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Chapter 7

Construction programmes and residential mobility: multipliers and loglinear models

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INTRODUCTION

Residential construction programmes in the Netherlands reflect a longstanding goal of the Dutch national government: to eradicate the persisting quantitative and qualitative housing shortage. These two types of shortage are closely related: the addition of a unit to the housing stock not only increases the size of that stock but also prompts moves by which other units are vacated. Since the units thus vacated become available to qualifying households, the existing distribution of housing may be improved. As a result of the level of present-day construction activity and of current demographic changes, both the quantitative housing shortage and the construction output will decrease in the near future. Consequently a solution for the qualitative problem of housing distribution will depend increasingly on the positive effects of residential mobility on the redistribution of units in the present stock. It is therefore imperative that the new construction that does occur should have maximum impact on the redistribution of housing.

The method used for analyzing the effects of residential mobility is known as vacancy chain analysis. In this context mobility may be defined as a redistribution process: a dwelling becomes available for occupancy by a household which in turn vacates a unit that becomes occupied by others, until the chain is broken by the appearance of a newcomer in the housing market. This chapter applies the method of input-output analysis to the study of vacancy chains. The application of such analysis to vacancy chain problems renders redundant certain commonly used yet inefficient procedures for data collection. The major advantage of the application of the input-output model is that it furnishes multipliers which may be employed to gain insight into the efficiency of the residential mobility process with regard to the redistribution of dwellings. The derivation of multipliers also facilitates the simulation of the effects of alternative residential construction programmes with a view to estimating their contribution to a solution of the qualitative housing shortage.

A complete and valid answer to the question of which of the various possible construction programmes would contribute most to a solution of the housing problems cannot be derived from a mere study of actual moves; it requires consideration of preferred moves

as well. The loglinear model discussed in this chapter provides the option to compare actual moves with preferred moves. The empirical data on both the observed and the preferred moves for this study were derived from the survey of regional housing needs that was carried out in 1977 (DGVH, 1977). That survey, in which questionnaires were answered by 54 417 individuals, was sponsored by the Ministry of Housing; the Dutch Census Bureau (CBS) was responsible for the data collection.

This chapter deals first and foremost with the potential of the input-output model and the loglinear model for analyzing the processes that take place in the housing market. The methods used are thus introduced, albeit briefly, before the results of the calculations are presented. A more complete description of these methods and of some aspects of the functioning of housing markets is presented in Scholten and Hooimeijer (1984). The analysis and results presented in this paper concern the southeastern part of the Netherlands.

RESIDENTIAL MOBILITY SUMMARIZED IN MULTIPLIERS: THE INPUT-OUTPUT MODEL

The first set of calculations is performed on a frequency distribution of actual residential moves (occurring between defined types of dwelling) and on the rate of appearance of newcomers in the housing market (per type of dwelling). The frequency distribution is transformed to a matrix P, which consists of coefficients derived by taking the number of observations in each cell of the distribution of moves by housing types involved and dividing it by the total number of settling households in each housing type (see Table 7.2)

$$P_{ij} = \frac{m_{ij}}{\sum_j m_{ij}} \qquad (1)$$

where: m_{ij} is the total number of movers from dwelling type j to dewlling type i.

The coefficients p_{ij} are the first links of the vacancy chains and thus depict the direct effects of residential mobility on housing redistribution. The segment of matrix P that contains the relationships between the relevant types of dwellings is designated as matrix Q. The powers of matrix Q represent the respective chain lengths, and the sum of all possible chain lengths yields:

$$F = (I - Q)^{-1} \qquad (2)$$

where: I is the unity matrix.

Input-output analysis is a technique specifically designed to summarize and quantify industrial linkages within an economy. But, as can be shown, the structure of the model makes it particularly suitable for analyzing linkages among housing sub-markets as well (White, 1971). The interpretation of matrix F is as follows: in the rows of the matrix, each element represents the number of dwellings of specified types that are vacated as a result of the primary supply, i.e. the addition of a dwelling in a specified

sub-market; these elements are the multipliers. The sum of the multipliers per row represents the total number of vacated dwellings resulting from the addition of a unit of that type to the housing stock; it corresponds to the average chain length. The most important advantage of calculating multipliers is that they quantify the effect of construction of a dwelling of a certain type on the vacating of other dwellings. Thereby, the practice of tracing individual vacancy chains becomes superfluous.

THE LOGLINEAR MODEL

To describe moves between housing types, certain variables are generally employed, namely housing type at origin, housing type of destination, types of households, and the location of the dwellings. Relationships between these variables may be studied using the loglinear model. In this research project the loglinear model has been employed to delineate sectoral sub-markets (consisting of housing types) and to compare spatial sub-markets. This paper focuses on a specific application of the loglinear model: the substitution of interaction parameters.

The model selected to specify the relationship between the housing types of origin and destination is the saturated loglinear model in a multiplicative format (Bishop *et al.*, 1975):

$$m_{ij} = w\, w_i^A\, w_j^B\, w_{ij}^{AB} \qquad (3)$$

where:

m_{ij} is the number of movers from housing type j to housing type i;

w is a scale factor which specifies the effect of the sample size;

w_i^A is the representation of the relative size of the destination sub-markets;

w_j^B is the representation of the relative size of the sub-markets of origin; and

w_{ij}^{AB} is the interaction effect between the sub-markets of destination and origin.

Some moves take place between almost all sub-markets, although the probability of a move declines when the distance between sub-markets is increased. Distance may be expressed in terms of price, size, or tenure category, but also in terms of geographical distance. The interaction effect w_{ij}^{AB} expresses the influence of all such distance indicators. Because the values of the interaction effects are independent of the absolute size and relative share of the various sub-markets, they may be transformed into a different matrix (Willekens, 1983; Scholten, 1984). The transformation can take place by means of a bi-proportional fitting procedure. The starting point for this procedure is a matrix of flows of preferred moves. Iteratively, these flows can be so transformed that their column and row totals correspond to those of a different matrix. Thus, a new matrix is generated consisting of cell values specified as follows:

$$\hat{m}_{ij} = v\ v_i^A\ v_j^B\ w_{ij}^{AB} \qquad (4)$$

where:

$\hat{m}_{ij}$ is the estimated number of movers in the second matrixi

v, v_i^A, v_j^B are the main effects corresponding to those in equation (3) for the second matrix; and

w_{ij}^{AB} is the interaction effects corresponding to those in the first matrix.

The estimated flows ($\hat{m}_{ij}$) may subsequently be compared with the observed flows to reveal the difference in interaction patterns, the tension between preferred and actual mobility patterns.

RESIDENTIAL MOBILITY PATTERNS IN THE SOUTHEASTERN PART OF THE NETHERLANDS

The spatial scale on which a balance between supply and demand should be reached may be described as a housing market area. This is the area within which households are generally willing to move; a move within such an area does not entail an unacceptable loss of social or cultural contacts or a change in place of work. Analysis of residential mobility should be undertaken for each of the delineated housing market areas. However, as it may be assumed that the structure of residential mobility in each of the housing market areas has certain common characteristics, generalization is legitimate. An analysis of these characteristics established a regionalization of the Netherlands in four regions which demonstrate an internally homogeneous structure of residential mobility. The input-output model and the loglinear model were applied to the data from the survey of regional housing needs (DGVH, 1977) in the southeastern part of the Netherlands (Figure 7.1, cluster II). In the model of vacancy chains the individual housing market areas (DGVH, 1979) form the basic units of analysis, since the process of redistribution was defined in terms of moves which yield vacated dwellings within the same housing market area. Households originating in a different housing market area are considered to be newcomers in a given housing market; thus they terminate the vacancy chain.

The definition of sectoral sub-markets is of crucial importance to the study of residential mobility. Sectoral sub-markets are distinguished by classifying dwelling types; moves between these types are the subject of study. The classification determines how adequately the structure of the redistribution process can be represented by the model. Two structuring factors may be isolated. The first one combines the factors of the demand side, namely the housing needs and housing aspirations of the households. Since the functioning of the housing market is not solely determined by the consumers, the second important factor combines the various dimensions of supply. A very large number of individual factors are potentially significant. But the classification should not be so detailed as to allot an insufficient number of observations per cell; the recruiting patterns derived from such a matrix would then be meaningless. Consequently, the classification used in this study comprises fourteen dwelling types (Table 7.1).

Table 7.2 presents the weighted number of respondents that moved into a dwelling in the southeastern part of the Netherlands

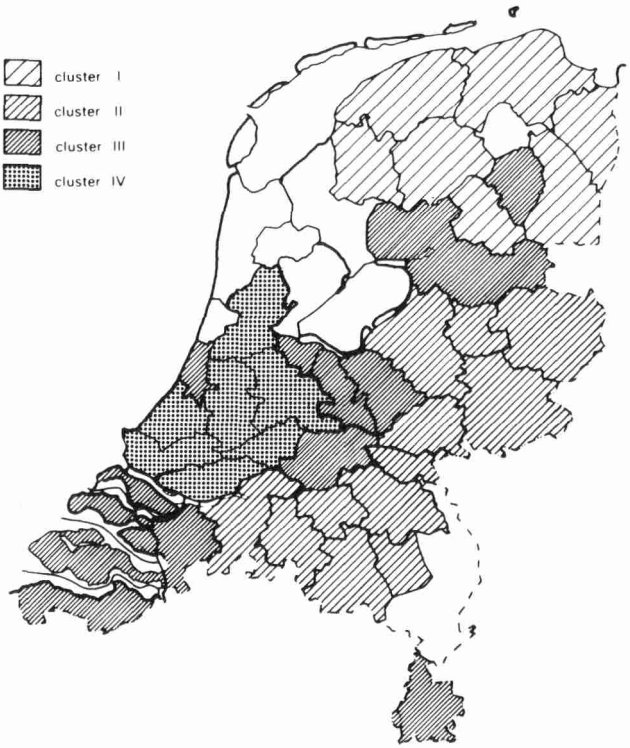

Figure 7.1 Spatial sub-markets in the Netherlands

in 1975, 1976, or 1977. The rows of the table represent the destination dwellings (the numbers correspond to those in Table 7.1). The columns represent the dwellings of origin (1-14), with the addition of columns 15 and 16 which represent, respectively, in-migrants from other housing market areas and starting households that moved into their first independent dwelling. The starting households form an important group, as they account for almost 50% of all changes.

The absolute numbers in Table 7.2 are accompanied by the coefficients p_{ij} (underneath) which describe the direct relationships between the dwelling types and the newcomers; the sum of the coefficients by row is 1. The coefficients can also be interpreted as the recruiting pattern of the specified dwelling types. The first 14 columns and the 14 rows of the table form matrix Q from which can be derived the matrix (F) of multiplier effects (Table 7.3). For each of the types of dwellings of destination, the sum of the multipliers has been computed so that the average chain lengths are specified. As described above, the multiplier effects may be used to determine the number of dwellings of each type that are vacated as the result of the primary supply of one unit of a specific dwelling type.

Table 7.1 Classification of dwelling types

1. Single-family rented dwelling, two or three rooms, monthly rent below 200 guilders (price level 1 July 1977)

2. Single-family rented dwelling, two or three rooms, monthly rent of 200 guilders or more

3. Single-family rented dwelling, four rooms, monthly rent below 200 guilders

4. Single-family rented dwelling, four rooms, monthly rent between 200 and 350 guilders

5. Single-family rented dwelling, four rooms, monthly rent of 350 guilders or more

6. Single-family rented dwelling, five or more rooms, monthly rent below 250 guilders

7. Single-family rented dwelling, five or more rooms, monthly rent between 250 and 400 guilders

8. Single-family rented dwelling, five or more rooms, monthly rent of 400 guilders or more

9. Rented dwelling in multi-family structure, two or three rooms, monthly rent below 200 guilders

10. Rented dwelling in multi-family structure, two or three rooms, monthly rent of 200 guilders or more

11. Rented dwelling in multi-family structure, four or more rooms, monthly rent below 300 guilders

12. Rented dwelling in multi-family structure, four or more rooms, monthy rent of 300 guilders or more

13. Owner-occupied dwelling valued below 150 000 guilders (price level 1 July 1977)

14. Owner-occupied dwelling valued at 150 000 guilders or more

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An abundance of information is compacted into Tables 7.2 and 7.3; to a large extent, they summarize the dynamics of the housing market. Table 7.2 demonstrates that the starting households (column 16) occupy a weak position in that market. Their share is largest in the least desired market sectors, namely dwellings in multi-family structures (types 9-12). The homeowner market and the rented sub-markets defined by medium-sized and large single-family homes are by and large inaccessible to this group. The migrants (column 15), on the other hand, seem to have a very strong position; their destination is predominantly the expensive, large single-family rented sub-market and the homeowner sub-market. The process of redistribution is described in Table 7.3. The average chain length - which equals the total multiplier - is predominantly influenced by the relative inaccessibility of certain sub-markets

Table 7.2 Residential moves in the southeastern part of the Netherlands, 1975-1977

Dwelling type of destination	Dwelling type or situation of origin: 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	572	0	365	0	0	556	175	0	57	187	256	269	907	103	0	4793	8240
	.069	.000	.044	.000	.000	.067	.021	.000	.007	.023	.031	.033	.110	.013	.000	.582	1.000
2	0	255	329	166	77	457	90	95	86	77	215	589	922	262	341	4567	8528
	.000	.030	.039	.019	.009	.054	.011	.011	.010	.009	.025	.069	.108	.031	.040	.536	1.000
3	1123	172	3136	283	114	612	69	0	952	309	1703	258	82	96	478	5799	15186
	.074	.011	.207	.019	.008	.040	.005	.000	.063	.020	.112	.017	.005	.006	.031	.382	1.000
4	243	0	1455	816	225	733	205	74	983	610	1498	1910	151	253	1486	14056	24698
	.010	.000	.059	.033	.009	.030	.008	.003	.040	.025	.061	.077	.006	.010	.060	.569	1.000
5	0	208	146	259	279	426	82	270	193	241	760	1116	0	327	1030	4714	10051
	.000	.021	.015	.026	.028	.042	.008	.027	.019	.024	.076	.111	.000	.033	.102	.469	1.000
6	197	181	848	72	142	347	200	240	457	77	869	329	343	87	470	4451	9310
	.021	.019	.091	.008	.015	.037	.021	.026	.049	.008	.093	.035	.037	.009	.050	.478	1.000
7	76	254	1032	902	281	397	218	655	305	580	869	892	288	163	1990	4524	13426
	.006	.019	.077	.067	.021	.030	.016	.049	.023	.043	.065	.066	.021	.012	.148	.337	1.000
8	0	0	95	256	175	98	286	358	79	143	484	732	495	492	2752	4889	11334
	.000	.000	.008	.023	.015	.009	.025	.032	.007	.013	.043	.065	.044	.043	.243	.431	1.000
9	209	0	297	0	89	550	164	0	599	198	64	239	204	178	174	5907	8872
	.024	.000	.033	.000	.010	.062	.018	.000	.068	.022	.007	.027	.023	.020	.020	.666	1.000
10	610	77	571	217	169	1072	766	0	652	543	826	235	386	0	1747	13953	21824
	.028	.004	.026	.010	.008	.049	.035	.000	.030	.025	.038	.011	.018	.000	.080	.639	1.000
11	100	0	714	0	0	0	89	0	162	156	507	148	370	70	390	6633	9339
	.011	.000	.976	.000	.000	.000	.010	.000	.017	.017	.054	.016	.040	.007	.042	.710	1.000
12	323	68	456	227	86	103	65	268	198	752	350	404	179	173	976	12505	17133
	.019	.004	.027	.013	.005	.006	.004	.016	.012	.044	.020	.024	.010	.010	.056	.730	1.000
13	234	186	1264	1577	907	531	1742	1036	346	1165	1629	3126	3749	1407	5310	20535	44744
	.005	.005	.004	.028	.035	.020	.039	.023	.008	.026	.036	.070	.084	.031	.119	.459	1.000
14	422	280	683	1977	996	468	1214	2267	308	888	619	1710	6824	6959	10688	11800	48103
	.009	.006	.014	.041	.021	.010	.025	.047	.006	.018	.013	.036	.142	.145	.222	.245	1.000
	4109	1681	11391	6752	3540	6350	5365	5263	5377	5926	10649	11957	14900	10570	27832	119126	250804

See Table 7.1 for key to items 1-14.

15 In-migrants from other housing market areas
16 Starting households moving into first dwelling

Table 7.3 Matrix F, the matrix of multiplier effects, showing the supply generated by the primary supply

Destination dwellings	Origin dwellings 1	2	3	4	5	6	7	8	9	10	11	12	13	14	chain length
1	1.09	.00	.09	.01	.01	.09	.04	.01	.03	.04	.07	.06	.15	.03	1.71
2	.01	1.04	.08	.03	.02	.07	.02	.03	.03	.03	.06	.10	.14	.05	1.70
3	.11	.02	1.31	.03	.02	.08	.02	.01	.10	.04	.18	.05	.04	.02	2.01
4	.03	.00	.10	1.04	.01	.05	.02	.01	.06	.04	.09	.10	.02	.02	1.59
5	.01	.03	.05	.04	1.03	.06	.02	.04	.04	.04	.11	.14	.02	.05	1.67
6	.04	.02	.15	.02	.02	1.06	.03	.03	.07	.03	.14	.06	.07	.02	1.78
7	.03	.02	.14	.08	.03	.05	1.03	.06	.05	.06	.11	.10	.05	.03	1.83
8	.01	.00	.03	.03	.02	.02	.03	1.04	.02	.03	.07	.09	.07	.06	1.52
9	.04	.00	.07	.01	.02	.08	.03	.01	1.09	.03	.03	.05	.04	.03	1.53
10	.04	.01	.06	.02	.01	.06	.04	.01	.05	1.04	.06	.03	.04	.01	1.47
11	.02	.00	.11	.01	.00	.01	.02	.00	.03	.03	1.08	.03	1.06	.01	1.42
12	.03	.01	.05	.02	.01	.02	.01	.02	.02	.05	.04	1.04	.02	.02	1.34
13	.02	.01	.07	.05	.03	.03	.05	.03	.02	.04	.07	.10	1.11	.05	1.69
14	.02	.01	.05	.07	.03	.03	.04	.07	.02	.04	.05	.08	.20	1.19	1.91

to newcomers. The inverse relationship between the chain lengths (in Table 7.3) and the proportion of newcomers among the occupants (in Table 7.2) is clearly discernible. Housing inaccessibility is mainly due to price levels and to housing allocation rules.

The individual multiplier effects as specified in Table 7.3 may be used to derive a number of statements about the functioning of the housing market:

a. Almost every type of destination dwelling shows relatively high multiplier effects with the medium-sized and large single-family rented dwellings (types 3 and 6) and with the large dwellings in multi-family structures (types 11 and 12). These are obviously sub-markets from which a large number of moves originate and which thus play an important role in the 'housing careers' of households. Dwellings in multi-family structures are important to starting households, and the single-family dwellings play an important part in subsequent stages of the housing career, as may be concluded from Table 7.2.

b. Few moves originate in the sub-market of small dwellings (with the exception of low-priced small dwellings in multi-family structures). The same is true for the more expensive single-family rented dwellings (types 4, 5, 7, 8) and for the expensive owner-occupier dwellings. These types of dwellings perform an important function in the terminal stages of housing careers.

c. Of great importance for the process of redistribution of dwellings are those of type 7. Vacancies of this type apparently generate vacancies throughout the other sub-markets, given the relatively high multiplier values. By means of new construction it is easy to create a primary supply of such dwellings, and this leads to great diversity in the secondary supply.

d. Of much less importance are the expensive owner-occupier dwellings, even though this sub-market shows a large total multiplier effect. The data show that 40% of the resulting moves remain within the homeowner sector. As far as the rented sub-markets are concerned, these moves are mostly limited to the vacating of expensive rented units.

The observations arrived at on the basis of the data in Tables 7.2 and 7.3 pertain exclusively to actual moves. But in order to simulate the effects of various residential construction programmes, the analysis should also include the pattern of preferred moves. Therefore, the next section of this chapter explores the existing tension between the preferred and the actual mobility patterns.

THE TENSION BETWEEN PREFERRED AND ACTUAL MOBILITY PATTERNS

The matrix of preferred moves is the starting point for this analysis. The matrix can be expressed in the form of a saturated loglinear model:

$$gm_{ij} = w\, w_i^A\, w_j^B\, w_{ij}^{AB} \qquad (5)$$

where: gm_{ij} is the expressed preference to move from housing type j to housing type i.

The interaction effect of preferred mobility is then transferred to the matrix of actual mobility. In this process, the following elements are assumed to be constant:

- the total supply of dwellings;
- the secondary supply, which may be defined as the total number of departing households per housing type;
- the number of newcomers - both starting households and migrants - in the housing market.

Expressed in model-building terminology, this implies that the specifications are those of a single-constrained model in which the column totals are fixed. The remaining effects are derived from the matrix of preferred moves. This results in a distribution of the total supply over the various destination types, which is equal to the distribution of the preferred moves, and it makes the interaction between sub-markets directly proportional to the preferred interaction pattern.

$$\hat{m}_{ij} = v\, v_j^B\, w_i^A\, w_{ij}^{AB} \qquad (6)$$

where:

$\hat{m}_{ij}$ is the estimated number of preferred moves that would take place given the supply constraints;

v is a scale factor, which expresses the effect of the magnitude of the total number of actual moves;

v_j^B expresses the relative size of the sub-markets of actual departures;

w_i^A expresses the relative size of the sub-markets that are the preferred destinations; and

w_{ij}^{AB} are the interaction effects from the model of preferred moves

The magnitude of the tension between actual mobility and the pattern of preferred mobility is approximated by first subtracting the estimated flows of movers from the observed flows and subsequently standardizing the outcomes. Table 7.4 presents in a simple fashion the results of such a procedure.

Table 7.4 The tension between actual mobility and the pattern of preferred mobility

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1			--				+		-	+			++		--	-	- 1784
2	-		++	-					-	--			+	+	--	--	-12130
3	+	++	++	++		++		-		++	++			+	+	+	+ 5566
4		-			+			-			--				-		- 4551
5		++						-	+	-	++		-	++	-	++	+ 676
6		+	--				+		++					+	-	++	+ 483
7		+	++			-	-	++	+	++	-			++		++	+ 2324
8				++				-		+	++	+	++	++	++	++	+ 6880
9	--		--			+					-	++		+	--		- 2078
10	++	-	--	++		++	++	-	-	-	++	-	-	-	-		- 1188
11			++	-		--				++			+	+	-	++	+ 3935
12	+		++	+						++	+			+	+	++	+11651
13	-			--	-	-		--					-	++		--	-20055
14	++	++	+	++	+		+	++	+	+	++	+		-	++	++	+12905
	4109	1681	11391	6725	3540	6350	5365	5263	5377	5926	10649	11957	14900	10570	27832	119126	250804

When a plus is entered in a cell of the table, this indicates that the actual moves exceeded the preferred moves in magnitude; similarly, a minus is recorded when the preferred mobility rate is not achieved in reality. The column totals of Table 7.4 correspond to those in Table 7.2, which formed the starting point of our analysis. The row totals indicate which sub-markets are characterized by a supply surplus (+) or a supply deficit (-) when the actual moves are compared to the preferred moves. Table 7.4 thus allows us to make a number of observations:

a. There proves to be a great overall shortage of small dwellings, especially of the single-family types (types 1 and 2). The group of newcomers to the housing market is found to desire a greater accessibility to these sub-markets.

b. The rental sector is characterized by a supply surplus, especially of large dwellings in multi-family structures (types 11 and 12). In these sub-markets the supply surplus is much larger than the primary supply of newly constructed dwellings.

c. The owner-occupier sector as a whole shows a supply deficit. Within this sector, however, the expensive sub-markets (type 14) show a surplus. In contrast, the inexpensive sub-markets (type 13) show a great deficit.

d. There is a notable surplus of inexpensive four-room single-family rental dwellings (type 3), while the somewhat more expensive dwellings of this type are in short supply (type 4). This rather puzzling outcome should be examined in more detail. If households prefer type 4 over type 3 because of quality differences, a balance might be reached by resorting to a renovation programme.

e. There is a clear supply surplus of expensive large single-family rental dwellings (types 5 and 8). It may be assumed that these dwellings are of a quality comparable to that of the inexpensive owner-occupier units. It may be assumed that if starting households and those currently occupying houses of types 4 and 8 are stimulated to move into the owner-occupier sector, the expensive single-family rented sector would show high vacancy rates.

Table 7.4 obviously lends itself to use in proposing changes in construction programmes to ensure that newly constructed dwellings correspond more closely to housing preferences. But in using it accordingly, one should be aware that a change in the differentiation of the construction programme influences the magnitude and composition of the secondary supply. These effects can be predicted by a simulation exercise wherein the modified residential construction programme is multiplied by the matrix of multipliers. If this exercise is followed by a loglinear analysis as specified above, it also becomes feasible to predict the extent to which a modified construction programme would contribute to a decrease of the tension between actual mobility options and the pattern of preferred moves. The evaluation of the outcomes of this procedure may be used as input for a further round of calculations. In order to produce reliable outcomes, such a simulation should explicitly address the feasibility of preferred moves, given the (financial) characteristics of the potential movers. But other constraints should also be included, especially those enforced by various government organizations, such as financial limitations, spatial restrictions, and, in general, the policy options under consideration.

CONCLUSIONS

The input-output model described in this article is an efficient method for obtaining a detailed overview of the magnitude and the composition of the supply of housing that results from a primary supply of specific types of dwellings. In contrast to 'common knowledge', the analysis clearly demonstrates that the promotion of redistribution of the housing stock does *not* require construction of expensive owner-occupier dwellings which for years has formed the corner-stone of housing policy. Expensive owner-occupier dwellings produce a large multiplier effect, but the addition of this type of dwelling generates vacancies predomin-

antly within the owner-occupier sub-markets or in the sector of expensive rented dwellings. The resulting redistribution of the housing stock thereby only benefits groups that have sufficient financial resources to operate in these sub-markets. On the other hand, it has been shown that construction of large single-family dwellings of an average rent level not only generates high mobility but also leads to vacancies of dwellings of the types that are characterized by a large demand surplus; the loglinear analysis as applied here leaves no room for doubt in this respect.

The high demand for small single-family rented dwellings cannot be satisfied by promoting redistribution of the existing stock. There is no one type of dwelling that is strongly linked to this sector; only the direct provision of this type of dwelling can thus improve conditions in this sub-market. A demand surplus has been shown to exist among young households (starters) as well as among older households. If such homes were to be built, they would have to be suitable for both young people and for the elderly; if the predicted demographic changes do take place, such dwellings would fulfil a useful function for a long time to come. When the number of starting households entering this sub-market diminishes, these dwellings will be occupied predominantly by households in the terminal stage of their housing careers. Thus, long vacancy chains will be initiated and will lead to many other vacancies in sub-markets that are high in demand (such as the inexpensive owner-occupier sub-market).

The research described here can be continued and expanded in several useful ways. The current economic recession has brought about changes in residential mobility patterns; it should therefore be ascertained as to what extent mobility in more recent periods differs from that of the period on which this analysis is based, 1975-77, and how any differences can be accounted for. In addition, the model demonstrated in this chapter could be applied to data for specific groups of households; this would probably result in the identification of more stable results.

REFERENCES

Bishop, Y.M., Fienberg, S.E. and Holland, P.W., 1975. *Discrete Multivariate Analysis, Theory and Practice* (Cambridge, Mass.: M.I.T. Press)

DGVH, Directoraat-Generaal van de Volkshuisvesting, 1977. *Woningbehoefteonderzoek 1977, deel I: Algemeen Overzicht* Ministerie van Volkshuisvesting en Ruimtelijke Ordening, Den Haag.

DGVH, Directoraat-Generaal van de Volkshuisvesting, 1979. *Woningmarktgebieden,* Ministerie van Volkshuisvesting en Ruimtelijke Ordening, Den Haag.

Scholten, H.J., 1984. Residential mobility and loglinear modelling, in *Recent Developments in Spatial Analysis,* ed. Bahrenberg, G., Fisher, M.M. and Nijkamp, P. (Farnborough: Gower).

Scholten, H.J. and Hooimeijer, P., 1984. The use of vacancy chains and loglinear models to analyse relationships among housing submarkets, *Tijdschrift voor Economische en Sociale Geografie,* 74.

White, H.C., 1971. Multipliers, vacancy chains and filtering in housing, *Journal, American Institute of Planners*, 37, 88-94.

Willekens, F.J., 1983. Specification and calibration of spatial interaction models, *Tijdschrift voor Economische en Sociale Geografie*, 74, 239-52.