

New construction and vacancy chains at the Olympic Village in Barcelona

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INTRODUCTION

The increase of housing prices during the last eighties jointly with a persistent unsatisfied demand and a growing migration from non-European countries has aroused again some particular issues such as housing turnover or housing opportunities in central cities of some developed areas. As a consequence, new studies in relation with filtering effects over the housing market have appeared adding some light to its functioning.

During the last decades, several empirical studies have been done in order to analyse how filtering occurs. Vacancy chains have been used as the main instrument to evaluate potentialities for housing policy to rely on the market outcome. Despite particular conditions and methodological constraints, two facts can be confirmed: on the one hand, the adequacy and validity of the vacancy chain analysis to investigate how the market works. On the other, the potentialities of this research to compare and evaluate the trade-off between a deep public intervention and the market outcome in a varied range of countries.

The present research project analyses the possibilities for Spanish housing policy for realigning or on market functioning in order to provide housing for low-income families. Firstly, the paper will discuss over definition of vacancy and filtering looking for a defined theoretical framework to look at several empirical research results, compiled in

an extensive summary of vacancy chain studies around the world. Secondly, a particular methodology will be used to analyse vacancy chains in an extreme and particular case of new construction, the Olympic Village in Poble Nou, Barcelona. I have chosen the empirical simulation and the Markov model as the research instrument to analyse the chains of moves in a local housing market in Barcelona. They involve not only demographic changes but changes in the residential housing stock and mobility in a single process. Both of them consider mobility as a consequence of the creation and destruction of vacancy opportunities in the different segments of the residential sector.

Finally, some suggestions are done in relation to housing policy orientation. The effectiveness of new construction policies as an instrument to provide housing for low-income families is questioned under the light of these case study results.

THEORETICAL FRAMEWORK

The vacancy chain concept

The seminal contribution to the vacancy chain concept was made a century ago and was related to migration movements to towns in Ravenstein's «laws of migration» (1885,1889). Firestone (1951) and Kristof (1965) introduced research about residential vacancy chains. Their analysis has been used as a basis for sociological studies (see Lansing, Clifton and Morgan, 1969 or Murie *et al*, 1974). Emmi and Magnusson (1988, 1993, 1994a, 1994b) have followed the microeconomic formulation of vacancy chains and the Markov tradition initiated by White (1971).

Vacancy chains are formed by the different transactions occurring to a purchase of a house —usually understood by researchers as a «new house»—. In general, there are two groups of households affected by a new purchase; those who are the effective buyers, directly beneficiaries of new buildings and those who are indirectly beneficiaries because they have moved into a sequence of vacancies initiated by the first group (Forrest & Murie, 1993).

A family with a certain level of income accessing a new flat implies an increase in the supply because of the empty house left. In this way, it is possible that another family occupies this second-hand house left empty by the first buyers. At a third level of the chain, a third family will take possession of the vacancy existing in the market because of the second buying. This process could be repeated till the house occupied by a family does not leave any vacancy in the market or the vacancy left unoccupied is not interesting to any demand segment.

From the supply side, there are some facts that have obvious effects on the length of resultant chains of new construction such as value, location or structural characteristics of the new vacancies (Sharpe, 1978). From the demand side, a vacancy chain should answer several questions such as who moves into the new dwellings and what kind of households take advantage of the secondary vacancies which are introduced by the addition of new units to the stock.

When focusing on vacancies, market transactions are reflected, from both the supply and demand sides. Additionally, concentrating in vacancies is useful for mathematical and practical reasons (Emmi & Magnusson, 1993); they are endowed with the mathematical properties needed to apply stochastic system models, households are not.

The analysis of housing opportunities is concerned with the mechanisms of opportunity creation, the patterns that determine flows between different housing sectors and how they are related. New construction, subdivision of a house and the death of a household are, among others, vacancy generation events; demolition and immigration can be considered examples of vacancy destruction causes.

The filtering effect

A contrasting hypothesis in vacancy chain studies is the «filtering effect». There are different conceptualisations of filtering in the economic literature (See Ratcliff, 1949; Fisher & Winnick, 1951; Lowry, 1960; Grisby, 1963; Smith, 1964; Weicher, 1977, for an earlier discussion of the concept.)

The filtering concept is usually associated with housing provision for poor people through the vacancy chain mechanism: as time goes by, a house deteriorates and its price and quality decline¹. If owners of this house decide to change its house for a better one, there is the possibility for low-income levels to buy this low quality house. If filtering works, there is only one direction in the shift of the demand through vacancy chains: from inexpensive, poor quality housing to better quality and high price houses.

Sharpe criticises generalisation in vacancy chain studies; the results of any vacancy chain study must be related to particular factors, which may vary from region to region or from period to period. He suggests that local and national housing policy,

¹ Usually called *turnover effect* in housing.

rate of demolition and construction, demographic composition, in/out migration should be taken into consideration in any vacancy study. Therefore, the outcome of any research will rather reflect local conditions than any general trend. Following Sharpe, Hegedüs and Tosics (1991) consider that comparisons could produce a biased picture. The strength of any vacancy multiplier is more likely to be a reflection of local market conditions than the values of the new units.

On the other side, Baer and Koo (1991) defend the possibility of comparison arguing the relative similarities that can be found in applied studies in spite of local and temporal variables. As a matter of fact, there are some common assumptions in vacancy chain studies. It has been defended (Lansing Clifton, Morgan, 1969; White, 1971) that the higher status a dwelling has the longer the chain it will generate. Moreover, the greater mobility on housing markets the better for all. Mobility generally improves housing conditions, only a small percentage suffers deterioration through the different moves. In conclusion, to build for the welfare of all would be translated into building large and expensive dwellings, which will ensure the higher rate of families displacement.

Traditional public intervention in housing markets is usually justified, assuming a set of imperfections, in terms of equity, redistribution and externalities production. Quite often, the results of housing policy are unsatisfactory to cope with the demand side need. Alternatively, the market can be used as an instrument to offer solutions based in the practice of supply and demand. Through the process of filtering, it is possible to cope with low-income families housing demand. It results as a consequence of the vacancy transmission generated by the acquisition of new dwellings by high-income households. Following this pattern, to build new housing of high quality and price promotes, once started the vacancy chain after the first purchase and presuming that housing filters down, the increase in the number of units available in low quality and price housing sub-markets, benefiting low-income demand.

Summarising, if the vacancy distribution due to new construction of high quality and price dwellings has generated chains long enough to benefit families located in the lower income range, the filtering effect occurs and an internal redistribution in the housing markets takes place, being satisfactory for the whole population. On the contrary, if vacancy chains are too short, it can be concluded that the functioning of the market by itself, do not provide solutions for a certain demand segment.

With the aim of comparison, Table I offers a general view of chain length results in vacancy chains research. As it can be seen, case study parameters differ considerably from each other.

Table 1. Vacancy chains research

Author	Area	N. Interview	Average length	Title	Published in	
Canada and United States						
Firestone	1951*	Montreal	n.a	1.3		
"	1951	Winnepeg	n.a	1.3		
"	1951	Victoria	n.a	1.3		
Kristoff	1965	N.Y. City	154	2.4	Housing Policy Goals and the Turnover of Housing	Journal of the American Institute of Planners 31. p. 232-245.
Lansing <i>et al</i>	1966	17 U.S areas	2.711	3.5	New Homes and Poor People	Plymouth, Michigan: Maxwell Pt. Co.
Pack	1970*	New Haven	n.a	1.9		
Jacob	1971*	Detroit	74	2.5		
Brueggeman	1972+	Columbus	1.364	2.3		
Hua	1972+	EUA	est. Of.	3.5		
"	1972+	Cleveland	est.of	3.8-4.2		
Adams	1973*	Minn/St.Paul	418	2.0-2.2		
Sands & Bower	1976	Rochester, Buffalo	1.150	1.6-2.4	Vacancy Chains in the Local Housing Market.	Ithaca, N.y. Center for Urban Development, Cornell University
Sands	1977	Detroit	500	3.1-4.0	A Vacancy Transfer Model of the Structure of the Local Housing Market.	AREUEA Journal 5. P. 128-138.
Dzus & Romsa	1977	Windsor	157	2.1	Housing Construction, Vacancy Chains and Residential Mobility in Windsor.	Canadian Geographer XXI 3
Sharpe	1978	Toronto	263	1.5	New Construction and Housing Turnover Vacancy Chains in Toronto.	Canadian Geographer XXII 2
Emmi	1979+	Boston	15.000	1.6-2.8		
Emmi	1979+	Washington D.C.	"	1.7-2.6		
Emmi	1979+	Houston	"	2.1-2.6		
Porell	1981	Pittsburgh	500	1.9-2.2	Spatial Impacts of Local Housing Programmes: An Empirical Analysis of a Housing Turnover Model.	Journal of the American Planning Association 47. P. 59-69.
Marullo	1985+	EUA	14.252	2.2-4.6		
Other developed countries						
Murrie & Hillyard	1972*	Northern Ireland	939	1.9		
Duffy	1972*	Christchurch, N.Z.	n.a	1.5		
Dept. Environment*		England	n.a	1.7		
Watson	1974	W. Central Scot.	1.377	1.6-2.1	Vacancy Chains, Filtering and the Public Sector.	Journal of the American Institute of Planners 40. P. 346-352.

Clarck,	1984	Southwest Skane		3.3-3.6	Housing Policies and New Construction. A Study of Chains of Moves in Southwest Skane.	Scandinavian Housing and Planning Research 1. P. 3-14.
Scholten Bysveen & Knutsen,	1986+ 1987	The Netherlands Oslo	13.400	1.6-2.2 1.5-2.5	Vacancy Chains initiated by Out-migration: a Study of the Housing Market in Oslo.	Housing Studies. Vol 2. 3. P. 203-212.
Emmi & Magnusson	1988	Gävle, Sweden	11.109	1.2-2.4	Residential Vacancy Chain Models of an Urban Housing Market	Scandinavian Housing and Planning Research 5. P. 129-145.
Forrest & Murie,	1993	Southern England		n.c	The Dynamics of Owner Occupied Market in Southern England in the Late's 1980s: a Study of New Building and Vacancy Chains.	Regional Studies. Vol 28. 3. P. 275-289.
Meulenbelt,	1994	Rotterdam Met.		n.c	Upgrading and downgrading within the Metropolitan region of Rotterdam.	Urban Studies. Vol 31. 7. P. 1167-1190.
Bessy, Guillouet & Soulignac,	1995	Region d'Ile-de-France	904	1.95-3.58	Construction neuve et demenagements en chaine.	Institut d'Amenagement et d'Urbanisme de la Region d'Ile-de-France.

Eastern countries

Hedegüs & Tosics	1991+	Kapsovar, Szolnok Veszprem, Hungary	1.110	1.5		
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Developing countries

Prentice	1976**	México city	270	2.4		
Yanez	1976**	Chihuahua, México	64	2.4		
Ferchou	1982+	Tunis, Tunis	182	2.1		
Koo	1989+	Seül, Corea	765	3.0		
Baer & Koo	1994	Seül, Corea	765	n.c	Housing Turnover in Developing Nations: The Case os Seoul.	Journal of Planning Education and Research 13. p. 104-118.

* Quoted in Sharpe (1978) *New Construction and Housing Turnover: Vacancy Chains in Toronto*. Canadian Geographer 22. págs. 130-144.

** Quoted in Ferchou (1982) *The Indirect Effects of New Housing Construction in Developing Countries*. Urban Studies 19, págs. 167-176.

+ Quoted in Baer i Koo (1994) *Housing Turnover in Developing Nations: the Case os Seoul*. Journal of Planning Education and Research 13. págs. 104-118.

n.c: not calculated

n.a: not available.

EMPIRICAL RESEARCH

In 1965, Kristof introduced the interview model as a way to identify links between vacancies. A representative sample of vacancy initiation allows starting interviewing families who have recently bought a new flat. In absence of official data, the interview reveals facts about the past location of the family: old address and characteristics of the former house. Those references make possible to continue interviewing families that have occupied the houses left empty by households

The aim of the empirical analysis is to measure the length of the vacancy chains generated by a first acquisition in a new development to make it comparable to other empirical results. The data needed in the Barcelona case study was obtained through an interview to a sample of families who had recently moved to the Olympic Village, a private development that involved 2,000 high-priced dwellings². In July 1995, 165 families that had bought a new flat in the Olympic Village were interviewed. The sample was designed to take into account the different dwelling characteristics and tenures in the Village. The interview consisted in 52 questions divided into three main categories: the present situation at the Village, the past situation in their former houses and the type of household.

According to the information provided by the households at the Olympic Village, it was possible to continue interviewing those families who move to any position of the chain initiated by new construction at the Village.

Research instruments

Once the interviews were done, it was possible to apply the empirical simulation and the Markov models to obtain information about chain length.

a) The empirical simulation model

Completed and uncompleted chains can be distinguished along interviews. The completed chains are those that in one step do not liberate any vacancy in the hou-

² The prices for flats went between 10M and 56M, 1992 current PTAs. Prices depended on square metres, proximity to sea and the availability of some services. In terms of price per square metre, the range was established between 175,000 and 325,000 PTAs.

sing market after a family move³. As long as the interview method reveals a high percentage of loss along the chain, uncompleted chains pick up this information.

The empirical simulation consist to apply for uncompleted chains, the same rate of end of chain found for completed chains. The assumption behind considers that non completed chains would evolve following the same pattern than those completed⁴. Results obtained through this method relay in the end chain rate chosen.

b) The Markov model

This model divides the urban housing market into homogeneous sectors considering their similarities. Usually, sectors are distinguished by housing characteristics such as size or tenure. Then, the transfer process is analysed, that is, when the vacancy is created in a determined sector, it may be occupied by a household moving from other sector withing the housing market of analysis.

Following Emmi and Magnusson (1993), the choice for families when moving is delimited by housing opportunities —available vacancies— in the market. Chains of moves in a local housing market are created by the existence of new vacancies due to new construction, subdivision of housing space and conversion from non-residential uses, or the «death» of a household; i.e., death of one-person household, sharing accommodation or out-migration. In contrast, the end of a chain is due to the «death» of a dwelling/vacancy: demolition, conversion from non-residential uses, merging housing space and long term vacancies, or the generation of a new household: move from parents, splitting of existing households, immigration and second homes (Short, 1978).

The Markov chain model simulates the impact of housing opportunity creation on intra-urban residential relocation. The information provided by those families who had recently bought a new flat at the Olympic Village regarding their present and past situation, allows to simulate, through the Markov model, the next steps of the chain without using the information provided by interviews to other families in subsequent levels. With the observed mobility at hand, the Markov model system simulated mobility in future positions.

Simulation implies two stages: first, the elaboration of a *transition matrix* (T), which reflects the passage between the former and the past situation. Three aspects

³ I considered as a reason for end of chain a move that liberates a vacancy outside the housing of the city —immigration—.

⁴ For an extensive application of this model, see Bessy, Guillouet and Soullignac (1995).

are taken into account in this case study: structure —measured through the number of rooms—, size —measured through the square metres of the dwelling— and tenure —considering only two possibilities, ownership and rent—.

Secondly, transition matrixes are transformed in *probability matrix* (P). The absolute values are translated into percentages⁵. The third stage infers the results of the simulation calculation the *Markov multiplier matrix* (M)⁶.

The chain length can be obtained as the row sum of the M matrix for each category. It represents the number of housing units involved when a vacancy is created in any sector by vacancy creation events.

Generally speaking, the chain length and the chain composition represent the utility of a vacancy chain model. This approach can be used to, a) knowledge improvement of the functioning of the housing market and, b) consider some alternatives to present public policies engaged in providing housing for low income families. In this paper, results are limited to calculations of chain length.

RESULTS

The typical household living in the Village was a couple in their thirties-forties, with one or two children and, in their majority, with two income earners. Most of them have lived in a flat before and they were owners of this previous flat—in a 30% of cases, they were renters—. The reason for moving was basically to improve living conditions. In most cases, families had decided to move to obtain more space or to enjoy a better view or neighbourhood.

a) Simulation model results

Accordingly to the simulation model, 82 completed chains were found while 83 were interrupted. Table 1 shows the reasons for chain completion in the four positions of the chain.

⁵ Column and row related to ends of chain are considered as absorption events, then, they are not included.

⁶ The Markov multiplier matrix is calculated as follows:
 $M=INV(I-P)$ where I is the identity matrix, P the probability matrix and INV the inverse function.

Table 1. Completed chains. Reasons for completion

	1st position	2nd position	3rd position	4th position	Total
Demolition	2	1			3
Former chain position outside BCN	15	6	1		22
Former chain position outside BCN province	12	3	1		16
Former chain position occupied by relatives	9	1	2	1	13
Divorce	1				1
Independence from parents	4	5	1	1	11
Marriage	7	1	1		9
Conversion to non residential use		3	2		5
Former chain position as a second home		1			1
Independence from students flat					1
Total	50	21	9	2	82

Under the light of these results, it can be concluded that the majority of families that arrived to the Village and to the following steps from the chain come from outside Barcelona City but from the same province. It means that in most cases, the metropolitan area of Barcelona represented a source of migration to the different positions of the chain. Also, families from outside Barcelona province showed the second higher percentage of reasons to move. The third reason to move in importance was the independence from relatives or parents.

Table 2 illustrates why the chains were uncompleted. Calculations based on this table settle a high loss rate⁷. Nevertheless, these percentages are comparable to those obtained in other international empirical studies.

Table 2. Uncompleted chains. Reasons for interruption

	1st position	2nd position	3rd position	4th position	Total
Do not give former address	10		1		11
Inaccurate former address		5	3	1	9
Vacant		17	2	3	22
Address not found		4			4
No answer		20	1	2	23
Others		11	2	1	14
Total	10	57	9	7	83

Summarising, Table 3 clarifies not only loss rates but also chain end rates⁸.

⁷ The loss rate accounts the relation between uncompleted or undone interviews and the potential interviews to carry out.

⁸ The chain end rate shows the relation between the number of chain completions in a determined position of the chain and the number of interviews effectively done in the same chain position.

Table 3. Loss rates and chain end rates

	1st position	2nd position	3rd position	4th position	Total
Potential interviews	165*	115	29	9	318
Done	165	50	18	2	235
Not done	0	65	11	7	83
Loss rate		56.52%	37.9%	77.7%	
Completed chains	50	21	9	2	82
Chain end rate	30.30%	42%	50%	100%	25.79%

* Those 165 are the beginning of all chains. All of them were done.

To apply the empirical simulation, it is necessary to choose among the different end chain rates that can be obtained according to the data. The end chain rate increases while higher positions are kept in view: it is more frequent to find in position third or fourth dwellings that do not liberate any vacancy in the market than in position first. Three possible end chain rates were contemplated depending on the number of positions considered: 30.30% —considering just completed chains of one position—, 45.71%— considering completed chains with two or more positions, 34.89% —considering completed chains of any length—.

As it was pointed before, the results about chain length obtained vary depending on the end chain rate considered. In both cases, the chain length retrieved was considerably higher than in the observed case. See Table 5.

Table 5. Chain length depending on end chain rate. Empirical simulation

	Chain length		
	Observed	Simulated (45.71%)	Simulated (34.89%)
Completed chains	1.55		
Completed + uncompleted chains		2.74	3.22

The chain length for completed chains is quite short. The chain length must be understood as the number of dwellings involved when a family buys a new flat. In average, new construction of 100 dwellings only liberates 55 older houses. The underlying explanation is the considerable amount of difficulties found during the realisation of the interview, reflected in the high percentage of loss. The observed length is, therefore, strongly biased. It only takes into account completed chains during the realisation of the interview, basically the shorter ones.

After the simulation, new construction liberates 174 or 222 dwellings if choosing as end chain rate 45.71% or 34.89%, respectively.

b) *Markov model results*

After obtaining matrix M, the Markov multiplier, the chain length is derived as the row sum of this matrix for each category. The assumptions of the Markov model state behind those calculations. Once housing sub-sectors are defined, vacancies in any sub-sector follow the same transition probability —*homogeneity*—, transition probabilities are constant for the simulated period —*stationarity*—, vacancy transfers are independent of their previous situation or their previous transfer —*markovicity*—.

Table 6 reveals vacancy chain lengths in all categories considered in relation to tenure, structure and size.

Table 6. Vacancy chain length according to housing characteristics

	1-2 rooms	3-4 rooms	5 or more r.	Less than 80 s.m.	Between 80 and 90 s.m.	Between 90 and 100 s.m.	More than 100 s.m.	Ownership	Rent
Chain length	1.86	2.6	3.53	2.15	2.59	2.60	2.28	2.79	1.68

Findings accomplish the main assumptions behind vacancy chain studies. Dwellings with less rooms or with less square metres liberate older dwellings in a lower degree, excepting for those flats with more than 100 metres. In respect to tenure, ownership causes longer chains than the rental sector: while 100 new ownership dwellings liberate 179 second hand flats, 100 new rental dwellings only liberate 68.

In both cases, the empirical and the Markov simulation, the results obtained show relatively short vacancy chains. It can be a reflection of a segmented housing market, imposing constraints to low-income families in obtaining a suitable home. In this sense, the filtering effect as a way to solve housing problems through the market process produces an unsatisfactory outcome in the Barcelona context.

CONCLUSIONS

Vacancy chains have been used to analyse the impact of new construction of high quality and high price dwellings at the Olympic Village, Barcelona. The chain length was chosen as a standard parameter to evaluate the possibilities of filtering in this context. This research has avoided any complementary references to add qualitative variables to a merely quantitative result. In this sense, conclusions must be valued in a very limited extend.

It seems arguable that the dichotomy offered to housing policy in this context, building new housing to high-income families while houses filter down through the vacancy chain or designing *ad hoc* policies to those that can not afford market conditions, has a clear response under the obtained results. If transparency and flexibility of the market are not guaranteed, vacancy chains originated by new construction are quite short and can not be used as an indirect mean to, through the process of filtering, provide housing for low-income people.

There are still some persistent problems in Barcelona that must be solved by policy initiatives. The unsatisfied demand generated in the latest years has determined to some extent, an increase in internal mobility and a negative migration balance of the city in favour of peripheral cities. In this sense, housing policies with the aim of providing housing for low-income people and keeping the attractiveness of the central city must be oriented to reach higher housing standards at reasonable prices. The filtering effect strongly relates high construction rates in peripheral areas and the degeneration of living conditions in the city centre.

Moreover, expectations over new family creation denote additional housing difficulties in the city area in the very next future. However, in the long run, the evolution of the demand pattern insinuates the opposite situation, that is, a superavit in the housing market, raising possibilities for positive migration and impeding the improvement of the housing stock due to the excess of supply.

Additional research on the relationship between vacancies, housing opportunities and filtering would provide some sights of what is happening in the central city housing market and to what extend, housing policies can take advantage of the market mechanism as a way to offer housing for low-income families.

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