Housing Modifications, Neighbourhood Environment, and Housing Prices: Traditional Paradigms Re-examined

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Introduction

Since the pioneering studies of Zangerle (1927) and Henderson (1931) in real estate appraisal, attention to the effects of neighborhood and building factors (landscape views, vegetation, noise, air pollution, building patterns, etc.) on property values has been unsubsiding (Penington et al., 1990; Lockwood & Tracy, 1995; Asabere & Huffman, 1995; Feitelson *et al*., 1996; Tomkins *et al*., 1998; Spahr & Sunderman, 1999; Tyrvainen & Miettinen, 2000; Johnston et al., 2002; Grudnitski, 2003). The ongoing interest in this issue is due to the sizable contribution property taxation makes to the financial base of local authorities, and the presence of numerous players acting on the property market and affected by it, both directly and indirectly - construction companies, planning organizations, mortgage banks, and private investors (Appraisal Institute, 1992; Delisle *et al*, 1994; Yermiyahu, 1999).

In defining the interaction between the neighborhood environment, residential construction, and house prices, the modern theory of real estate appraisal and management relies on a number of *assumptions*, three of which are as follows:

- Objective location factors determine the market values of residential properties: Real estate prices in better locations are always higher and more stable than elsewhere;
- The neighborhood environment affects house prices directly: If environmental conditions are favorable, real estate prices are high and *vice versa*;
- New housing construction is always beneficial for local authorities: New building, even at the expense of local amenities, brings more taxes to the local budget.

The present paper attempts to revisit these popular concepts using empirical data available for two major cities in Israel – Jerusalem (650,000 residents) and Haifa (300,000 residents).

The paper is organized as follows. It starts with a brief description of the cities under study and data sources used in the analysis. Then, the aforementioned assumptions of the real estate theory are discussed in turn, and their validity is verified against available empirical data. As we argue, *public perception* about residential location (rather than *objective* location *per se*) tends to affect house prices. We also suggest that the neighborhood environment and house prices *correlate indirectly*, via housing rehabilitation efforts of property owners, who chose to invest in the maintenance and expansion of their properties (in building additions, modifications, renovations, etc.) or to refrain from such investment. Lastly, we argue that new residential construction, taking place at the expense of local amenities, may increase the inflow of local property taxes only in the short run, whereas, in the long run, it may *undermine the local tax base*, due to residential succession.

Data Sources

Data for the present analysis came from the following three main sources:

- *General data* on house prices were obtained from the Housing Prices Blue Book, published by the Levi-Yitzhak Appraisal & Survey Agency (Levi-Yitzhak, 2003);
- *Detailed data* on real estate transactions in selected neighborhoods were drawn from the Apartments and Houses' Sales Database, maintained by the Israel Tax Office.
- *The information on the neighborhoods' physical and environmental characteristics* was obtained via field surveys, using specially designed field tables, as further detailed in this section.

Eight neighborhoods were covered by the analysis, four in each city under study. A total of 449 housing units were surveyed in Jerusalem and 754 units - in Haifa (see Appendix 1). All the neighborhoods surveyed were built in the early 1970s through the 1980s as mass construction and are formed by privately owned houses

and apartments of similar size and design, which facilitated comparative analysis.[1]

Post-occupancy housing changes and modifications (HCMs) in the neighborhoods were recorded *in-situ*, using a specially designed field table (Appendix 2). The table in question assigns numerical codes to most typical changes (01,02,..N), and provides open-ended numbering for earlier unobserved changes and modifications (Etzion *et al*., 2001).

Proximities to neighborhood amenities and disamenities (distance to parks, major roads, etc.) are important research variables, reflecting neighborhood location. This information was assembled in two steps. First, all the major amenities and disamenities in the neighborhoods and in their vicinity were identified during field surveys and positioned on neighborhood and city maps. At the next phase, these environmental features were transferred into ArcGIS9 © databases, and aerial distances from each of them to individual apartments and houses were calculated using the 'spatial join' tool (for more detail, see Minami, 2001).

A sizable part of investment in residential properties (viz, furnishing, layout change, renovation, and plumbing) occur inside apartments and houses and cannot be traced from outside. Investment intentions of property owners are another important indicator of homeowners' response to neighborhood conditions and building characteristics, which cannot be investigated by a field survey, without entering individual properties. The present study dealt solely with *external* housing changes and modifications in residential neighborhoods, assuming that follow-up studies may focus on the survey of interior modifications and direct interviewing of homeowners.

The effect of location

Broadly defined, residential location is the geographic position of a residential property in urban space, relative to the city's center, major places of employment, open areas, etc. Empirically, the location of a residential property may be defined by the *environmental attributes* of the neighborhood in which it is located (eg, air pollution and noise levels, elevation above the sea level), or by its *proximity* to various urban features, such as open areas, sea shore, major streets, industrial areas, university campuses, large shopping centers, etc. (Appraisal Institute, 1992; Baum and Crosby 1995; Delisle and Sa-Aadu, 1994).

In most empirical studies, the Hedonic Price Method (HPM) is used to identify and measure the effect of location factors and building characteristics on property values. This modeling approach assumes that the monetary value of a dwelling unit depends on the attributes a particular house or apartment may possess. For instance, the market price of a dwelling may reflect its physical size and environmental characteristics, such as the number of rooms, age, location, etc. (Rosen 1974; Becker and Lavee, 1999; Des Rosiers, 2002; Plaut & Plaut, 2003). According to the underlying assumptions of this method, the marginal price effect of environmental amenities and disamenities is attributed either to an individual's willingness to pay for a particular attribute (eg, for a sea view or for proximity to a recreation area) or to a price-dumping effect which a certain attribute (eg, traffic noise or unattractive view) may have on the house's value.

The Hedonic Price Method (HPM) is usually termed a *revealed preference method* in order to distinguish it from the *stated preference approach*, such as the Contingent Valuation Method (CVM). The latter method investigates the intended (hypothetical) rather than actual market behavior. This survey-based approach is a well-established technique for measuring the public's willingness to pay (or the amount they would need to be compensated) for a perceived benefit (or loss) stemming from a specified change in the quality of the environment, such as traffic noise from a nearby highway or distance from a waste disposal site (Palmquist, 1982; Smith & Desvousges, 1986; Ryan, 1999).

After nearly 60 years of qualitative empirical research in real estate valuation, *is there strong empirical evidence that objective location factors and attributes contribute substantially to a property's market value?*

Although not claiming to be totally exhaustive, our analysis indicates that the answer to this question is rather *negative*. In particular, in no empirical study we reviewed during preparation of this paper,[2] evidence was found that location attributes *per se* explain more than 10-15% (!) of variation of house prices, with ca. 85-90% of price variance attributed to other factors, such as age of the property, building materials, housing quality, market conditions, etc.

In order to illustrate how ambiguous the relationship between neighborhood location and property values might be, let us consider a few examples drawn from the City of Haifa (Figure 1), one of the two cities under study.

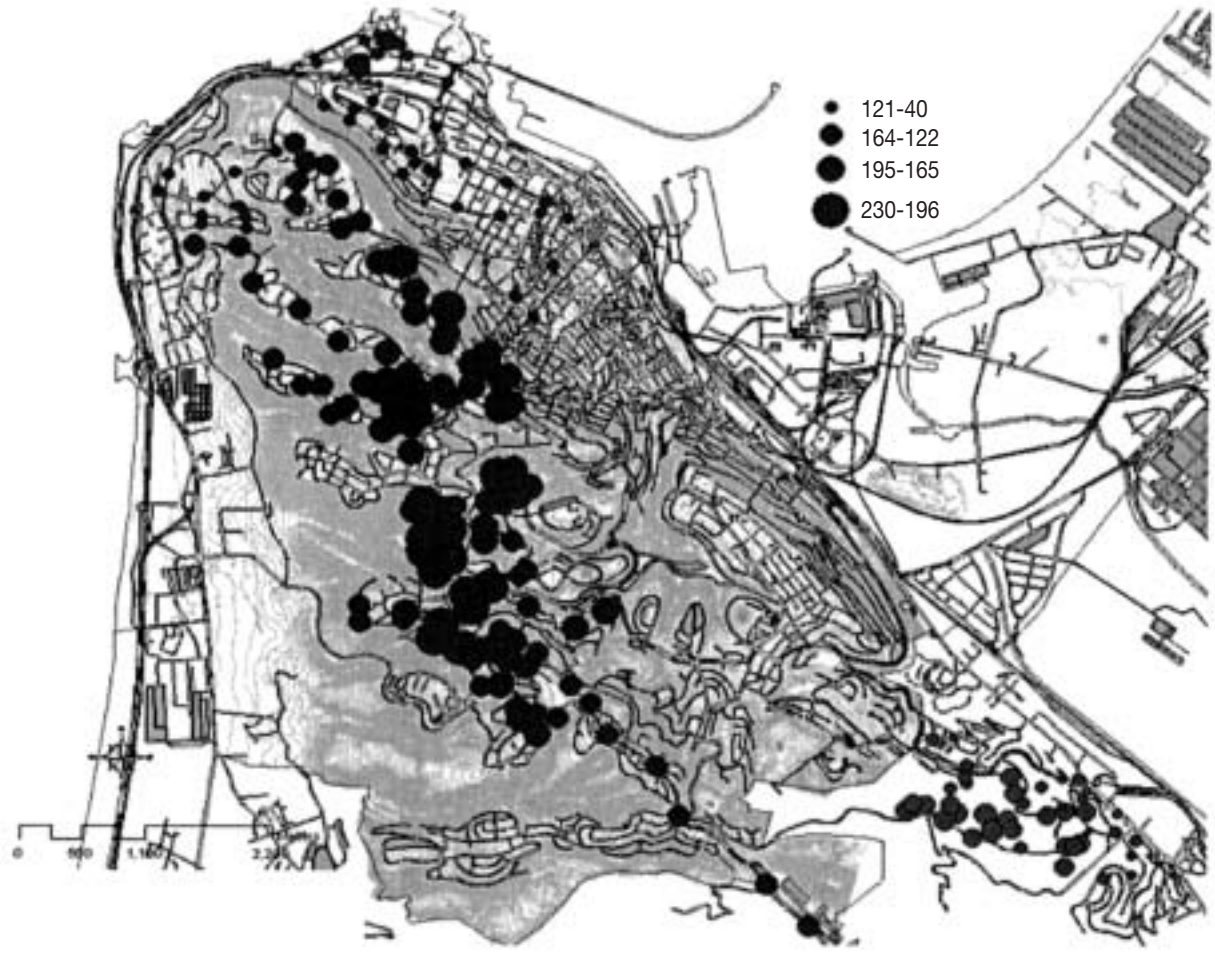
Although the city is very compact (ca. 60km^2), the average market prices of similar residential properties appear to vary considerably across different locations, ranging from US$40,000 to US$230,000.

Figure 2 illustrates the relationship between the proximity of apartments to open areas

[1] In Israel, there is practically no rental housing owned by commercial firms. Instead, public housing agencies (such as *Amidar* and *Amigur*) own a sizable portion of the housing stock in many localities. There is also a fairly well-developed market for rental of privately owned apartments and houses (Portnov and Erell, 2003).

[2] Correll *et al.*, 1978; Penington et al., 1990; Hughes & Sirmans, 1993; Been, 1994; Lockwood & Tracy, 1995; Asabere & Huffman, 1995; Feitelson *et al.*, 1996; Bullard, 1996; Ellen and Turner, 1997; Gat, 1998; Tomkins *et al.*, 1998; Spahr & Sunderman, 1999; Ryan, 1999; Freeman, 1999; Mahan *et al*., 2000; Rush and Bruggink, 2000; Tyrvainen & Miettinen, 2000; Wilhelmsson, 2000; Cole and Reeve, 2001; Bond *et al.*, 2002; Haider, and Haroun, 2002; Irwin, 2002; Johnston *et al.*, 2002; Fleishman & Odish, 2003a,b; Grudnitski, 2003; Portnov *et al.*, 2005

FIGURE 1
The City of Haifa: Topography, Road Network and Average Market Of Prices of 3-bdr Apartments at Different Locations (in US$1000)



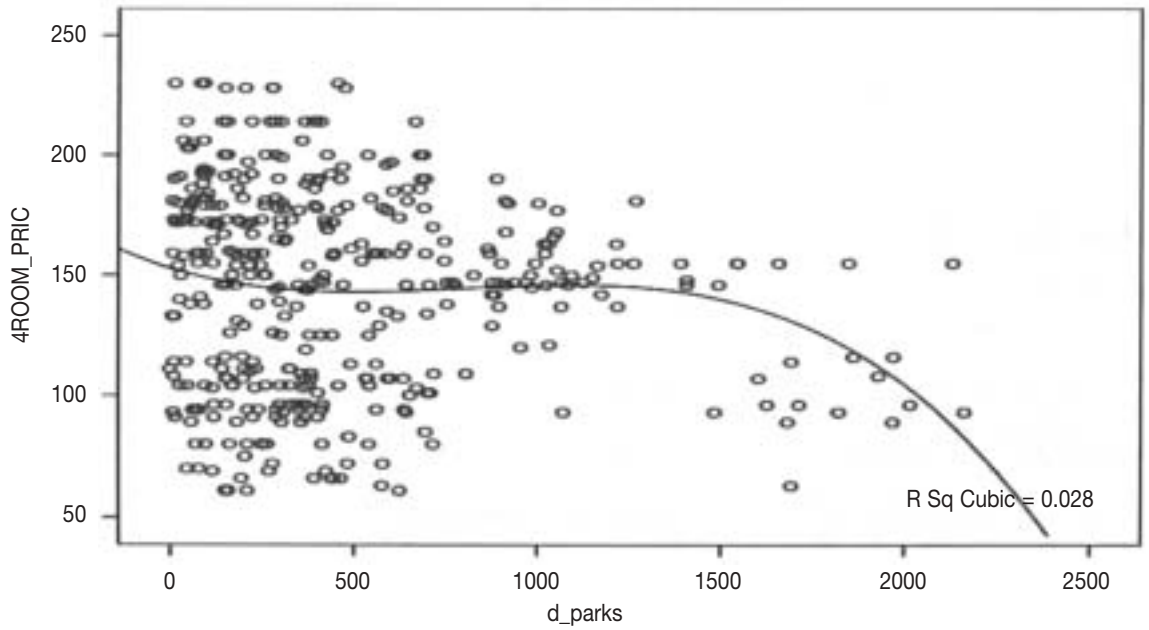
and their average market prices, whereas Figure 3 features the link between the properties' location on the city topography (elevation) and their average price levels.

As we can notice, in *neither case*, the link between location attributes and property prices appears to be straightforward. Such a link is especially weak in the case of open-space proximity. In particular, Figure 2 shows no obvious relationship between the two factors under study. Although in the case of *elevation* (Figure 3), the average prices of apartments do increase initially in line with rising elevations, this initial increase is altered by leveling off and subsequent decline. Moreover, nearly on any elevation, the range of apartments' prices (marked by thick black arrows in the diagram) tends to exceed the price averages observed on these elevations.[3]

Let us take a look now at the effect of neighborhood location on residential price dynamics. Figure 4 illustrates the price change in four residential neighborhoods in Haifa over the five-year period of 1990-2002. The comparison between two neighborhoods – *Ramot Remez* and *Kiryat Haim* (marked by thick color lines in the diagram) – is especially instructive. Both neighborhoods were established during the early 1970s and share similar building patterns. While environmentally, *Ramot Remez* is an attractive place, due to its positioning on relatively high elevations, proximity to two university campuses and green areas, *Kiryan Haim* is clearly disadvantageous. The neighborhood is

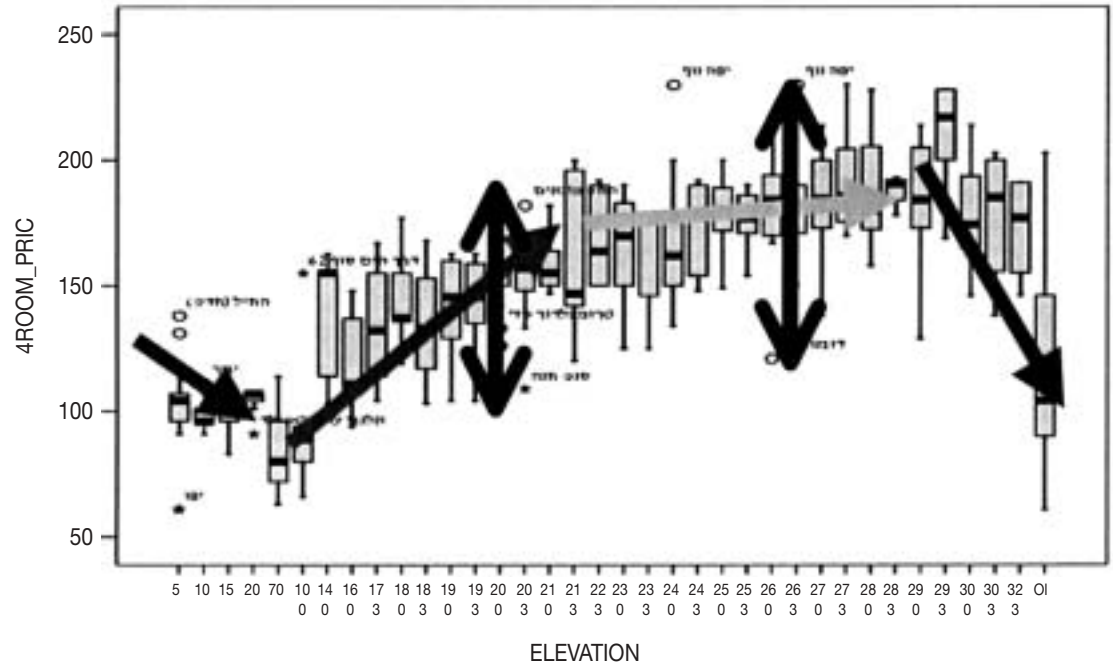
[3] In Israel, in general, and in the city of Haifa, in particular, the elevation of a house above the sea level is a considerable environmental amenity. High elevations are normally concomitant with panoramic views of open areas and provide better cross ventilation of indoor and outdoor spaces during hot and long summers.

FIGURE 2
The City of Haifa: Apartment Prices vs. Proximity to Main Open Areas



4ROOM_PRIC = Price of a 4-room (3-bedroom) apartment in US$1000
d_parks = distance to parks in meters

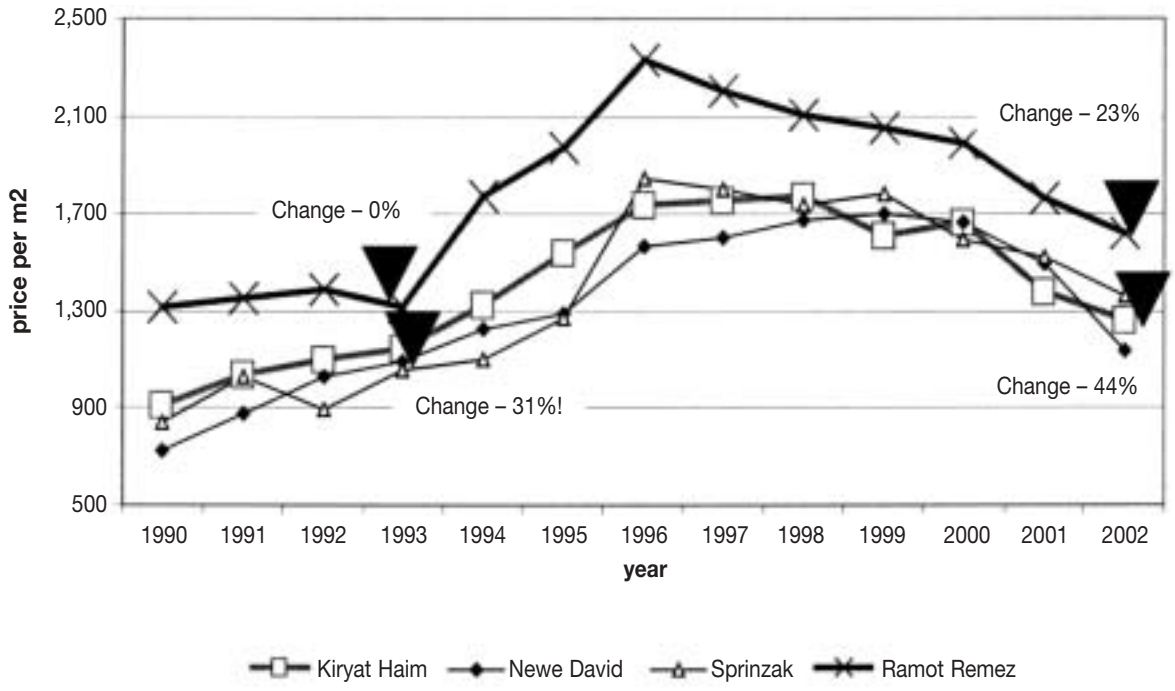
FIGURE 3
The City of Haifa: Average Apartment Prices vs. Elevation of Properties Above the Sea Level



4ROOM_PRIC = Price of a 4-room (3-bedroom) apartment in US$1000
ELEVATION = elevation of the apartment above the sea level in meters

FIGURE 4
Housing Price Change in Selected Residential Neighborhoods

Note: prices per m² are given in US$



positioned on a flat topography, provides no views of open areas, and is close to a major oil refinery plant.

However, as Figure 4 shows, *Kiryat Haim* exhibited in 1990-2002 (contrary to all expectations!) a stronger price gain than the better positioned *Ramot Remez*. This phenomenon may have a simple explanation: the *Ramot Remez* neighborhood is commonly perceived as "peripheral", located far away from main city attractions and major transportation nodes. Perhaps in the past this was correct. However, recent infrastructure developments changed this situation dramatically. Nevertheless, the perceived "peripherality" of this neighborhood is still deeply recorded in "collective" memory. Although the *Ramot Remez* still has a higher average house price level than elsewhere, longitudinally, its price change appears to be rather slow (23% in 1990-2002 vs. e.g., 44% in *Kiryat Haim*; see Fig. 4), thus indicating that less environmentally favorable neighborhoods are likely catch it up eventually.

Thus, not the "objective" features of residential location affect the house price changes , but rather the *public perception* about such features tends to affect it. In other words, *the "perceived location" of residential properties, not the "objective" location per se, is likely to be the main driving force behind house prices and their dynamics.*

Does the neighborhood environment affect house prices directly?

Neighborhood amenities, building patterns, and housing characteristics may appear to affect house prices *only* directly, which is not always true, as we shall argue later in this section. The direct links between neighborhood and building characteristics, on the one hand, and house prices, on the other, indeed *appear* to be fairly straightforward. Whereas a sea view or proximity to open areas may bring a price premium to homeowners (Benson et al, 1998; Morancho, 2003), structural wear is likely to lessen a building's value, and house prices near a noisy road tend to be low (Asabere and Huffman, 1995; Ryan, 1999; Wilhelmsson, 2000).

However, in our view, such direct relationships may be grossly oversimplified. Why do house prices tend to be low in a heavily polluted neighborhood? Because apartments and houses in such a neighborhood are unattractive to buyers, the appraisal theory readily tells us. Yes, it is correct, but only in part. Will individual property owners in such a neighborhood invest much in the maintenance and expansion of their properties – in building additions, renovations, and gardening? The answer to this question is rather no. The reason is simple: in an environmentally disadvantageous or poorly located neighborhood, any future price gain can hardly be expected. As a result, such a neighborhood will naturally become a *disincentive for rehabilitation decisions*.

Thus, the adverse neighborhood environment may 'strike' the local house prices twice: *first, by lowering the*

neighborhood's attractiveness to buyers, and, second, by causing underinvestment on the part of homeowners. The same link may also work in the opposite direction: if the neighborhood's environment and location are favorable, homeowners may be inclined to invest more in housing renovations. Since a well maintained neighborhood attracts buyers, its individual properties retain their value.

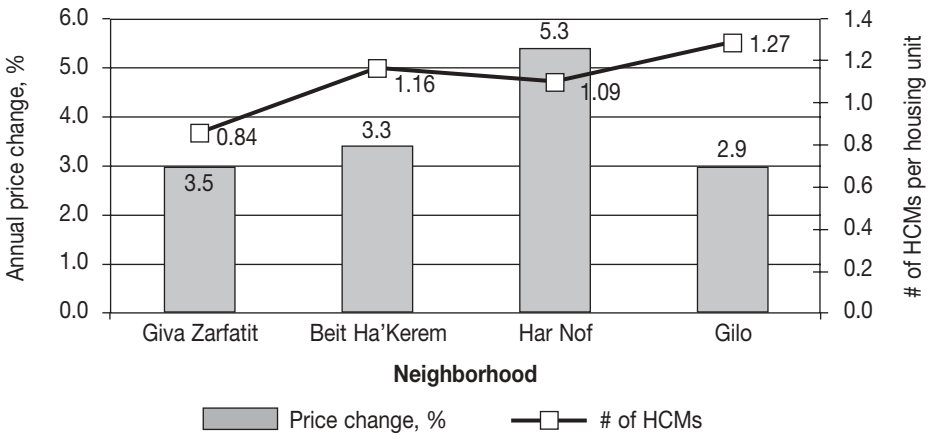
According to the explanation we propose, the link between neighborhood conditions, renovation activity of homeowners and house prices thus works as follows. Environmental amenities in a residential neighborhood (proximity to open areas, attractive views, etc) encourage homeowners to invest more in the *physical expansion and maintenance of their properties* – in building additions, modifications, renovations, gardening, etc. As a result, with the passage of time, the neighborhood appearance improves overall, and the property prices remain high. In contrast, if the environmental conditions in the neighborhood are unappealing (eg a neighborhood is situated on low elevations, deprived of green views, open spaces, surrounded by noisy roads or incorporates other environmental disamenities, either existing from the outset or added later), the local homeowners may see little value in investing in the maintenance of their properties. As a result, the physical conditions of individual properties in the neighborhood deteriorate, leading to low house prices.

In six (out of eight) residential neighborhoods we surveyed, the average number of accumulated post-occupancy changes and modifications indeed appeared to correlate firmly with both environmental conditions in the neighborhoods and their annual price change (see Figure 5). With a notable exception of *Gilo* in Jerusalem and *Ramot Remez* in Haifa, where slow price increases are likely to be determined by a variety of localized factors, the relationship between

FIGURE 5
Average Number of Housing Changes and Modifications (HCM) per Housing Unit and Annual Price Change in the Neighborhoods Surveyed in Jerusalem (A) and Haifa (B)

Note: The neighborhoods are ranked according to their environmental conditions, from the worst (left) to best (right)

5A



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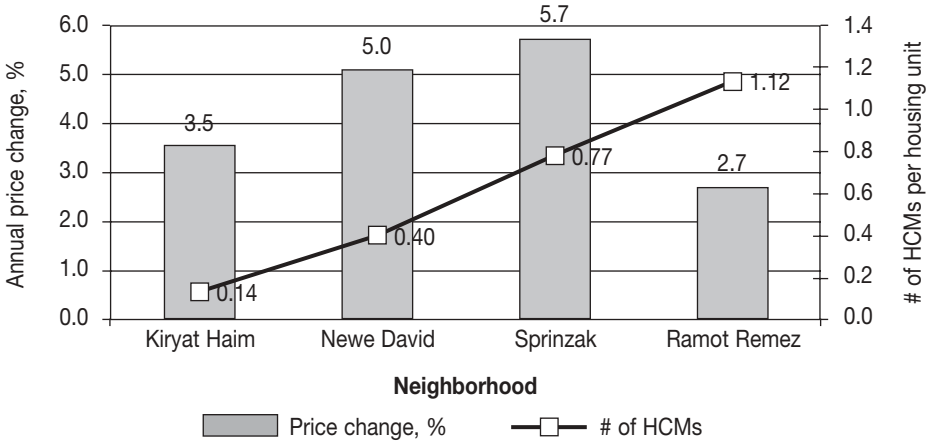


the variables under study appeared to be fairly straightforward: *more environmentally attractive neighborhoods tended to exhibit more rehabilitation activity and more rapid average price increases*.

Thus, in Haifa (Figure 5B), the Sprinzak neighborhood (0.77 housing changes and modifications (HCM) per average dwelling) exhibited in 1990-2002 the average annual price increase of some 5.7%, whereas Kiryat Haim (0.14 HCM) witnessed a price increase of only 3.5% per annum. However, these relationships clearly require a further analysis of potential confounders.

Does new construction always boost locally generated incomes of municipalities?

There exist two different systems of taxation, according to which the local property taxes are levied:

- According to the value based (*ad valorem*) tax system, payable property taxes are determined by house values, and are a function of the assessed property value, actual use of property (assessment rate) and the tax rate;
- According to non-value based property tax systems, property tax is determined by physical size of property (eg, its floor area) and the tax rate.

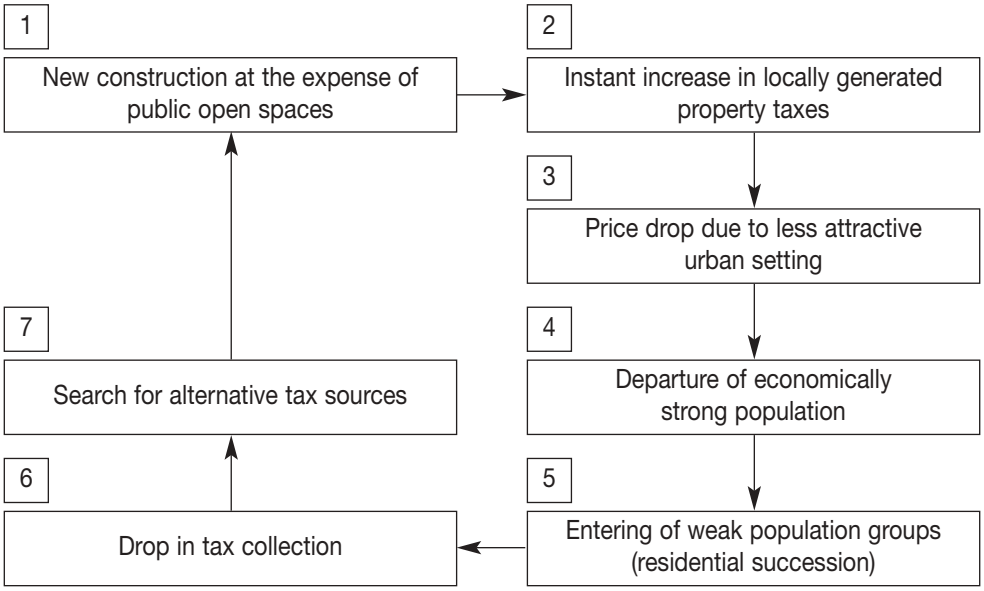
While the former approach is used in most developed countries of the world, there are also a few unique examples of non-value based property tax systems, which are found in Poland, Hungary, Czech Republic, Bulgaria and Israel (Portnov *et al*., 2001).

Under any of these assessment systems, a local authority, interested in increasing its tax base, often chooses to boost new construction in the area of its jurisdiction. Such a practice is especially common when the non value-based tax system is used, according to which the taxes collected are a direct function of the total floor area of building in the locality.

In some cases, local municipalities struggling for additional sources of income are ready to sacrifice local environmental amenities, such as open areas and green slopes, to attract more developers and tax payers. *Does it actually happen?* Yes, perhaps in the short run. However, over time, such practice is likely to be harmful for the local budget, as outlined below (see Figure 6):

New construction, carried out in built urban areas, increases property taxes accruing to the local authorities shortly after new housing units are completed and new dwellers moved in. However, the reduction of open areas and growing residential densities lead to a price drop eventually, because wealthy home-buyers, willing to pay more for proximity to parks and for green views, may start looking for alternative locations. Dropping house prices naturally lead to a departure of economically strong residents from the municipality and to their replacement by weaker population groups, a process known as "filtering" or "residential succession" (Duncan and Duncan, 1957). A weakening population leads to fewer taxes collected by local authorities, because weak population groups often enjoy tax breaks or are simply incapable of paying any taxes at all, due to

FIGURE 6
Proposed Model of Interaction between New Construction in Existing Urban Areas and Tax Collection by Local Municipalities



limited financial means. A drop in the local taxes collected and shrinking tax base cause local authorities to search for alternative sources of income. One of them is stimulating new constructions anywhere possible, including at the expense of remaining open spaces and other local amenities. New housing units built there result in a temporary increase in the local taxes, but, in the long run, lead to more out-migration of economically strong residents and additional tax drop. As a result, the municipality goes back again and again to "square one": drop in housing values, residential succession, search for new sources of income, etc. (Figure 6).

Conclusions and policy implications

Informed urban development policy requires clear understanding of the mechanisms of interaction between environmental factors, renovation activity in city neighborhoods and house prices. This knowledge may assist policy-makers in developing neighborhood rehabilitation programs, strengthening local environmental amenities, and enhancing local property values. In this respect, the results of the present analysis (albeit preliminary and requiring further substantiation) may have a number of important policy implications.

First, realization of the fact that the *subjective perception* of the urban physical environment, rather than *objective* physical qualities of this environment, tends to affect house prices may spur local surveys, aimed at identifying the most disturbing environmental disamenities and most attractive amenities, perceived by city residents. The results of such surveys may be used, in turn, for the preparation of long-term physical development plans and local development strategies.

Second, in empirical studies, specifically those employing the hedonic price approach, a way should be found to incorporate "publicly perceived" amenities and disamenities instead of "objective" attributes of a property's location. The latter may have no particular bearing upon the public's willingness (or unwillingness) to pay for a particular housing attribute and may thus only bias the results of the analysis. As expected, the introduction of such "subjective" amenities and disamenities in the empirical analysis may lead to improving explanatory models, used for both forecasting the housing price impact of various planning measures, such as new road construction, installation of cellular-phone antennas, etc. Technically, information on "perceived amenities and disamenities" in residential neighborhoods can easily be collected via individual interviews with tenants and homeowners.

The above "subjective" models may become especially useful in light of growing use of Geographic Information Systems (GIS) for GIS-assisted mass appraisal, applied in the cases in which only a limited number of comparable sales are available, which do not permit more accurate individual assessments (see inter alia Weber, 2001).

Third, understanding of the fact that post-occupancy housing modifications and maintenance efforts of homeowners affect housing values and that such activity is affected, in turn, by environmental conditions in residential neighborhoods, may help to justify public investment in environmental programs, aimed at enhancing local environmental amenities in residential areas. As expected, such public investment may initiate a dynamic process, spurring rehabilitation activity of local homeowners and improved maintenance of their properties. Expectedly, this process will lead eventually to raising local house prices and municipalities' locally-generated incomes.

Lastly, comprehension of the fact that the encouragement of new construction in existing urban areas at any costs, even the expense of existing environmental amenities, not necessarily leads to an influx of more property taxes to the local coffers, may help local municipalities to break away form the current "vicious circle" of shrinking tax base, budget deficit and socio-economic deterioration they experience. In particular, an alternative to the current wide-spread practice of new construction activity in already densely populated areas may be public policy of strict preservation of existing local amenities, their enhancement and creation of new environmental attractions in existing built areas. As expected, this policy will make a locality more attractive for economically strong population groups, eventually leading to a rise in local property prices and to the expansion of the local tax base. In addition, in the places, in which the non-value based system of property taxation is enforced (such as *Arnona* taxation in Israel), it should be substituted by a market-oriented approach based on property values. This substitution will divert the local authorities from a (perceivably) "easy path" of local-tax boosting via "wholesale" encouragement of new construction in existing urban areas, which may be detrimental for the locally generated incomes of municipalities in the long run.

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APPENDIX 1

Selected Characteristics of the Neighborhoods Surveyed

Neighborhood	Total No of housing units	No of apart-ments surveyed	Price, $/m2 (2-bdr)	Annual price change in 1990-2002, %	Housing turnover per annum, %	No of HCMs per housing unit	Distance to parks, m	Distance to roads, m	Green views, %	Urban views, %	Elevation above the sea level, m	Vegetation (1-3)*	Cleanness (1-3)*	Structural condition of buildings (1-3)*
Jerusalem														
Giva Zarfatit	2,106	153	2,198	2.9	3.1	0.84	232	109	0.0	39.2	820	2.8	2.7	3.0
Beit Ha'Kerem	3,871	100	2,189	4.3	1.3	1.16	168	60	6.0	9.0	765	2.5	2.6	2.4
Har Nof	3,323	96	2,247	5.3	1.2	1.09	102	27	79.2	1.0	750	1.5	2.4	3.0
Gilo	8,911	100	1,864	2.9	3.5	1.27	41	67	0.0	52.0	830	1.4	1.9	1.9
Total:	18,211	449												
Haifa														
Kiryat Haim	10,584	168	1,374	3.5	1.1	0.14	444	36	0.0	0.0	5	1.4	2.0	2.0
Newe David	1,878	117	1,290	5.0	1.7	0.40	160	68	8.5	0.0	26	1.8	2.1	2.2
Sprinzak	1,673	152	1,338	5.7	5.2	0.77	33	161	30.3	3.3	59	1.6	2.0	1.9
Ramot Remez	2,161	327	1,749	2.7	2.6	1.12	71	217	17.4	66.1	271	1.3	2.1	1.7
Total:	16,296	764												

* See legend to Appendix 2 for explanation

APPENDIX 2

A. Field survey table - data sources and examples of records

Address				Building								Apartment				Location (Proximity to ...)				
Apartment ID	Street	House #	Apart #	# of floors	Apart per floor	Physical condition	Relative condition	Changes	Elevator	Greenery	Cleanness	Storage	Parking	Private court-yard	View	Dis-amenity (ies)	Open spaces	Major road	Commercial centre	Elevation above sea level
Scale →				#	#	*	*	#/cost	yes/no	*	*	yes/no	yes/no	yes/no	*	meters	meters	meters	meters	meters
Source	Sale database			Field survey								Field survey				GIS calculation				
1	Pel yam	23	7	5	2	3	2	8/36100	yes	3	3	yes	yes	yes	4	458	56	120	1200	450
...																				
n	Naviim	15	45	4	3	1	3	2/13000	no	1	2	no	no	no	1	53	1236	45	540	24

LEGEND (*):

Physical condition		Relative condition (compared to adjacent buildings)		Greenery		Cleanness		View	
1	Poor	1	Worse	1	Few	1	Poor	1	No view
2	Average	2	Same	2	Some	2	Reasonable	2	Sea view
3	Good	3	Better	3	A lot	3	Good	3	Green view
								4	Urban view
								5	Industrial view

B. Change coding and examples of records

Address				No. of changes by change type														
Apartment ID	Street	House #	Apartment #	1 Window	2 Door	3 Solid roof	4 Arbor	5 Room	6 Storage	7 Balcony	8 Paving	9 Air conditioner	10 Wall, fence	11 Gate	12 Stairs	13 Other	Total # of changes	Estimated cost
1	Pel yam	23	7	1	2		1	1			1	2					8	36100
...																		
n	Naviim	15	45	1	1												2	1300

Note: Apartment ID1 (street address Pelyam 23/7) : 1 new window; 2 doors added; 1 arbor; 1 room addition; paving; 2 air conditioners added.