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ABSTRACT

In the housing market, new properties sometimes experience delays before they are sold. Such delays reflect the preferences of buyers in respect of the homes' characteristics. Therefore, it is important for managerial purposes to identify the causes of housing sales delays. After analyzing the delays in sales of housing in Beijing City, China, the principal finding of this study is that delays are largely explained by the dwellings' characteristics and location. Policy implications of the research findings, particularly those related to means of reducing the delays, are discussed.

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DURATION OF HOUSING SALES IN URBAN BEIJING

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Abstract: This paper analyses the duration of housing sales in the city of Beijing, China. In the housing market, new properties sometimes experience delays before they are sold**.** Such delays reflect the preferences of buyers in respect of the homes' characteristics. Therefore, it is important for managerial purposes to identify the causes of housing sales delays. A survival model with heterogeneity is adopted in the present research. The principal finding of this study is that delays are largely explained by the dwellings' characteristics and location. Policy implications of the research findings, particularly those related to means of reducing the delays, are discussed.

Keywords: Duration models, survival models, heterogeneity, Beijing, China.

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1. Introduction

This paper analyses delays in the selling of residential properties in the city of Beijing, China taking into account the uncontrolled heterogeneity of the data. Beijing is the capital of China and its house market has risen in recent years due to prosperity that has brought development along with potential bubbles in the market. Today's burgeoning real estate prices have incurred the inhabitants' unanimous aversion to purchasing new homes and have led Government's harsh intervention. Therefore it is important to analyse the causes that explain house sale delays in China since it is a main issue in house demand management, since it increases the cost of the dwelling due to accruing interest and other costs while the dwelling remains unsold. Therefore, the question of housing sales delays is of paramount importance to realtors because of the uncertainty that it involves (Cunningham, 2006).

Survival models in housing have been adopted by Gronberg and Reed (1992), Mok, Chan and Cho (1995); Lacour-Little and Malpezzi (2003); Cunningham (2006); Bulan, Mayer and Somerville (2009); Feijten and Mulder (2010); Ström (2010) and Kau, Keenan and Li (2011) among many authors. However, none of these authors analyse sales delays neither take heterogeneity into consideration in their survival models.

The present research was motivated by the following issues. First, survival models have proven to be particularly suitable for the modeling and analysis of duration events. Although the usefulness and reliability of survival modeling for predicting duration events has been recognized in several urban contexts (Lacour-Little and Malpezzi, 2003; Cunningham, 2006; Bulan, Mayer and Somerville, 2009; Feijten and Mulder, 2010; Ström, 2010, and Kau, Keenan and Li, 2011), their application to housing has not attracted much research interest. Second, since, as mentioned above, housing sales delays are of great importance in housing management, it would be of value to ascertain which covariates best explain the delays in selling housing, since these covariates may be specific to the market analyzed. Third, it is important for policy purposes to investigate the factors that influence purchasers' home-buying decisions. Finally, the consequence of heterogeneity are also taken into account in the present research.

The paper makes two important contributions to the literature: first, by analyzing the determinants of home sales delays in the case of the Beijing housing market, an Asian city that has attracted little research so far; and second, by adopting a survival model with heterogeneity, which is a novelty in the context of survival models. We are not aware of any research paper previously adopting survival models with heterogeneity in housing.

This paper is organised as follows. After the introduction, the contextual setting on Beijing house market is presented, followed by the literature survey in Section 3. Next the theoretical background is presented in Section 4, followed by the hypotheses to be tested in Section 5. The results are given in Section 6, while Section 7 contains some discussion and concluding comments.

2. The city of Beijing and its house market

Beijing, which is the political and cultural centre as well as the capital city of China, has always been the first to be affected by the central government's policies, and there is no exception with respect to the development of the housing market. Before the reform launched by the central government in 1978, it was featured a planned economy, without a housing market. A public housing system provided urban inhabitants with low-costs accommodation (Yu, 1999), which was part of the social welfare (Chen et al., 2011). However, the housing supply and the related investment was quite insufficient (Show, 1997; Zhang, 2000), especially when the population in the urban areas was continuously increasing. Thereafter, the National Urban Housing Conference recommended the commercialization to tackle the problems in 1980 and then a series of experiments were initiated across several urban areas in China, leading to an overall housing reform nationwide in 1992 (Show, 1997), including validating "*paid transfer of land-use rights*" in the Constitution of the People's Republic of China in 1988 (Tian and Ma, 2009), establishing the urban Housing Provident Fund (HPF) and the urban commercial housing transaction market (Chen et al., 2011) , to facilitate the transition. During the period from 1992 to 1997, the side effects of the housing credit, which was offered by banks to finance the housing market, brought out speculation and irrational behaviour in the housing market. The welfare-oriented public housing distribution system was abolished in 1998[1], implying a market-based housing system, with the majority of Chinese families purchasing houses through it (Chen et al., 2011). After these successive reforms, the private ratio as well as the price of the urban housing increased dramatically.

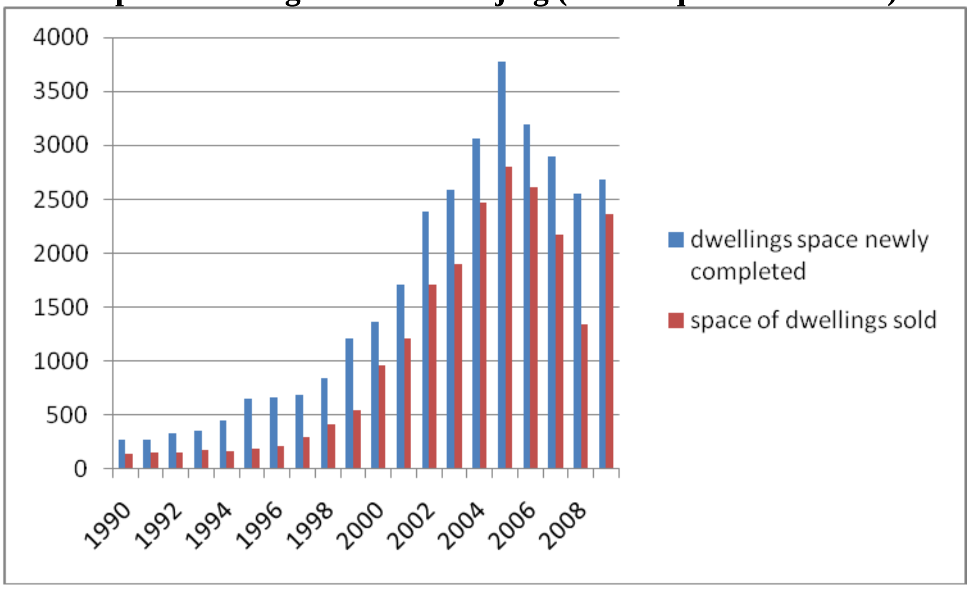
With the reform, the housing market was estimulated to be booming in Beijing. The dwelling condition significantly improved, i.e. the households that possess their own house accounts for 72.8% in the total (State Statistical Bureau, 2010), and the average dwelling space per capita for urban residents have ascended from 6.7 square meters in 1978 to 21.61 square meters in 2009 (Beijing Statistical Yearbook, 2010). Meanwhile, Beijing is one of the top four metropolitan areas in China that undergone a soaring housing price. During the period between 1992 and 1997, the housing price in Beijing steadily went up. And since then, it fluctuated around 5000 yuan per square

[1] This was also regarded as a measure to estimulate the internal consumption and to reduce the negative effects of Asian financial Crisis (Liu and Shen, 2005)..

meters until 2004, when a surge in price began, reaching 11648 yuan per square meters (China Real Estate Statistics Yearbook, 2001-2009). Besides the reform, there were also definitely other prominent exogenous factors that can partly explain the sharp increase in housing price, such as the large population[2] and the 29th Olympic Game that entitled Beijing to hold in 2001.

Although there is some evidence showing strong demand on the property in Beijing, the provision of houses seems to be in excess persistently (See Graph 1), and a significant part of the newly built houses were not sold every year[3]. Moreover, a large amount of it remained unsold more than 3 year (See table 1). Therefore, there exists no equilibrium in the housing market of Beijing, inevitably resulting in welfare loss and resources mismatch.

Graph 1: housing market in Beijing (10000 square kilometer)[4]



Sources: Beijing Statistical Yearbook, 2010

[2] The population of the city has reached about 17.55 million in 2009, while it only covers an area of 16410 square kilometers.

[3] Some authors argued that the supply structure of the housing market has distorted the market in Beijing (Gao and Asami, 2010).

[4] It includes the commercial residents, office buildings, residence etc.

Table 1 presents the number of dwellings unoccupied from 2001 to 2009 and it can be observed that from 2005 to 2009 the number of unoccupied dwellings substantially increased.

Table 1: dwellings unoccupied on sale in Beijing

	2001	2002	2003	2004	2005	2006	2007	2008	2009
within 1 year	429.4	557.9	745.5	744.4	993.5	628.3	697.2	945.1	768
more than 3 year	84.6	96.4	109.8	72.9	75.8	106.9	203.1	209.8	229.9

Sources: Beijing Statistical Yearbook, 2010

3. Duration models in housing. A review

There are some paper adopting survival or duration models in housing, mostly focusing on USA mortgage market (Vandell et al., 1993; 2001; Ciochetti et al., 2003a,b; Lacour-Little and Malpezzi, 2003; Foote, Gerardi and Willen, 2008; Kau, Keenan and Li, 2011) or duration of rental vacancies in USA (Sternberg, 1994; Gabriel and Nothaft, 2001; Deng, Gabriel and Nothaft, 2003; Archer, Ling and Smith, 2010); moreover, the timing of land development in USA was also analysed (Cunningham, 2006). Papers outside USA include Bulan, Mayer and Somerville (2009) in Canada, Feijten and Mulder (2010) in the Netherlands, and Ström (2010) in Sweden. Therefore the focus on a main city along with the analysis of sales duration and the adoption of a heterogeneity survival model have not yet been used in urban research. Therefore, the present research innovates in this context.

Adopting a time framework to analyse survival models in housing, Vandell et al. (1993) analyse individual commercial mortgage default with data from a major multi-line USA insurance company. Using a Cox proportional duration model, they conclude that the dominance of the equity effect, as proxied by contemporaneous market loan-to-value ratios, is a major covariance explaining defaults, alongside loan structure. Secondary effects were cash flow effects, borrower effects and property-type. Sternberg (1994) analyses the duration of rental unit vacancies with a gamma mixture survival model, adjusted for length, truncation and survivorship-bias, of exponential distributions with hazard rate linear in dwelling characteristics. The conclusion in the paper is that duration is directly related to dwelling age, atypicality, the degree to which the neighbourhood is "run down," and the number of rental units in the building. Gabriel and Nothaft (2001) analyse the duration of rental vacancies in major USA metropolitan areas with ordinary least square regressions. Ciochetti et al. (2003a) analyse the factors driving the borrower's decision to terminate commercial mortgage contracts with the lender through either prepayment or default. Data on loans from large USA insurance companies are used. The Cox proportional duration model with competing risks is adopted, accounting for unobserved heterogeneity and identifying two distinctive borrower groups. It is found that implicit put and call options drive default and prepayment actions in a non-linear and interactive fashion. High value of the put/call option is found to significantly reduce the call/put risk since the borrower forfeits both options by exercising one. Cash flow and credit conditions as well as *ex post* bargaining powers are also found to have significant influence upon the borrower's mortgage termination decision. Ciochetti et al. (2003b) analyse loans default with a proportional Cox model with competing risks hazard model using data on loans from large USA companies. They find that the probability of default is positively related to loans-to-value ratio, along the debt service coverage ratio.

Deng, Gabriel and Nothaft (2003) analyse the duration residence in rental housing in major USA metropolitan areas with a proportional Cox hazard model concluding that residence duration is positively explained by median housing costs, public housing share of rental stock, poverty rate and African-Americam and Hispanic share of tenant households. Negatively covariates are elevator buildings, unemployment rate, population growth and central city share.

Lacour-Little and Malpezzi (2003) analyze the quality of mortgages loans in Alaska with the Cox proportional duration model, concluding that decreasing appraisal quality is associated with an increase in the mortgage default hazards rate. Cunningham (2006) analyzes the delay in the timing of land development in Seattle with an exponential, a Weibull and a Cox proportional survival model, concluding that uncertainty over the future prices reduces the hazard of current-period development, and at the same time raises land prices. Another interesting paper is Foote, Gerardi and Willen (2008) where the authors realte negative equity and mortgage default in a dataset of Massachusetts homeowners during the early 1990s. Bulan, Mayer and Somerville (2009) analyze the extent to which uncertainty delays investment in condominium development in Vancouver, Canada with a Weibull survival model. These authors conclude that builders delay development during times of greater idiosyncratic uncertainty in real estate prices and when the exposure to market risk is higher. Kau, Keenan and Li (2011) analyze residendial mortgage defaults and prepayments, using a Cox survival model with frailty. They investigate whether mortgages originated in the same Metropolitain Statistical Area share any common factors. Feijten and Mulder (2010) analyze the timing of moving into long-stay housing based on postponed marriages and childbirth in the Netherlands with the Cox survival model. They conclude that the macro context explains the postponement decision. Ström (2010) analyzes the extent to which the housing-type decision is constrained by first births in Sweden. A Kaplan-Meier survival curve is used to analyze the time taken to move to a new dwelling after the first birth and piece-wise constant hazard survival models are used to analyze the dwelling choice. The author concludes that the size of dwelling seems to be the most important housing-factor decision related to the first birth. Archer, Ling and Smith (2010) analyse housing turnover rates in Chicago between 1992 and 2002 using a Cox proportional hazards model concluding that household characteristics are the most important determinants of housing turnover rate.

Chinese housing-related variables have been examined by authors such as Peng and Wheaton (1994), Fu, Tse and Zhou (2000) and Yan (2006) though none of them use duration models in their research.

4. Theoretical Framework

The survival model estimated in this study is based on the theory of consumer behavior developed by Lancaster (1966) and the concept of hedonic prices (Rosen, 1974). The economic theory of consumer behavior assumes that a consumption decision faced by an individual aiming to maximize utility, subject to budgetary restrictions, is taken on the basis of prices and income (Varian, 1987). This traditional framework, however, does not allow for circumstantial conditions and product characteristics, which are known to play an important role in shaping housing demand, given the composite or differentiated nature of the services that comprise a housing market (Ström, 2010). Therefore, the demand for houses is derived from the demand for the various goods and services offered by a house market (Ben-Akiva and Lerman, 1985), adopting the Lancaster approach.

4.1 The Method

In this study, housing sales delay is analysed using survival models. Survival models, also known as duration models, measure the duration of an event, defined as the time elapsed until a certain event occurs. The house sale delay is an example of duration. The use of survival models to model time is based on the fact that the distribution of the error in this context is traditionally skewed to the right (Hosmer and Lemeshow, 1999).

Three issues must be addressed when using survival models in housing: first, the identification of the data set, i.e., cross-section vs. panel data; second, the censoring of the data; and finally, the heterogeneity of the population analysed. In relation to the first issue, the present paper adopts panel data, therefore time-variant models, will be adopted (Wooldridge, 2002). Regarding the second issue, data is censored, because some houses are sold during the period of study and therefore not observed at the end of the study. With regard to the third issue ignoring heterogeneity results in asymptotic parameter underestimation (Cameron and Triverdi, 2005). Given these considerations, the following estimating strategy is adopted. First, the traditional Cox proportional hazard model for single-event data is adopted, assuming that the house sale delay are likely to be independent. Second, the proportional hazard Weibull model is estimated for comparative purposes, following Hosmer and Lemeshow, 1999). However, there may be some correlation among individuals and ignoring this dependence could yield erroneous variances estimates and possibly biased estimates (Box-Steffensmeier, Reiter, and Zorn, 2003). Therefore, we finally estimate a heterogeneous Weibull proportional hazard model

For the Cox model, the hazard is specified as:

$$h_{ik}(t \mid X_{ik}) = h_{0k}(t)\exp(\beta X_{ik}) \qquad (1)$$

where k denotes the event number at time t of the i^{th} individual, $h_{0k}(t)$ is the baseline hazard at time t, which is the hazard function in absence of covariates, which varies by event number; X is a vector of covariates which can be time dependent but in the present case is time-invariant and β is a vector of parameters. The parameters are estimated using a partial likelihood function given by:

$$L(\beta)=\prod_{i=1}^{n}\prod_{k=1}^{K_i}\left(\frac{\exp\left(\beta X_{ik}\right)}{\sum_{i=1}^{n}\sum_{k=1}^{K_i}Y_{ik}\exp\left(\beta X_{ik}\right)}\right)^{\delta_{ik}}, \qquad (2)$$

where δ is a censoring indicator equal to one if observed and zero otherwise, and Y is a risk indicator which is equal to one if the individual is at risk for the current event and zero otherwise.

We also consider the Weibull model defined by:

$$\begin{aligned} h(t/x_j) &= h_0(t)\exp(x_j^t\beta) \\ &= pt^{p-1}\exp(\beta_o + x_j\beta) \end{aligned}, \qquad (3)$$

where p is an ancilarry shape parameter estimated from the data and the scale parameter is parametrized as $exp(\beta_0)$. Both models are estimated using a maximum likelihood procedure.

Overdispersion is caused by misspecification or omitted covariates. Heterogenous (frailty) models attempt to measure this overdispersion by modelling it as resulting from a latent multiplicative effect on the hazard function, e.g.

$$h(t_i/\alpha_i)=\alpha_i h(t_i)=\alpha_i h_o(t_i)\exp(x_j^t\beta), \qquad (4)$$

where the dependent parameter, α_k corresponds to the omitted covariate.

5. Research Design: The Hypotheses

As noted above, the delays of sales can be explained by several factors. Based on the available data set, the following characteristics were used: 1) price of dwelling; 2) area of the dwelling; 3) building type, 15-24 floors; 4) property management fee; 5) location, and 6) quality. Using the data on these characteristics, we tested the following hypotheses.

<u>Hypothesis 1</u> *(Price)*: the delay on a dwelling's sale is a negative function of its price, signifying that the higher the price, the shorter the time to sell, because rich people who need a house can buy it. The credit rationing exists for lower middle class. Based on the fact that the Chinese present development middle class is estimated as 37% in 2009 compared with the South Korean 67% (Amadeus, 2010), this hypothesis makes sense in this context. Furthermore, there is an abundant literature on house prices, using various methods and analyzing distinct regional markets. However, Strange (1992) notes that these studies have had minimal success in finding significant effects that explain dwelling prices. Sirmans et al. (2005) review the hedonic pricing models of many empirical studies, recognizing that there is some parameter of uncertainty, even for key housing characteristics. This research justifies the importance of the housing price in any market decision, supporting the present hypothesis.

<u>Hypothesis 2</u> *(Area of dwelling)*: the delay on a dwelling's sale is a negative function of the dimensional area of the dwelling. The importance of a property's area is well recognized in housing markets, (Forrest et al., 1996), which therefore justifies the inclusion of this variable in the present research.

<u>Hypothesis 3</u> *(Building type)*: the delay on a dwelling's sale is a positive function of the dwelling type. Given China's vast population, the most common form of housing construction is the apartment tower block. According to the classification criteria applied by Chinese real estate companies, if the number of the floors is above 25, the building is classified as a ‘super high-rise’ building, 15-24 floors as a ‘high-rise’ building, 8-14 floors as a ‘middle-rise’ building, and 4-7 floors as a ‘multi-rise’ building. If the number of floors does not exceed 4, it is a low-rise building, which is the category in which homes are priced beyond the means of most households. This is a traditional hypothesis in housing demand studies (Raya, Montolio and Garcia, 2010; Garcia and Raya, 2010).

Hypothesis 4 *(Management fee).* The delay on a dwelling’s sale is a negative function of the dwelling management fee, Anderson (2005). The service of property management fee is a traditional cost, but as explained in the contextual setting, it is new for Chinese citizens and so they may react negatively to this price as it happens to any price effect.

Hypothesis 5 *(Green):* The environmental location of a dwelling as characterized by the proportion of green space in the building’s immediate vicinity affects negatively the delays on a dwelling’s sale. Reasons for this negative effect are unclear in the literature (Conway et al., 2010), but may be related to the country origin of most city dwelling Chinese.

Hypothesis 6 *(Location)*: the delay on a dwelling’s sale is a positive function of its location (Li and Brown, 1980; Kiel and Zabel, 2008). This is also a traditional hypothesis in house demand, which justifies the inclusion of a location variable in the present research (Bonnet, Gobillon and Laferrère, 2010).

Hypothesis 7 *(Quality)*: the delay on a dwelling's sale is a positive function of the quality of its decoration and fittings (Zabel, 1999). Quality is a main characteristic in housing and the price-quality relationship is a main issue on buying a house (Cheung, Ihlanfeldt and Mayock, 2009)

5.1 Study Context

The research study conducted on the Beijing housing market is based on data gathered from the China Real Estate Statistics Yearbook 2001-2009, in relation to dwellings sold in the period 2001-2009. Table 2 sumarizes the main characteristics of the data.

Table 2: Characterization of the Variables

Variable	Description	Min[a]	Max[b]	Mean	Std. Dev
Delay	Number of days between home's appearance on the market and its sale	11	1057	433.10	348.45
Price	The price of the dwelling (yuan/square meter)	2580	75000	11613.08	7880.6
Area	The area of the dwelling (floor space in square meters)	829	8000000	101212.6	346793.5
Green	Green area proportion	5	80	34.557	7.971
Type 1	Building type 15-24=1, otherwise=0	0	1	0.421	0.494
Type 2	Building type 8-14, otherwise =1	0	1	0.501	0.500
Fee	The building's management fee (yuan/square meter/month)	0.4	28	2.943	1.989
Location 1	City location, defined by the 3rd to 4th Ring Roads =1, otherwise=0	0	1	0.258	0.437
Location 2	City location, defined by the 2nd to 3rd Ring Roads=1, otherwise=0	0	1	0.228	0.419
Quality	Quality index, defined as: poor decoration=1, blank/adequate decoration/ undecorated =2, good decoration=3, high-quality finishings=4	1	4	2.623	0.990
Year	Year 2001-2009	2001	2009	2005	-

[a] Min – Minimum; [b] Max – Maximum

In order to evaluate the degree of correlation among the explanatory variables, which can cause multicollinearity, the correlation matrix is presented in Table 3.

Table 3: Correlation between the variables

	Price	Area	Type1	Type2	Fee	Green	Loc 1	Loc 2	Quality
Price	1.0000								
Area	-0.0398	1.0000							
Type1	-0.0622	-0.0324	1.0000						
Type2	-0.0831	0.0005	-0.1465	1.0000					
Fee	0.1316	-0.0767	0.0475	-0.1021	1.0000				
Green	-0.0355	0.0822	-0.0147	0.0474	-0.0364	1.0000			
Loc 1	0.1055	-0.1078	0.1193	-0.0340	0.1148	-0.1752	1.0000		
Loc 2	0.0802	-0.0520	-0.1059	-0.0093	0.0841	-0.0766	-0.1801	1.0000	
Quality	0.3232	-0.0719	0.1055	-0.0621	0.3679	-0.0044	0.0115	0.0377	1.0000

It is observe d that the degree of correlation among the variables is small.

6. Results

Table 3 presents the results of the estimated duration models. The Weibull model is presented, both without and with sample selection, for comparative purposes. The dependent variable is the number of days between the date of the property first appearing on the market and its sale. Positive covariates increase the hazard, e.g./i.e. the number of days unsold on the market. Negative covariates decrease the hazard.

Table 2: Results(1)

	Cox Model		Cox model clustered by location		Weibull-Het	
	Coef	T-ratio	Coef	T-ratio	Coef	T-ratio
Intercept	—	—	—	—	-11.530	**-9.01**
Log price	0.1856	1.55	0.1856	**3.17**	0.1932	**3.12**
Log area	-0.0246	-0.77	-0.0246	**-14.19**	0.032	**8.32**
Green	0.0045	0.82	0.0045	**2.27**	0.0051	**2.89**
Type 1	0.2028	**2.28**	0.2028	**5.62**	**0.2154**	**4.32**
Type 2	0.2513	1.62	0.2513	**8.38**	**0.2537**	**5.32**
Fee	-0.0358	-1.35	-0.0358	**-9.75**	**-0.0385**	**-4.26**
Location 1	0.0784	0.48	0.0784	**8.66**	0.0813	**4.71**

Location 2	-0.0390	-0.36	-0.0390	-0.75	**0.0412**	-1.28
Quality 2	-0.2056	-1.38	-0.2056	**-3.42**	-0.2721	**3.25**
Quality3	-0.2630	-1.49	-0.2635	**-19.81**	-0.2512	**-4.32**
Quality 4	-0.4850	**-2.86**	-0.4850	**-4.85**	-0.4874	**-3.58**
Year 2004	-1.9536	**-11.44**	-1.9536	**-32.71**	0.9135	**-4.29**
Year 2005	-2.7358	**-14.53**	-2.7358	**-55.73**	0.9032	**-5.12**
Year 2006	-2.8061	**-14.92**	-2.8061	**-63.91**	0.9372	**4.27**
Year 2007	-2.7870	**-15.39**	-2.7870	**-54.56**	0.9847	**5.91**
Year 2008	-2.8318	**-15.97**	-2.8318	**-59.81**	0.9734	**4.37**
Year 2009	-2.8044	**-15.28**	-2.8044	**-22.97**	0.9945	**5.32**
Sigma	—	—	—	—	**5.613**	—
Theta	—	—	—	—	**1.620**	—
Log of the Likelihood	- 3712.29	—	-3712.38	—	-161.603	—
Nobs	728		728		728	—

(1) – All models were estimated in Stata 10

The results are quite similar in their main findings in all three models, but the Weibull with heterogeneity (Weibull-het) is the chosen model, on the basis of the log likelihood statistics and the statistically significant of sigma and theta variable. Moreover, it was verified that the variables have the same signs in different models. Based on the log-likelihood statistic and the statistically significant theta variable, the Weibull model with heterogeneity was chosen to derive the conclusion. The rationale for this decision is that heterogeneity represents characteristics that influence the conditional probability of ending a housing delay in the Beijing, but which are not measured or observed, and that there are no measurement errors in the variables. Unobserved heterogeneity has been a subject of concern and analysis (see Chesher, 1984 and Chesher and Santos-Silva, 2002). Heterogeneous behaviour is commonly observed in individuals; and not to take this into account is likely to lead to inconsistent parameter estimates or more importantly, inconsistent fitted choice probabilities. In the present study, this implies that different individuals can have different preferences relative to the probability of ending a tourist stay. The variance of unobserved individual specific parameters induces correlation across the alternatives in the choice and therefore, survival models with heterogeneity are required.

In this regard, all variables affect positively the sales delay in the housing market of Beijing, with exception of the area of the dwelling, the building's management fee, to leave in first city location, on the quality ranks and on the years. These are intuitive covariates that explain the increase the house sale delay such as price. Some of these variables are not intuitive.

7. Discussion and conclusions

The paper analyses the determinants of house sale delay in Beijing, using survival models. In relation to the hypotheses, taking into account the Weibull model with heterogeneity, the results allow us to accept the majority of the research assumptions.

The general conclusion relative to the hypothesis is firstly, price is positive signifying that the higher the price, the longer the delay, which implies that higher priced homes sell with more difficulty than lower priced homes. This is a situation found in markets with credit restrictions and lowe wealth, in which poorer households cannot afford to buy there homes, and the more affluent have already bought their home. Second, the greater the dimensions of the property, the shorter the delay, signifyng Chinese families born on country side and now buying city flats preferr larger houses. Third, the presence of gardens will increase the sales delay, which signify that gardens are related to quality and prices. Fourth, the higher the building type, the longer the sale delay, signifying that Chinese house owners do not like tall buildings. Fifth, the higher the management fee, the lower the sale delay, signifying the management fee is a proxy for quality. Sixth, location 1 (defined by the 3rd to 4th Ring Roads) increases the sales delay, but location 2 (defined by the 2nd to 3rd Ring Roads) decreases it, which is due to their location. Seventh, quality decreases the length of stay signifying that there is ademand for quality houses in Beinjing. Finally, the time variable in all years decrease the sales delay signifying that Beijing house market is bullish in the period analysed.

The general significance of these results, taking as reference the Weibull with heterogeneity, is that they indicate that more expensive, higher-quality homes have the shortest sales delays in the Beijing housing market.

With regard to the policy implications, while recognizing that it is not possible to control all the elements contributing to sales delays, it is possible to concentrate on those identified in the present research, to eliminate it. Therefore, the results suggest that home realtors seeking to manage housing sales in Beijing should target the more expensive, high-quality homes, since they have shorter sales delays.

With regard to comparisons of these findings with previous research, this paper is innovative, in that statistically significant variables were chosen to explain the sales delay duration. Consequently, our findings are not directly comparable with those of previous studies. Finally, in the present research, a parsimonious procedure identified the small group of statistically significant variables among the many insignificant variables. There is, thus, a need for further research to apply survival modeling in analyzing the determinants of sales delay duration in a variety of other contexts. As the body of research into the determinants of housing sales delays grows, at some point in time it may be possible to investigate the differences in results across studies using meta-analytical techniques. More research is needed to confirm the present findings.

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