Residential prices, housing development, and construction costs

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Abstract

This chapter covers the relationships between residential market and housing development focusing on the role that construction costs play as an incentive for housing prices. Attention is paid to the existing links between construction costs and price changes. A specific database is built from real development projects seeking to analyse several cost groups and selling prices. Two non-linear models (average cost model and new supply model) are defined to explore the cost–price relationship using panel regression techniques. The first one identifies components that have negative effects on average costs, highlighting scale economies in those inputs. The second one estimates individual impacts on selling prices of nine cost groups measured in euros and pooled from real projects’ accounting data in a new supply model framework. Results support the existence of scale economies in the cost of pavements and labor, the strong effects of foundation costs on prices, and the existence of sunk costs, that is parts of construction costs which are not reflected in house prices (such as carpentry or painting). It also identifies direct and indirect effects of costs on prices, as in the case of green areas, suggesting that extra-construction costs incurred by creating housing amenities increase housing prices through affecting demand tastes and the housing quality perception.

Introduction

House prices are the key determinant of market equilibrium. What distinguishes the roles of prices in the housing market from those played in other markets is the bundle of influences on house prices that make those prices fluctuate far from the expected path sometimes. The literature has broadly focused on identifying housing price fundamentals and the sources of their dynamics, as a way to explain how housing prices actually evolve. However, the role of construction costs in housing price formation has received less attention from the literature.

It is widely agreed that housing prices depend upon two main demand-driven groups of factors: socioeconomic fundamentals, and financial innovations (Hwang and Quigley, 2006; Himmelberg et al., 2005; Haffner and de Vries, 2009; Mikhed and Zemcik, 2009). The bulk of literature (see Smith et al., 1988 as a good summary; and Di Pasquale and Wheaton, 1992 for
an explanation of the model) clearly explains that the increases (decreases) in fundamental variable (demography, income or purchasing power) movements press house prices to grow (or diminish) in the market. Financial flows and capital market conditions facilitate housing investment or increase the household purchase capacity as well (see seminal papers such as those by Meltzer 1974, or Kearl 1979). A summary can also be found in Smith et al. (1988), and for more recent works see Miles and Pillonca (2008), especially as regards homeowner markets directly affecting prices.

In accordance with the economic theory of market principles, changes in prices coming from changes in demand sources constitute the determining factor for supply responses, insofar as the total quantity supplied usually rises when prices exceed the average unit cost, through the establishment of a new equilibrium. It is assumed that the housing market follows the law of supply that is valid for any other good, but, unlike other markets, housing products remain in the market for a long time (Glaeser and Gyorko, 2001), which means that the housing market supply combines both existing and new units to satisfy all the housing needs. The present chapter delves into the area of new unit constructions as the response to market signals on the part of the developers’ sector. New units (or housing investment) have been examined by the literature from two perspectives associated with the reaction to market incentives, both of them directly linked to building decisions: as a response to market price changes; and as a reflection of direct investment plans from capital flows into the housing sector.

Rising prices consequently lead developers and landlords to react, either offering an increasingly high number of existing units or developing new ones. In the latter case, it is also agreed that the development process may be affected by several constraints, two of which are clearly identified by the literature: (a) the shortage of land supply; and (b) the delays resulting from the administrative permissions system. The former could appear for multiple reasons, such as lack of land, oligopoly situations in which the land market is controlled by few landlords, or restrictions concerning land regulation, all of which results in higher-than-normal land prices. Land is a key input for development. The lack of available land or the absence of land market flexibility reduces the possibility for developers to build, since these problems lengthen the building period and increase the degree of uncertainty with regard to expectations of builders’ profits.

On some occasions, excessively high housing prices (or land prices) discourage house construction because the price level does not match the existing purchase capacity amongst the potential household demand, thus making houses unaffordable. When this happens, the housing demand diminishes, reducing the pressure on prices, and then on new construction, which in turn shows the limits of growth and contributes to the end of the boom-cycle phase (Meen, 2000). The effect of house prices on house development additionally differs depending on time (based on the strength of demand sources) and space (based on local markets) factors. The new development reaction to price changes varies across local markets due to idiosyncratic local features (Mayer and Somerville, 2000b; Malpezzi and Vandell, 2002) where aspects such as land market, administrative regulations, or developer sector structure play a relevant role in the definition of housing construction levels.

From the developers’ perspective, the final new unit price has a lot to do with construction costs. This mainly comes as a result of uncertainty in relation to future selling prices when a development is starting, and the need exists to set a selling price based on the (estimated) total construction costs. In fact, what developers take into account is the traditional economic “maximum benefits” rule of thumb, according to which they should start developing new houses when it becomes clear to them that housing prices exceed their average total cost per unit. High risk exists in such situations because prices may change with the housing cycle during that period.
The present chapter focuses on the price formation mechanism in new units. It is structured in four sections. The second explains market equilibrium and summarizes the literature devoted to explain the house price dynamics from several economic perspectives, after which the following section focuses on the role that construction costs play in housing prices and development, providing evidence of the effects that construction costs have on housing prices. The chapter finishes with a summary of the most important conclusions drawn from our research work.

**Housing market equilibrium: a view from the new housing supply perspective**

The key issue in this work is the extent to which house price influences the housing supply mechanism by inducing new construction. Regarding the supply as a whole (new and existing units), the total available units in the market are considered fixed in the short run (Arnott, 1987) as a result of the special characteristics of the construction process, because increasing new building takes time and requires administrative procedures that delay the development process (Topel and Rosen, 1988; Quigley, 1997; Arnott, 1987). Since the stock cannot increase instantaneously (all of a sudden), any change in the demand component leads to an immediate change in housing rents. Figure 7.1 illustrates this mechanism, which consists in determining the rent in the property market where demand changes affecting rents can be seen by the shift on the demand curve due to changes in the economic conditions that affect demand sources. Rents go from \( r_1 \) to \( r_2 \) in response to a positive shift in housing demand.

New rent levels induce new construction through the impact on house market prices. The so-called cap-rate relates rent prices to property prices following a “predictive” financial rule – the capitalization rate (net rent/price ratio, \( r = \text{rent}/\text{price}; \text{price} = \text{rent}/r \)) – i.e. being considered as an indicator of the yield that makes the investor hold the real estate asset.

When rent rises, housing price should also increase to maintain the cap-rate constant. By way of example, when \( r_1 \) rise to \( r_2 \) (in Figure 7.1), the cap-rate (\( \text{Cr}_0 = r_1/P_1 \)) changes (\( \text{Cr}_1 = r_2/P_1 \))

![Figure 7.1 Rent determination in property markets](source: Adapted from Di Pasquale and Wheaton, 1992: 188)
making investors react and affecting house prices in the same direction as rent movements bringing the cap-rate to the equilibrium ($C_{eq} = r_1/P_2$). The cap-rate cannot be observed but is influenced by four variables: the economy’s long-term interest rate; the expected growth in rents/comparable returns in capital markets; the risks associated with the rental income stream; and the tax treatment (Di Pasquale and Wheaton, 1992).

The new price level affects new development through the real estate market defined in Figure 7.2, where the impulse on starts can be seen as a result of the price incentive or market signal (prices rising from $P_1$ to $P_2$ in the curve $P$). The development response will depend on the new supply elasticity ($\epsilon$), that is, the development industry’s sensitivity to price changes in each particular housing market, represented by the new supply curve slope. Such sensitivity reflects the existence of any limitation stemming from inputs such as land scarcity, the permits system, or market power, amongst others. As new construction increases the stock, the total supply rises to meet a larger demand. This process, which extends over several periods to reach the equilibrium, constitutes one of the origins of housing cycles.

The supply curve may change (Figure 7.2, function $P^*$) with the increase of any cost component – such as interest rate, land price, construction materials, or wages – which in turn makes the cost of new units rise and leads to a reduced development level at the current prices. In other words, there will be less construction at a price level $P_2$. The new cost combination has made the new construction costs rise thus establishing a new equilibrium between costs and prices that inevitably reduces the incentives to build (due to problems such as lower profitability or financial losses).

The key mechanism from the developers’ perspective can be found in Figure 7.2, which shows how construction reacts to property price movements that could change due to, amongst other reasons, demand source variation, changes in the financial/asset market, or other investor-related variables (including risk perception), all of which will affect the capitalization rate. Any shock increasing property prices will encourage new supply towards a larger level of

\[ P^* = \phi_2(C\text{Const}_2) \]
\[ P = \phi_1(C\text{Const}_1) \]

**Figure 7.2 Asset market, construction**

*Source: Adapted from Di Pasquale and Wheaton, 1992: 188*
construction (the reverse is also true). In this case, larger new supply flows enter the real market raising the available supply and reducing rents, matching the new house price level (see Di Pasquale and Weaton, 1992 and 1996 for greater detail). Furthermore, when any shock affects construction materials or land prices (either scarcity or prices), the new supply curve moves to fit its cost–price equilibrium. An increase in costs is seen as a negative effect on new supply that causes the curve to shift to the left and reduce the construction level (for a deeper explanation see Rosenthal, 1999; Di Pasquale, 1999; or Mayo and Sheppard, 2001).

The role of construction costs in development

Following the Di Pasquale and Wheaton model (1992), new housing supply reaction firstly depends on prices and construction costs, the response scope of these two factors being closely linked to a number of other institutional and market variables. Several studies have found that construction costs (costs of material and labor), the cost of land and land availability (Goodman, 2005; Malpezzì and Vandel, 2002), along with the cost of finance, are the main determinants of house building within a market-oriented equilibrium framework (Blackley, 1999; Somerville, 1999a; Di Pasquale, 1999; Mayer and Somerville, 2000a; Somerville, 1999b). Taltavull de La Paz and Gabrielli (2015) checked that construction materials constitute a key house-building determinant in Italy, but are insignificant in Spain’s new housing supply. Taltavull de La Paz (2014) also found empirical evidence that some markets do not react strongly to changes in prices to explain new development.

Furthermore, the construction literature generally argues that developers determine the selling price for new units basing their calculations on total construction costs despite the effect of other visible exogenous variables. For instance, Akinci and Fischer (1998: 70–72) define two groups of variables that affect final construction costs: the early technical estimate of project costs (structures, foundations, enclosures, façades, as well as others related to climate location and the project as such); and other costs (related to the general economy and risks of a different kind). Akintoye (2000: 77) uses a factor analysis to identify seven areas affecting final costs, while Warsame (2006: 10–16) summarizes the factors determining construction costs as four: project factors (size, complexity, quality); client/developer factors (size of parts, type of contract); competitiveness conditions (market power and development level in the period); and finally, macroeconomic and market conditions (such as interest rates and inflation, to quote just two). Most of those variables actually depend on non-construction-related facts, which points towards the role of the market mechanism in price determination. Nevertheless, it is widely believed that most development costs really come to be known before the development starts (Warsame estimated that 95 percent of development costs are identified before the construction phase starts (2006: 11)), which permits the determination of the unit price for every house to be sold.

The micro-economic theory explains how costs are related to market prices through the widely accepted decision-making process for production theory: Any firm will establish the production level when its marginal cost equals its marginal income as a general rule, or when the market price (P) equals (or exceeds) the total average costs. That is, prices are compared to the cost by unit (P ≥ CTAV) or to the variable average cost (minimizing losses: P ≥ CVAV, Krugman et al., 2013: 208) in order to take the decision to produce. In accordance with this, the importance of exploring the relationships between final market (selling) price and cost directly has to do with what the economic theory supports. A need exists to reconcile the approaches to explain how costs affect prices, identifying how prices reflect costs in house development with the micro-economic principles.
Construction costs and new house prices: empirical evidence

This section explores the relationships between construction costs and prices hypothesizing whether or not construction costs determine final house prices. A real-cost-based model is presented to that end using a database specially collected for this purpose. It comes from the accounting of 16 house development projects from which the main construction cost components have been extracted and analyzed.

The data were collected directly from accountancy information at the companies’ headquarters. It comes from 16 projects built during the 1998–2012 period by three different construction companies operating in Alicante. The documentation provided included both cost-related and technical information, which permits us to describe these 16 projects from an architectural and economic perspective. The database was built analyzing the whole project, including construction techniques and materials used, thus allowing us to account for total constructed size, soil type and foundation features, façade types, or other technical characteristics. The latter include the execution costs list by type of material controlled by the foremen (building engineer responsible for that process under Spanish regulation) as well as the transaction price (from the notarial document also included in the package).

Some initial data descriptions suggest consistency in the analyzed projects. There are 16 apartment projects, three large ones (with 92 to 116 apartment-units built), seven medium-sized ones (between 14 to 21), and six small ones (between one house and six units). All of them show different amenities but the cost by unit (of one apartment) is consistent across them (Figure 7.3) showing a sign of scale economies as the project becomes larger.

Selling prices also give consistent average values according to the type of house built, ranging from €200,000 in isolated or very low-density housing, to around €100,000 in the rest of the cases (Figure 7.4, panel a). When applying the theoretical principle of decision, the

Figure 7.3 Cost per house in euros

Source: Author
Figure 7.4  Construction costs database: detail of prices and benefits. (a) Final selling price, (b) price–average costs difference

Source: Author
differences between price and average costs (not including land costs) give normal benefits (P ≥ AvCt; P − AvCt ≥ 0), the normally distributed benefits being consistent with the general theory.

Two relationships were tested in order to explore the cost component linkages: first, the sensitivity of average costs to each different cost group; and second, the price sensitivity to cost groups through a new housing supply model framework.

The specific groups of construction costs were pooled into nine sets of those sharing common characteristics (from C1 to C9) and are those used in the empirical exercise described below.

**Average cost sensitivity to construction-cost groups**

A log–log cost model relates the average cost per unit to the groups of costs explained above, finding consistent evidence of the role played by each set of inputs used in project construction.

The model estimated can be seen in Equation 7.1.

\[
\text{AvC} = \alpha + \Gamma \ast C + \Omega \ast K + \varepsilon 
\]  

Where AvC is the average cost per house/apartment, C is a matrix of costs including the nine sets of aggregated costs, K a matrix of four control variables which captures basic project features affecting cost (Akinci and Fischer, 1998: 70–72), such as size, existence of green common areas, type of basement built, and number of rooms. \( \Gamma \) and \( \Omega \) are matrices of the parameters to be estimated and \( \varepsilon \) is the error term. Since costs could present non-linear relationships, the role played by each set of costs affecting the average total cost per house is estimated here by means of a log–log model specification, as shown in Equation 7.2.

\[
\text{lAvC} = \alpha + \sum_{i=1}^{9} \beta_i \text{lC}_i + \sum_{j=1}^{4} \gamma_j \text{lK}_j + \mu 
\]  

Where lAvC is the log of AvC, lC is the log of cost ‘i’, lK is the log of the ‘j’ control variable and \( \alpha, \beta \) and \( \gamma \) are the parameters to be estimated, with \( \mu \) as the error term in the equation.

In this model, the non-linear relationships between costs approach their cross-contribution to average cost changes through the estimated parameters that may be interpreted as elasticities showing the responses (in %) of average costs to a change in 1% of every cost set. Table 7.1 provides a two-panel result: panel one is for a pure cost-model (showing the estimated betas in Equation 7.2); and panel two contains results of the cost model controlled by project-specific features, mainly defined as the project size affecting the total cost in some accounting items (showing both beta and gamma parameters also represented in Equation 7.2).

Results in both models consistently show how changes in cost groups are transmitted to average prices. For instance, groups 1, 2, 3, 5, and 7 cost increases have the effect of reducing average costs, showing a kind of scale economies in those inputs. Most of those groups refer to common production processes. For instance, a 1% increase in the cost of installations results in a 0.57% decrease in the average cost per house. Furthermore, cost-set numbers 4, 6, 8 (mainly manufactured goods to be installed, labor, and painting), and 9 (other expenses, project fees, and taxes) positively affect the total average cost showing the extent to which it increases. Regarding full model results, an increase in taxes in group 9 elastically affects the average cost in such a way that a 1% increase in this item makes the average income rise by 1.23%. The remaining positive parameters are inelastic – therefore an increase of labor costs by 1% results in an 0.1% increase of the average cost per house.
Results in Table 7.1 also indicate the effect of having common green areas, which increases the average cost per house by 0.45%. As for negative parameters, they quantify the marginal reduction of unitary cost as the project grows.

**New housing supply model**

This section estimates the new housing supply model as presented in Figure 7.2, using information from the construction cost database. The housing prices registered in the database are transaction based and collected from the notarial document of transmission included in the accounting documents corresponding to each project. Seeking to control for heterogeneous houses, as the database is supported on micro-data observations, price is quality controlled by means of a hedonic specification in the supply equation. The new supply model definition reads as follows:

\[
H_i = \alpha + \Gamma \ast C + \beta \text{Ph}_i + \Phi \ast X_i + \nu
\]  

(7.3)

Where \( H \) is the number of start units (new supply), \( C \) is a matrix of the nine sets of construction costs that have labor costs as a separate variable, \( \text{Ph} \) is the selling price of each house and \( X \) is a matrix with a set of \( \{x\} \) housing characteristics for control purposes in the
model. Fixed effects by each of the three cities are considered including dummy variables. Cost components will be disaggregated into the nine cost sets used in the cost model in order to capture the separate contribution on prices of each group (following Somerville, 1999b; and Coulson, 1999), while Cost_09 includes the financial costs paid in the project. Hence our decision to exclude interest rates from the model (as Cost_09 already includes those costs).

Along the lines of hedonic model methodology traditions, the specification is non-linear with a semi-log functional form in which the continuous variables are expressed by means of natural logarithms while categorical variables appear in levels. The general expression of Equation 7.3 can be found in Equation 7.4. \( a, G, b,F \) are the parameters to be estimated and \( u \) is an error term.

\[
\ln P_h = \alpha + \sum_{i=1}^{8} \beta_i C_i + \beta_{P} H + \sum_{j=1}^{8} \rho_j x_j + u
\]

(7.4)

Rearranging the terms:

\[
I_{P h} = \frac{\ln P_h - [\alpha + \sum_{i=1}^{8} \beta_i C_i + \beta_{P} H + \sum_{j=1}^{8} \rho_j x_j]}{\beta_{P}} + u
\]

(7.5)

\[
I_{P h} = \theta + \sum_{i=1}^{8} \gamma_i C_i + \psi_i H + \sum_{j=1}^{8} \varphi_j l x_j + \epsilon
\]

(7.6)

Where \( \gamma_i = b_{i}/b_{io}, \psi_i = 1/b_{io}, \varphi_j = r_{j}/b_{io} \); expressed differently, the parameters are inverse elasticities amongst characteristics, costs and prices. Since one of the variables in \( `x` \) is house size in \( m^2 \), Equation 7.6 could become Equation 7.7:

\[
I_{P h} = \ln m^2 = \ln P_h/m^2 = \theta + \sum_{i=1}^{8} \gamma_i C_i + \psi_i H + \sum_{j=1}^{8} \varphi_j l x_j + \epsilon
\]

(7.7)

Equation 7.7 is estimated using panel-OLS in three steps. First, the hedonic house price model per \( m^2 \) is calculated on the basis of housing attributes (x). Second, residuals are calculated from the former to represent quality-controlled prices (cqP), and to serve as a dependent variable for the housing new supply model, defined in this step as an inverse new supply function \( cqP = f \) (cost, new supply), i.e. approaching the cost role in the unobserved price components. And third, the full model as Equation 7.7 is estimated.

It is assumed here that parameter \( j \) for \( \log m^2 \) is close to the unity. Any value \( \neq 1 \) refers to non-linearity between housing price and size and is partially captured by the price per \( m^2 \).

Table 7.2 provides the results of all three models in panels. Panel 1 shows the parameters and test results in the hedonic model. The houses observed in this sample are main residence apartments where aspects such as height, having three or more bedrooms, having more than four external rooms, being closer to the city center, proximity to Elche, having common green areas, being a non-public house, forming part of lower density buildings (constructions), with two or more bathrooms or toilets and being new, are highly valued. The model explains 95% of price-per-m\(^2\) variability according to such attributes. Panel 2 explains the reduced inverse supply equation based on residuals from the hedonic model, that is, quality-controlled prices. Only a small number of cost-set components are statistically significant to explain the unobserved component of price per \( m^2 \) in this model. Some components can affect prices negatively and positively. Those with negative parameters are cost of foundations (C1) and labor costs (C6) (at 5%) suggesting scale economies with size; construction materials (C5 at 5%) and other expenses (C9) show positive parameters, which suggests that any increase in these
Table 7.2 Semilog Inverse New Supply Model

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Log of real house price/m²</th>
<th>Unstandardized residual</th>
<th>Log of real house price/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>St. error</td>
<td>β</td>
</tr>
<tr>
<td><strong>Panel 1: Hedonic regression</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>4.835***</td>
<td>0.192</td>
<td>-0.46***</td>
</tr>
<tr>
<td>D_ South-East orientation (best)</td>
<td>0.019</td>
<td>0.011</td>
<td>0.01</td>
</tr>
<tr>
<td>D_ 1 bedrooms (house)</td>
<td>-0.075</td>
<td>0.044</td>
<td>0.03</td>
</tr>
<tr>
<td>D_ 2 bedrooms (house)</td>
<td>0.034</td>
<td>0.028</td>
<td>0.06**</td>
</tr>
<tr>
<td>D_ 3 bedrooms (house)</td>
<td>0.040***</td>
<td>0.015</td>
<td>0.07***</td>
</tr>
<tr>
<td>D_ 2 external rooms</td>
<td>-0.252***</td>
<td>0.041</td>
<td>-0.16***</td>
</tr>
<tr>
<td>D_ 3 external rooms</td>
<td>-0.049***</td>
<td>0.013</td>
<td>-0.06***</td>
</tr>
<tr>
<td>D_ 4 external rooms</td>
<td>0.093***</td>
<td>0.011</td>
<td>0.09***</td>
</tr>
<tr>
<td>Log Distance to Town Hall (m)</td>
<td>-0.159***</td>
<td>0.014</td>
<td>-0.38***</td>
</tr>
<tr>
<td>Torrellano (Excluding Elche)</td>
<td>0.141**</td>
<td>0.057</td>
<td>-0.42***</td>
</tr>
<tr>
<td>Alicante (Excluding Elche)</td>
<td>-0.318***</td>
<td>0.039</td>
<td>-1.50***</td>
</tr>
<tr>
<td>D_ With urbanization common green area</td>
<td>0.309***</td>
<td>0.040</td>
<td>1.54***</td>
</tr>
<tr>
<td>D_ Free house/(public house)</td>
<td>0.159***</td>
<td>0.024</td>
<td>0.01</td>
</tr>
<tr>
<td>D_ 4 Floors (including basement)</td>
<td>-0.428***</td>
<td>0.045</td>
<td>-0.46***</td>
</tr>
<tr>
<td>D_ 5 Floors (including basement)</td>
<td>-0.379***</td>
<td>0.035</td>
<td>-0.44***</td>
</tr>
<tr>
<td>D_ 6 Floors (including basement)</td>
<td>-0.311***</td>
<td>0.040</td>
<td>-0.17***</td>
</tr>
<tr>
<td>D_ 7 Floors (including basement)</td>
<td>-0.046**</td>
<td>0.021</td>
<td>-0.18***</td>
</tr>
<tr>
<td>D_ 1 bathrooms in the house</td>
<td>-0.095***</td>
<td>0.030</td>
<td>-0.13***</td>
</tr>
<tr>
<td>D_ &gt; 2 bathrooms in the house</td>
<td>0.002</td>
<td>0.020</td>
<td>0.00</td>
</tr>
<tr>
<td>Log Years since built</td>
<td>-0.748***</td>
<td>0.058</td>
<td>0.41**</td>
</tr>
<tr>
<td>LogC1_Earth Movements and Foundations</td>
<td>-0.05**</td>
<td>0.02</td>
<td>0.36***</td>
</tr>
<tr>
<td>LogC2_Installations</td>
<td>-0.11</td>
<td>0.08</td>
<td>0.47**</td>
</tr>
<tr>
<td>LogC3_Pavements and tiling</td>
<td>-0.06</td>
<td>0.04</td>
<td>-0.51***</td>
</tr>
<tr>
<td>LogC4_Sanitation, kitchen furniture and lift</td>
<td>-0.02</td>
<td>0.06</td>
<td>Exclud</td>
</tr>
<tr>
<td>LogC5_Construction materials</td>
<td>0.07**</td>
<td>0.03</td>
<td>0.81***</td>
</tr>
<tr>
<td>LogC6_Labour</td>
<td>-0.11**</td>
<td>0.05</td>
<td>-0.43***</td>
</tr>
<tr>
<td>LogC7_Carpentry (wood and others)</td>
<td>0.05</td>
<td>0.05</td>
<td>Exclud</td>
</tr>
<tr>
<td>LogC8_Painting and false ceilings</td>
<td>0.08</td>
<td>0.06</td>
<td>Exclud</td>
</tr>
<tr>
<td>LogC9_Other expenses, tax, project fees</td>
<td>0.19***</td>
<td>0.07</td>
<td>-0.19</td>
</tr>
<tr>
<td>Log New houses</td>
<td>-0.05**</td>
<td>0.02</td>
<td>-0.45***</td>
</tr>
<tr>
<td>R²</td>
<td>0.954</td>
<td>0.06</td>
<td>0.97</td>
</tr>
<tr>
<td>Adj R²</td>
<td>0.952</td>
<td>0.04</td>
<td>0.97</td>
</tr>
<tr>
<td>Equation standard error</td>
<td>0.066</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>F</td>
<td>494.53***</td>
<td>2.97***</td>
<td>526.10***</td>
</tr>
<tr>
<td>DW</td>
<td>1.450</td>
<td>1.54</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Notes: D_ = Dummy variable  
*** p-value < 0.01, ** p-value < 0.05, *p-value < 0.1  
Source: Elaborated by the authors
cost items contributes to raise differences in prices. Panel 3 presents the full model. Results match with the previous two in signs and some additional parameters become significant this time. For instance, the most significant differences are the elastic responses of existing green areas in the house (parameter shift from 0.309 to 1.54 in the presence of costs) and the elasticity of Alicante location, which also becomes highly elastic (from -0.318 to -1.50), suggesting that price/m² dramatically diminishes for houses located within the Alicante city limits, and when costs are taken into account.

Some of the cost-sets become statistically significant in the full model. For instance, foundation and installation costs (C1 and C2) increase their influence on final price per m² in an inelastic way (a 1% increase in foundation costs leads to an increase by 0.36% in the final house price per m²). Construction materials also show a similar effect (an 1% increase results in a 0.81% growth of prices/m²). Two construction cost components strongly support the existence of scale economies as the project becomes larger, namely: costs of pavements and labor (the higher the labor costs increase, is associated to the lower the house price per m² increase), consistently with other model results in the literature. Finally, four cost components are excluded from the model or regarded as non-significant to explain changes in house prices.

The results above suggest that the influence of construction costs on final prices not only directly but also indirectly affects housing prices. For instance, it can be said that the better the amenities, the higher the price, because the demand values amenities not because of construction costs but through the price increase due to the availability of amenities as such.

The aforementioned results additionally suggest that not all construction cost components affect house prices. Some costs are clearly transmitted to an increase in house prices, such as foundation costs, installations or construction materials; instead, others transmit their influence through final quality, attributes or amenities in the house, like green area; in other words, indirectly. This is almost the same as accepting that part of the construction costs are sunk ones (they remain unseen) which can hardly be perceived by the demand, and therefore do not affect the final price at all.

In summary, some cost components do directly affect house prices, whereas others do not; and some show the existence of scale economies according to size. Those findings suggest the need for careful costs analyses in separate groups when a developer evaluates the effects that incurring construction costs has on housing prices. After all, the relationships between costs and final housing prices are far from clear and direct.

**Conclusion**

The literature has broadly focused on identifying housing price fundamentals. Consensus exists on the fact that housing prices depend on two main demand-driven groups of factors: socio-economic fundamentals, and financial innovations. Changes in prices arise as the main determinant(s) of supply responses, insofar as the total quantity supplied usually rises when prices go up. The literature justifies that development reacts heterogeneously to price changes across regions, showing different responses reflecting regional idiosyncratic and behavioral characteristics. This chapter explains the economic rationality as well as the market mechanisms behind developers’ decisions to start housing projects, and it equally provides empirical evidence about the relationship between various groups of construction costs and housing prices.

The existing literature supports the idea of prices and construction costs (drawing a distinction between those associated or related to materials, labor, and finance) directly affecting the decisions to build. This chapter explores price sensitivity to different construction costs
using a new database especially built for this purpose. The database extracts the actual costs, pooling them in consistent production phases included in the whole development as cost components in a new-supply model. Results demonstrate that building processes show the existence of sunk costs, that is, parts of construction costs that are not reflected in house prices (e.g. carpentry or painting). Other costs have a (direct) influence on prices, in such a way that prices rise when those costs increase (installation costs, for instance). Finally, a number of relevant cost-accounting items show clear scale economies as project size grows (pavement and labor costs, amongst others). By way of conclusion, it can be stated that construction costs affect housing prices in a heterogeneous way, which suggests that further research needs to be undertaken so that the precise price effect of every group of costs can be estimated.

References


