Estimation of a semi-parametric hazard model for Mexico's new housing market

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1. Introduction

The purpose of this paper is to study the market duration of new homes constructed by real estate developers in Mexico, that is, the time a new house stays on the market before it is sold. Making use of a particular Mexican housing-market database, a flexible hazard model was estimated in order to study how market duration is affected by structural characteristics of the home, including market supply price, and changes in economic activity and in the mortgage market. The hazard is defined as the probability that a home will be sold in quarter *t* given that it has been for sale for *t-1* quarters. The period of analysis is from the second quarter of 2006 to the fourth quarter of 2009.

Over the last ten years, Mexico has enjoyed macroeconomic stability, which has favored the housing sector. In addition, several financial regulations were introduced to improve the banking sector's supervisory and regulatory framework. These factors have contributed to an increase in funds available to finance the private sector, in particular, the housing market. Hence, this paper focuses on how the increase in credit affects the market duration of new homes constructed by real estate developers. Specifically, the interest is in how the chance of a home being sold is affected by the annualized quarterly growth rate of financing injected into the housing market by the two most important financial institutions in the mortgage market: Infonavit, a public sector intermediary, and commercial banks as a group.

Moreover, this paper investigates, state by state, whether economic activity has an effect on the probability that a housing unit will be sold given that it has been for sale during previous periods. To study this effect, the paper uses the annualized quarterly growth rate of the economic activity index by state, constructed by the Mexican central bank. As will be explained later, there are various channels through which economic activity can affect the market duration of a home.

The results indicate that growth in economic activity has a positive and significant effect on the probability that a home will be sold in quarter *t* given that it has been for sale for *t*-1 quarters. In particular, if the economic activity growth rate doubles, the chance of a home being sold increases 86.9%, which is a non-negligible effect and is statistically significant. In contrast, growth in mortgage credit by commercial banks and Infonavit has no significant effect on the chance of a home being sold. Finally, the results also indicate that if the price increases or if the housing unit is an apartment instead of a house the probability decreases, whereas if the floor size or the number of periods on the market increase, the probability of a home being sold increases.

There are two papers that estimate a hazard model for the housing market: Das (2007) and Zuehlke (1987). In both papers, the authors use a hazard model to study the relationship between the probability of a house being sold and its time on the market. They estimate a Weibull hazard model using data from the housing markets in New Orleans and Tallahassee,

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[1] The views expressed in this paper are those of the author and do not necessarily reflect those of the Banco de México. Edgar Islas-Rodríguez and David Camposeco-Paulsen provided excellent research assistance. All errors are my own. E-mail: carolina.rodriguez@banxico.org.mx.

respectively. The data were obtained from the corresponding Multiple Listing Service books. Both authors find evidence that vacant houses have a higher rate of time dependence compared to occupied houses. Additional studies that relate other aspects of the housing market with duration analysis are Deng (1997) and Deng et al. (2003).

The rest of the paper is structured as follows: the next section explains how macroeconomic stability influenced the Mexican mortgage market, section 3 examines why it is important to control for economic activity performance, section 4 summarizes the data set and the variables used in the estimation, section 5 provides a detailed explanation of the method used, section 6 contains the estimation results, and section 7 concludes by discussing possible future directions for research.

2. Macroeconomic stability and the Mexican mortgage market

During the last ten years Mexico has enjoyed macroeconomic stability, which has favored the housing sector. Between 2001 and June of 2010 the annual inflation rate averaged 4.7%. Moreover, the public sector balance, measured by public sector borrowing requirements (PSBR) as a percentage of GDP, has steadily decreased since 2000, reaching 1% in 2007.[2] This implies that the public sector has reduced its financial needs, leaving the private sector with more resources available. Additionally, short term interest rates[3] dropped from an average of 16.2% in 2000 to an average of 4.63% in the first half of 2010.

All of these factors have contributed to the increase of funds available to the private sector. In fact, total financing to the private sector has started to recover, and represented 37% of GDP in 2009. From 2004 onwards, commercial banks' lending to the private sector has been rising. In 2002, commercial banks began to increase their consumer credit portfolio. Later, in 2005, they began participating more actively in the mortgage market, primarily in the residential mortgage segment. Finally, in 2007, commercial banks started to increase their business credit portfolio. As a result, commercial banks' participation in total financing to the private sector has continuously expanded since 2005, reaching 14.76% in 2008 and 14.26% in 2009. These factors have guaranteed an expansion of the mortgage market.

The most important public sector intermediary in the housing credit market is the *Instituto del Fondo Nacional de la Vivienda para los Trabajadores* (Infonavit). This government-sponsored agency provides credit to households that belong to the formal sector of the economy. In previous years, Infonavit financed workers who earned up to four times the monthly minimum wage.[4] The agency's traditional fixed-rate mortgage loan has had a limit of 180 monthly minimum wages and could only be used to purchase houses priced below 350 times the monthly minimum wage. More recently, Infonavit started to provide credit to other segments of the market. For example, "Apoyo Infonavit" is a joint program with banks and non-bank institutions for workers who earn more than four times the minimum wage. This program allows individuals to leverage their Infonavit savings to obtain market-based mortgage financing. This kind of initiative has made Infonavit the leading institution in the mortgage market. Infonavit's market share of total home financing increased considerably in the last 10 years, from 27.62% in 1997 to 55.85% on average for the first five months of 2010.

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[2] However, in 2008 and 2009 the PSBR registered rebounds, perhaps as a consequence of the countercyclical fiscal measures implemented by the government during the financial crisis.

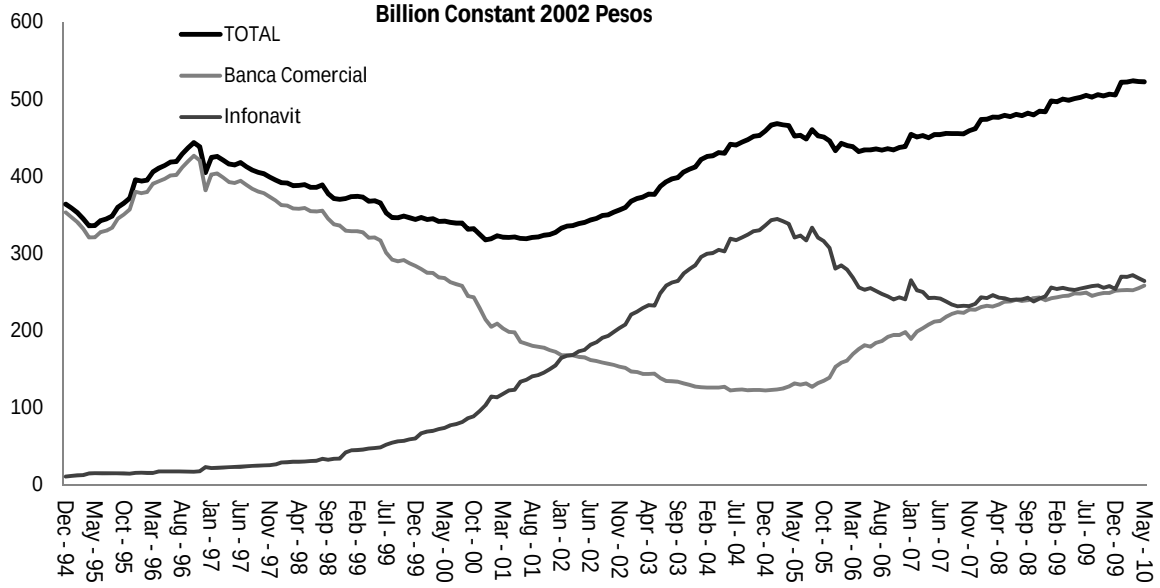
[3] This refers to the nominal interest rate of federal government three-month bonds (91-day CETES).

[4] The monthly minimum wage is 162 dollars PPP as of 2008.

Commercial banks constitute the second most important intermediary in the housing market and the first among private sector institutions. This was not always the case. Only in recent years have commercial banks been more involved in the mortgage market. This enhanced role is explained by the significant efforts that have been made to overcome the obstacles to financial sector development, in general, and housing finance, in particular. A number of legislative and regulatory efforts were made to improve the ability of financial institutions to obtain creditor information, improve contract enforcement and bolster creditor rights, by clarifying and streamlining foreclosures and repossession procedures.[5] As a consequence, the market share of commercial banks as of 2010 was 29%, compared to 21% in 2005.[6] In general, the products offered by commercial banks are in Mexican pesos, with fixed interest rate schemes, and they usually finance medium- to high-income households.

To summarize, the two most important intermediaries in the housing sector, Infonavit and commercial banks as a group, have increased the resources available for the housing sector for the period of analysis, that is, from 2006 to 2009 (Figure 1). This could have an important effect on the probability of a home being sold.

Figure 1: Mortgage Loan Portfolio
INFONAVIT & Commercial Banks
Billion Constant 2002 Pesos



Source: Banco de México

3. Recent economic activity

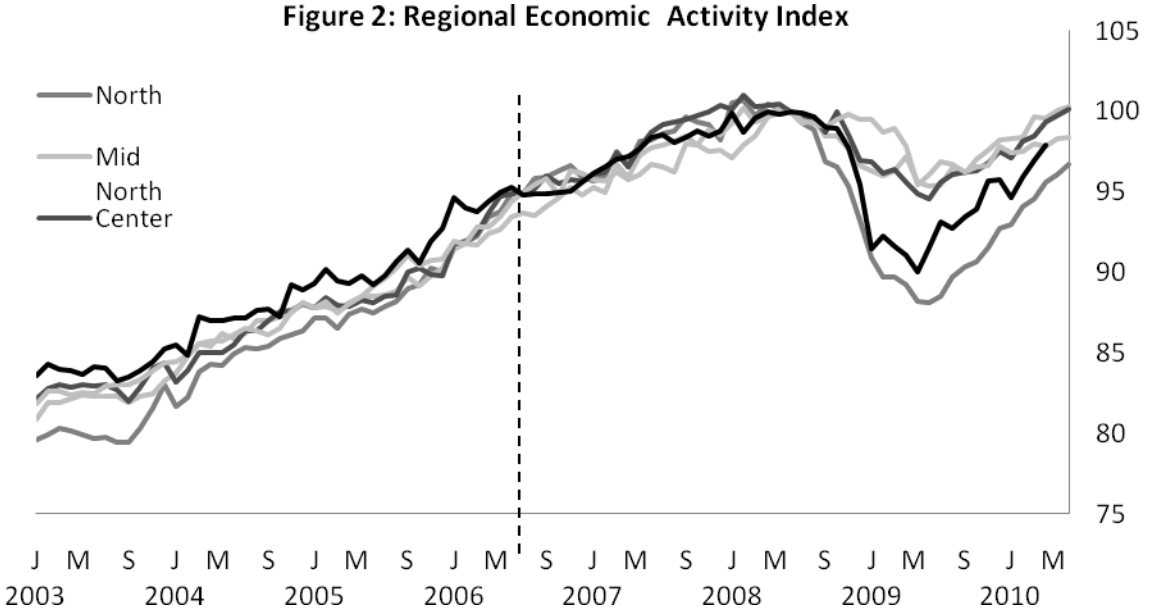
There are various channels through which economic activity can affect the market duration of a home. From the demand side, if current economic conditions deteriorate with respect to previous periods, people may be less likely to buy a home. This means a lower probability that the developer will find a buyer, thus implying decreased probability of a home being sold and increased market duration. However, from the supply side, it could be the case that

[5] See Espinosa-Vega and Zanforlin (2008).

[6] The other 15% of the credit market is shared by FOVISSSTE, development banks, and non-bank institutions such as Sofoles y Sofomes.

sellers, in view of worse economic conditions, decrease the sale price of their homes being offered, which in principle increases the probability of a home being sold and decreases the market duration. Also, the economic activity performance, in particular the behavior of the labor market, affects mortgage loan origination through different channels, as explained in Carballo-Huerta and González-Ibarra (2008). "First, available funding to allocate credit, which depends on workers' contributions, is closely related to employment and payroll levels. Second, applicants' Infonavit credit score depends, among other things, on the number of consecutive periods contributing to the housing fund. Third, current and expected economic conditions affect households' mortgage loan demand."

Figure 2: Regional Economic Activity Index



Source: Banco de México

Figure 2 plots the *Índice Coincidente Regional* (ICR), a regional economic activity index constructed by the Mexican central bank. This is a compound index, based on five variables that measure different aspects of the monthly economic activity per region. The variables are total formal workers (to control for labor market performance), wholesale and retail sales (to control for the demand for goods and services), manufacturing production index and electricity index (to control for production activity). Also, the chart includes the *Índice Global de la Actividad Económica* (IGAE), a national economic activity index. From the chart it is clear that the economy was experiencing steady performance, with positive growth rates in the ICR from 2003 up to the second half of 2008, when the financial crisis started to affect the different regions. The North was the region most affected by the crisis, since it is most closely linked to economic activity in the USA. However, even the South region had negative economic growth rates. This behavior could have an impact on the market duration of new housing units.

4. Data

The data used in this study comes from the *Dinámica del Mercado Inmobiliario* (DIME) database created by SOFTEC, a Mexican real estate consulting firm. SOFTEC collects quarterly data on new homes constructed by real estate developers in the 39 most important real estate markets in the country. The main objective of the DIME is to have a general

picture of the housing market situation in each quarter. SOFTEC uses the collected data to calculate, in a given quarter and region, the total number of homes constructed, homes sold and homes for sale, among other variables. As of 2009, SOFTEC estimates that the real estate markets it follows account for 80% of the total sales of new homes constructed by real estate developers in a given quarter for the whole country. Also, SOFTEC calculates that new homes represent between 70% and 80% of the whole housing market. Moreover, SOFTEC states that real estate developers produce approximately 60% of all the units constructed in the national new housing market. The other 40% consists of new homes constructed by owners.[7] Thus, the percentage of the housing market that SOFTEC observes through DIME is between 42% and 48%.

The main advantage of this data set is the huge number of observations it contains and the number of characteristics recorded for each observation. The sample to which I have access ranges from the first quarter of 2006 to the first quarter of 2010,[8] however the time span of the DIME is greater and includes 12,834 real estate developments. Each development has a model home. Thus, the data base contains, for each real estate development, the number of units identical to the model home and the structural characteristics of the model home, as well as the characteristics of the real estate development. Examples of these variables are floor size in square meters, lot size in square meters, number of bedrooms, number of bathrooms, whether the property is a house or an apartment, number of parking spaces, asking price at each quarter, county and state where the real estate development is located, total number of home units constructed in the development in a given quarter, total number of homes sold in a given quarter, and total number of homes for sale in a given quarter.

The DIME follows the same development over time until all home units identical to the model home are sold. In this sense, the database is a panel. However, the way the data is collected does not guarantee that, for each period, the information in the data base corresponds to the same model home. In fact, some individual characteristics such as number of bedrooms, floor size, or whether it is a house or an apartment, change over time, which implies that we cannot follow the same home model, over time, for all real estate developments. For duration analysis it is important to observe the same model home over time for each development. Thus, it was necessary to keep only the developments that make reference to the same model home. We therefore eliminate all developments with inter-temporal inconsistencies in the following variables: price and date when the real estate development started sales,[9] floor size, number of bathrooms, number of bedrooms, whether it is an apartment or a house, and economic classification.[10] Only 10,822 real estate developments survived this exercise, that is, 84% of the sample.[11]

For the purposes of the duration analysis, it is necessary to know the number of units sold in each quarter. DIME includes the accumulated number of homes sold since the real estate development started selling. Therefore, all that is needed is to subtract this variable in period *t* from the figure observed in period *t*-1 to obtain sales per quarter. However, for some periods, this calculation yields a negative number, that is, "negative sales" in a quarter. According to SOFTEC, there are different reasons that this happens. It could be the case

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7 See SOFTEC (2009).

8 Nevertheless, the period of analysis is from the second quarter of 2006 to the last quarter of 2009, for reasons explained later in the paper.

9 This date does not necessarily coincide with the date on which the real estate development entered DIME.

10 The economic classification categories are: social, economic, medium, residential and residential plus. These categories are constructed by SOFTEC according to the price of the housing unit.

11 There is no evident reason to think that eliminating these inconsistencies yields a non-representative random sample; however, further tests need to be performed.

that the buyer decides not to buy the home, the seller did not have the unit ready, the mortgage credit was not authorized, etc. Even in these simple cases, the result is that the sales and purchase contract was never signed. To solve this issue, it is assumed that the accumulated number of homes sold at quarter *t* is the minimum of total sales reported between *t* and τ , the last period in which the development is observed. From this variable, the number of home units sold per quarter is constructed by subtracting the observed value in period *t*-1 from the value in period *t*.

4.1 Summary Statistics

After eliminating some developments that were observed for only one period, and some with missing variables, the final sample, taken from the 10,822 real estate developments that remained, consists of 9,304 developments observed between the second quarter of 2006 and the last quarter of 2009. These were equivalent to 976,960 housing units, among which 629,039 were sold and 347,921 were not. Descriptive statistics for this sample are in Table 1. The characteristics of the housing unit included as covariates in the hazard model are: logarithm of the floor size in square meters, logarithm of the market supply price at each quarter, indicator that the housing unit is an apartment versus a house, logarithm of the number of quarters the home has been for sale since development sales started, state indicators, and starting quarter indicators.

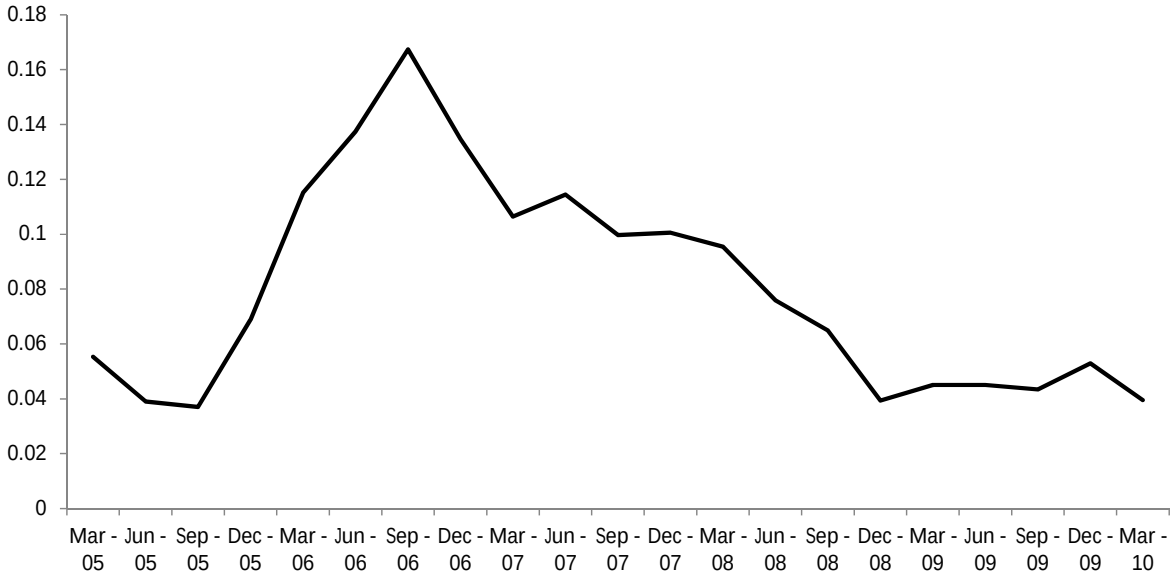
Table 1: Summary Statistics

Variables	Mean	Std. Dev.	Min	Max
Floor Size in m^2	72.57	49.127	26	1000
Price $_t$ [a,†]	656802	1298253	159948	72600000
Apartment Indicator	0.0966	0.2953	0	1
House Indicator[‡]	0.9034	0.2953	0	1
Quarters Since Development Started [a]	4	4	1	40
Duration range begins in:				
2006 - I	0.279	0.449	0	1
2006 - II	0.050	0.217	0	1
2006 - III	0.079	0.270	0	1
2006 - IV	0.044	0.205	0	1
2007 - I	0.069	0.253	0	1
2007 - II	0.092	0.289	0	1
2007 - III	0.079	0.269	0	1
2007 - IV	0.045	0.208	0	1
2008 - I	0.030	0.171	0	1
2008 - II	0.046	0.209	0	1
2008 - III	0.030	0.171	0	1
2008 - IV	0.028	0.166	0	1
2009 - I	0.054	0.226	0	1
2009 - II	0.040	0.195	0	1
2009 - III	0.035	0.185	0	1

Total number of observations is 976,960.
[a] Since these variables are time variant, statistics refer to the period when market duration range begins.
[b] Annualized quarterly growth rate.
[†] Constant 2008 Pesos.
[‡] Omitted Variable.

On average, the floor size of a housing unit is 72 square meters. Approximately 90% of the entire sample consists of houses. The average price of a housing unit when the market duration spell[12] begins is $656,802.2 real Mexican pesos as of January 2008. For almost all homes in the sample, the market duration range started before the real estate development was observed for the first time by SOFTEC. In fact, when the real estate development is first observed in DIME, the average duration since the real estate development started sales is 4 quarters. Most of the real estate developments, 28% of the sample, entered DIME in the second quarter of 2006.

Figure 3: Commercial Banks and Infonavit Loans to the Housing Sector
Annualized Quartely Growth Rate



Source: Banco de México

To measure the effect of commercial bank and Infonavit credit on the market duration of a home, the annualized quarterly growth rate of both commercial bank and Infonavit lending to the housing market was included as a covariate in the hazard model estimation. As shown in Figure 4, the growth rate is consistently positive between March of 2005 and March of 2010. For the period of analysis, from the second quarter of 2006 to the last quarter of 2009, the annual growth rate reached a maximum of 17% in the third quarter of 2006, followed by a steady decline until the last quarter of 2008, when the growth rate registered 4%. Between 2009 and the first quarter of 2010, the growth rate of total lending by Infonavit and commercial banks stayed at around 5%.

Finally, to control for the performance of economic activity at the state level in the hazard model estimation, the annualized quarterly growth rate of the *Índice Coincidente Estatal* (ICE) was included as a covariate in the hazard model. This index is similar to ICR, but covers states rather than regions.

[12] Range and spell are used interchangeably.

5. Method

A flexible hazard model estimates the market duration of a new home before it has been on the market for *t* quarters. The focus is on the effect that different factors have on the probability of selling a new developer-constructed home between quarters *t* and *t*+1, given that it has not been sold before quarter *t*. The method used here is the same presented in Meyer (1990). Although the unit of observation is the housing unit, a panel was constructed in which each observation corresponds to a specific real estate developer in a specific quarter. The reason for this is that only one type of housing unit per real estate development is observed, so all housing units within a development are identical except that they have different market durations and prices. Each row of the panel indicates the number of homes sold in the corresponding quarter by the real estate developer, their duration in the housing market, the number of censored homes per quarter in the real estate development, and their corresponding vector of covariates. In this paper a home is censored if it has not been sold during the last quarter in which it was observed. The maximum number of periods for which a housing unit is observed is 15.

The main benefits of using a flexible hazard model, compared to parametric hazard models like the Weibull or the logistic models, is that no assumptions about the distribution of the duration range are necessary. Also, this semi-parametric hazard model naturally allows for time dependent covariates.[13]

Let T_i be the market duration of home i, that is, the time it stays on the housing market before it gets sold. Then, the hazard in this case is defined as the probability that home i will be sold between quarter *t* and quarter *t*+1, given that home i has survived on the market up through quarter *t*. With this definition, the hazard is parameterized using a proportional hazard form as follows:

Let $\lambda_o(t)$ be the baseline hazard at time *t*, $\mathbf{x}_i(t)$ be the vector of possibly time varying explanatory variables for home i, and β be the vector of parameters. Then the hazard function for home i is:

$$\lambda_i(t) = \lambda_o(t)exp[\mathbf{x}_i(t)'\beta] \quad (1).$$

Using equation (1) we can write down the probability that a duration range will extend until time *t*+1 given that it has lasted until *t*.

Using the fact that $\mathbf{x}_i(t)$ is constant in the interval [*t*,*t*+1) and the following definition from Meyer (1990),

$$\gamma(t) = log \int_t^{t+1} \lambda_o(u)du \quad (2)$$

the probability of a home not being sold in the first k_{i-1} intervals can be written as:

$$\prod_{t=1}^{k_i-1} exp\{exp[\gamma(t) + \mathbf{x}_i(t)'\beta]\} \quad (3)$$

Moreover, the probability that duration T_i falls into interval k_i is given by:

$$1 - exp\{-exp[\gamma(k_i) + \mathbf{x}_i(k_i)'\beta]\} \quad (4).$$

Using the probabilities defined in equations (3) and (4), the log-likelihood function for a sample of *N* homes is:

[13] For more detailed explanations of these and other advantages please refer to Meyer (1990).

$$L(\gamma,\beta)=\sum_{i=1}^{N}\left\{\delta_i log[1-exp[-exp[\gamma(k_i)+x_i(k_i)'\beta]]]-\sum_{t=1}^{k_i-1}exp[\gamma(t)+x_i(t)'\beta]\right\} \quad (5).$$

Where $\gamma=[\gamma(1),\ldots,\gamma(T)]'$, C_i is the censoring time for individual i, $\delta_i=1$ if $T_i \leq C_i$, i.e., the observation is censored, and 0 otherwise, and $k_i=min\{int(T_i),C_i\}$.

Since the maximum number of periods in which a home is observed is 15, the log-likelihood function is maximized through standard techniques with respect to the 15 elements of γ and the vector β.

Before explaining the empirical hazard of the data, two clarifications must be made. First, notice that the market duration observed by SOFTEC was used in the estimation procedure, rather than the market duration since the real estate development started sales. This is because the time variant covariates related to the home, like the price, are not observed for the periods before the development is first observed in the database. However, the market duration since the real estate development started sales was included as a control variable. Second, the hazard is constructed according to the number of quarters the housing unit has been for sale since the real estate development entered the DIME database, although housing units entered the sample in different calendar quarters. In other words, all durations are aligned to the same starting point because all that matters is the number of periods they have been for sale since they were first observed by SOFTEC.

Table 2: Failures, Censoring, and the Kaplan-Meier Empirical Hazard

Quarter *t* in sale	Risk Set	Exits	Censoring	Hazard	Std. Error
1	907393	117565	69567	0.130	0.000
2	740816	89104	49012	0.120	0.000
3	600785	83068	50927	0.138	0.000
4	490248	73023	27469	0.149	0.001
5	391402	63685	25823	0.163	0.001
6	298360	45085	29357	0.151	0.001
7	232345	38338	20930	0.165	0.001
8	179151	48830	14856	0.273	0.001
9	119201	26778	11120	0.225	0.001
10	80223	20229	12200	0.252	0.002
11	49706	8485	10288	0.171	0.002
12	35032	5063	6189	0.145	0.002
13	24956	3042	5013	0.122	0.002
14	17545	5021	4369	0.286	0.003
15	1723	1723	10801	1.000	0.000

Table 2 summarizes the variables to construct the hazard function. The risk set at the beginning of quarter *t* refers to the number of housing units for which the range has not ended or been censored at the beginning of quarter *t*. Total exits refers to the number of homes for sale that were sold during quarter *t*. As an example, 117,565 home units were sold during the first quarter, that is, about 12% of the sample. As was mentioned before, censored exits refers to the number of homes not sold as of the last period in which they were observed. For example, being censored in the first quarter implies that the home was not sold during the first quarter and that this was the last period in which it was registered in the

sample. Actually, 69,567 homes were censored during the first quarter, around 7% of the sample. Finally, the hazard in Table 2 corresponds to the Kaplan-Meier empirical hazard for the whole sample. The empirical hazard is the fraction of ranges, ongoing at the start of a quarter, which end during the quarter. The empirical hazard is relatively low and stable for the first seven periods (0.145 on average). Then the hazard of being sold in the 8th, 9th, and 10th period of being on the market increases to 0.250 on average. The hazard is one in the last period because no observations last more than 15 periods. Therefore, once one subtracts the censored observations from the risk set, all remaining homes are sold in that period.

6. Results

Column 1 of Table 3 shows the results from the flexible hazard model when only characteristics of the home are included as explanatory variables. According to the estimates, a 1% increase in floor size increases the probability of a home being sold by 6.9%. If the housing unit is an apartment, the probability of being sold increases 9.4%. Perhaps people simply prefer apartments to houses. However, new apartments are usually in urban areas, whereas new houses are, in most cases, located in areas where the cost of land is cheaper. Hence, prospective buyers may prefer an apartment compared to a house because of its location. A 1% increase in the asking price decreases the probability of a home being sold by 19.2%, everything else being equal. If the market duration, since the real estate development sales started, increases by 1%, then the probability of a home being sold increases 22.2%. All coefficients are statistically significant at the 1% level.

Table 3: Flexible Hazard Estimated Coefficients

Variables	(1)		(2)		(3)	
log(Floor Size in m2)	0.069	**	0.138	**	0.138	**
	(0.006)		(0.007)		(0.007)	
Apartment indicator	0.094	**	-0.113	**	-0.113	**
	(0.006)		(0.008)		(0.008)	
log(Sale Price)[a]	-0.192	**	-0.252	**	-0.256	**
	(0.004)		(0.005)		(0.005)	
log(Quarters since Development Sales Started)	0.222	**	0.412	**	0.427	**
	(0.003)		(0.003)		(0.003)	
State's Economic Activity Index [a,b]					0.869	**
					(0.063)	
National Commercial Bank and Infonavit Credit to Housing Sector [a,b,†]					-0.085	
					(0.127)	
Starting Date Indicators	No		Yes		Yes	
State Indicators	No		Yes		Yes	
Log-likelihood	-1737744.2		-1713411.3		-1711549.3	
Sample Size	976960		976960		976960	

Standard Errors in parentheses.

Estimated γ vector not included in table, but available upon request.

[a] Since these variables are time variant, statistics refer to the period when market duration range begins.

[b] Annualized quarterly growth rate.

[†] Excludes non-bank institutions.

**p<0.01; *p<0.05.

Column 2 of Table 3 includes the variables in column 1, plus state indicators and indicators for the quarter in which the real estate development was first observed by SOFTEC and incorporated in DIME, in other words, starting date indicators. State indicators are necessary to control for differences across states. The omitted state is Aguascalientes. The starting date indicators are useful to control for seasonal differences in duration distributions. The omitted quarter is the second quarter of 2006. The coefficients for these indicators were not included in Table 3, but are available upon request. A 1% increase in floor size increases the probability of a home being sold by 13.8%, and the coefficient is statistically significant. The sign of this estimate is equal to what we found in column 1, but the magnitude increased from 6.9% to 13.8%. Once we control for location through state indicators, apartments are 11.3% less likely to be sold than are houses. In other words, people prefer houses to apartments once we control for location. Also, a 1% increase in the sale price decreases the probability of being sold by 25.2%. This coefficient is larger than the corresponding coefficient in the previous column. The coefficient on market duration is still positive and of higher magnitude, 41.2% compared to 22.2%. This means that once we control for state and seasonal differences, the more time the house spends on the market, the higher is the probability of its being sold. All coefficients are statistically significant at the 1% level.

The most interesting results for the purposes of this paper are in column 3 of Table 3. This column, besides including all regressors from previous columns, includes two variables, one that measures state economic activity and another that measures mortgage credit loans made to households by commercial banks and by Infonavit. The effect of the state economic activity on the probability of a home being sold is measured by the annualized quarterly growth rate of the state economic activity index, ICE. It is expected that a greater growth in economic activity will increase the probability of selling a home constructed by real estate developers. The annual growth rate for national mortgage loans given to households was included in order to measure the effect that financial resources available to buy a home have on the probability of a home being sold. It can be expected that having more resources available to buy a home increases the probability of selling a new home.

According to the figures in this column, if a state's annual economic growth doubles, then the probability of a home being sold there increases by 86.9%, and the coefficient is statistically significant at the 1% level. However, the results indicate that if the annual growth rate in mortgage loans given by Infonavit and commercial banks to households doubles, there is no significant effect on the probability of a home being sold. One reason that could explain this is the fact that the series used to construct the variable for the annual growth rate in mortgage credit vary only over time, not across states, as is the case with the series used to construct the annual growth rate of economic activity. Thus, perhaps there is not enough source of variation in the series used to identify the effect of mortgage credit on the probability of a home being sold. Another explanation could be related to the fact that the percentage of the housing market that SOFTEC follows is around 45%. Therefore, it could be that for this fraction of the market, mortgage credit is not relevant.

7. Conclusion

Making use of a particular Mexican housing-market database, a flexible hazard model was estimated to study the market duration of new homes constructed by real estate developers in Mexico. The period of analysis is from the second quarter of 2006 to the fourth quarter of 2009. As expected, the results indicate that, all else being equal, the market duration of a home for sale is greater if the sale price is high, if the floor size decreases, if it is an apartment instead of a house, or if the economic activity deteriorates. Also, the probability of a new home being sold increases the longer it has been on the market.

Future extensions of this paper will investigate further the question of why mortgage credit given by Infonavit and commercial banks, as a whole, do not significantly affect the

probability of a home being sold. Also included will be an exploration of how different structural characteristics of a home, the sale price, economic activity performance and the mortgage market affect different housing market segments and different regions.

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