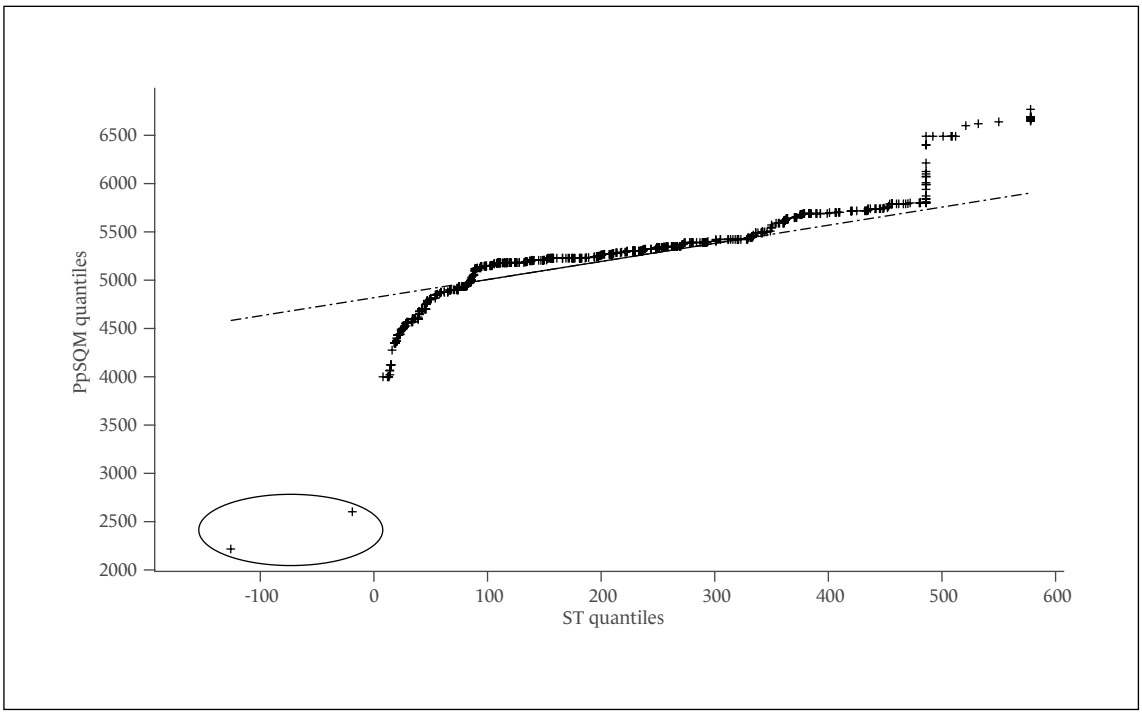
Appendix

Figure 1
Schema of a prospectus



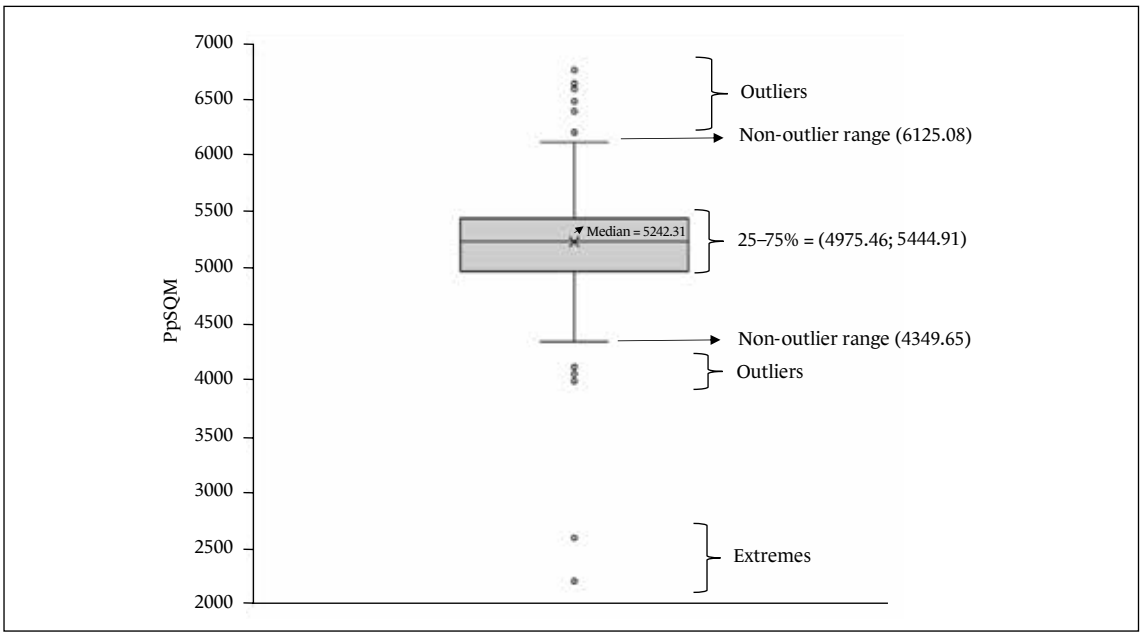
Source: authors' own elaboration on the basis of the attachment to the Act on the protection of the rights of buyers of a dwelling or a single-faimly house.

Figure 2
Quantile scatter diagram of the selling time from the price of one square metre, with indication of the transactions concluded before the official launch of the sale



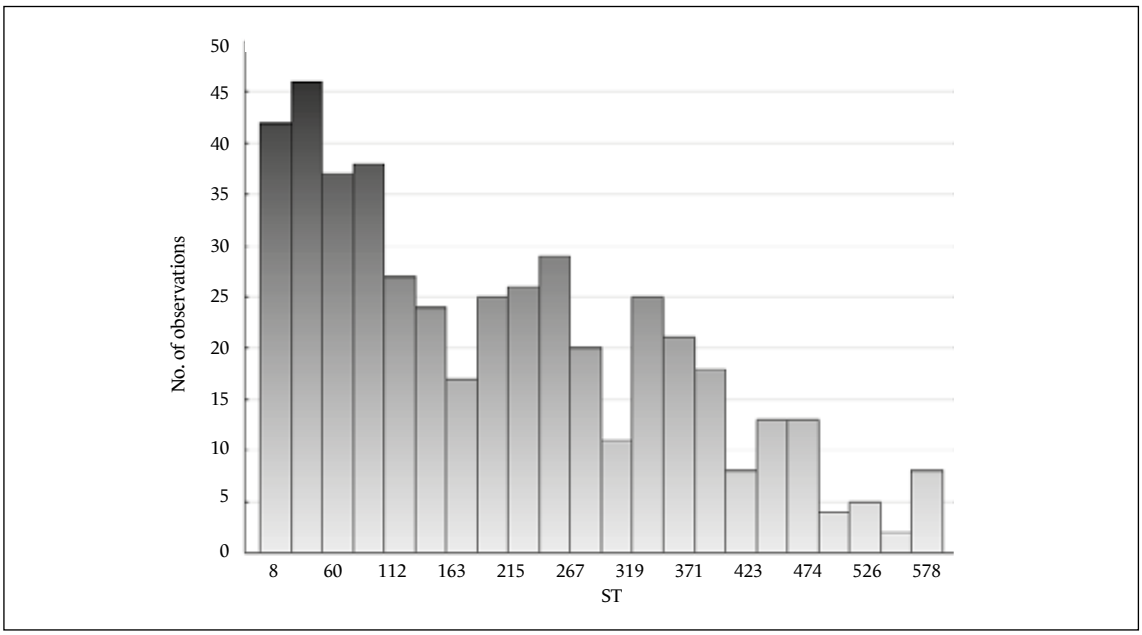
Source: authors' own elaboration.

Figure 3
Box plot of the price of one square metre with outlier and extremal data



Source: authors' own elaboration.

Figure 4
Histogram of the time of concluding a transaction (in days)



Source: authors' own elaboration.

Table 1
Statistics of frequency counts for the time of entering into a transaction in days

Range of days	No. of transactions	Accumulated no. of transactions	% of all transactions	Accumulated % of transactions
0 < x ≤ 100	148	148	32.10	32.1
100 < x ≤ 200	96	244	20.82	52.9
200 < x ≤ 300	90	334	19.52	72.5
300 < x ≤ 400	75	409	16.27	88.7
400 < x ≤ 500	37	446	8.03	96.7
500 < x ≤ 600	15	461	3.25	100.0

Source: authors' own elaboration.

Table 2
Matrix of Pearson's correlation of dependent and explanatory variables

	Y	X1	X2	X4	X5	X6	X7	X8	X9	X10	X11
Y	1.000	0.254*	0.363*	-0.123*	0.133*	-0.077	-0.019	0.049	0.056	0.057	0.160*
X1		1.000	0.141*	0.140*	0.939*	0.232*	-0.014	0.719*	0.048	0.010	0.057
X2			1.000	-0.009	-0.202*	-0.050	-0.099	-0.118*	-0.003	0.018	0.172*
X4				1.000	0.136*	-0.153*	-0.057	-0.007	-0.427*	-0.036	-0.403*
X5					1.000	0.250*	0.014	0.757*	0.047	0.013	0.009
X6						1.000	-0.308*	0.300*	0.204*	0.074	0.176*
X7							1.000	0.006	0.261*	-0.189*	0.020
X8								1.000	0.159*	0.044	0.110*
X9									1.000	-0.549*	0.412*
X10										1.000	0.384*
X11											1.000

* Indexes significant on the level of 0.05.

Source: authors' own elaboration.

Table 3
Assessment of the estimation parameters

	Assessment	**Standard error**	**Wald statistics**	**p -value**	**Odds ratio**
Intercept	9.954118	2.019597	24.29271	0.000001	
X1	-0.000011	0.000003	17.68764	0.000026	0.999989
X2	-0.001806	0.000402	20.19724	0.000007	0.998196
X11	0.145999	0.049799	8.59539	0.003370	1.157195

Source: authors' own elaboration.

Table 4
Classification of cases of dependent variable

	Predicted: 1	**Predicted: 0**	**% of right predictions**
Observed: 1	24	91	21
Observed: 0	19	211	92

Source: authors' own elaboration.

Table 5
Assessments of parameters of estimation for new values of units

	Parameter assessment for Y = 1	**Parameter assessment for Y = 0**	**Odds ratio for Y = 1**	**Odds ratio for Y = 0**
Intercept	9.95412	-9.95412		
X1	-0.10932	0.10932	0.896447	1.115515
X2	-0.18061	0.18061	0.834764	1.197944
X11	0.14600	-0.14600	1.157195	0.864158

Source: authors' own elaboration.

Table 6
Odds ratio for variables in dependence on their direction and value

	X1									
	PLN 10,000	**PLN 20,000**	**PLN 30,000**	**PLN 40,000**	**PLN 50,000**	**PLN 60,000**	**PLN 70,000**	**PLN 80,000**	**PLN 90,000**	**PLN 100,000**
Drop	1.12	1.24	1.39	1.55	1.73	1.93	2.15	2.40	2.67	2.98
Rise	0.90	0.80	0.72	0.65	0.58	0.52	0.47	0.42	0.37	0.34
	X2									
	PLN 100	**PLN 200**	**PLN 300**	**PLN 400**	**PLN 500**	**PLN 600**	**PLN 700**	**PLN 800**	**PLN 900**	**PLN 1,000**
Drop	1.20	1.44	1.72	2.06	2.47	2.96	3.54	4.24	5.08	6.09
Rise	0.83	0.70	0.58	0.49	0.41	0.34	0.28	0.24	0.20	0.16
	X11									
	1 min.	**2 min.**	**3 min.**	**4 min.**	**5 min.**	**6 min.**	**7 min.**	**8 min.**	**9 min.**	**10 min.**
Drop	0.86	0.75	0.65	0.56	0.48	0.42	0.36	0.31	0.27	0.23
Rise	1.16	1.34	1.55	1.79	2.08	2.40	2.78	3.22	3.72	4.31

Source: authors' own elaboration.