**Home Pricing Estimation in the Netherlands**

Selling your house is a tough job, as you have to find a buyer that is willing to pay the price you are ready to accept. In most cases, home owners ask real estate brokers to assist them in the selling process, but moreover to ensure that the price for which the house is offered on the market will maximize the price for which the house is sold. In the Netherlands, this process is not different; however, since a few years, home owners are selling their houses without the intervention of an established real estate firm. Home owners do this as this can easily save them a few thousand euros, as the real estate broker’s fee is a percentage of the selling price (<https://www.rtlnieuws.nl/editienl/klaar-met-de-makelaar-verkoop-je-huis-zelf>). This implies that the services originally provided by the real estate broker now have to be organized by the home owners themselves. Most of the activities, as providing a tour through the house to potential buyers or advertising the house, can be done without the assistance of a real estate broker; however, estimating the selling price of the house can be a difficult task.

Real estate brokers have the experience of valuating houses, and they know the local market, but most important they have access to private databases that allows them to easily compare houses on house characteristics and price. House owners do not have this experience nor have access to databases with housing price information. Consequently, there is asymmetric information between the real estate firm and the house owner, and real estate agents use that asymmetry to provide a service. From a commercial perspective, such a practice can be considered absolutely normal, however, in this particular case the information on houses, which is used by real estate firms, is no longer completely private. Nowadays, information on houses, which are for sale on the Dutch housing market, can be found on a large number of websites and are therefore accessible to the public. However, website design still does not allow home owners to perform easy comparison and therefore prevents them from valuating their house effectively and precisely.

This problem raises the following research question: **Can the elimination of asymmetric information improve the sellers position in the Dutch real-estate market?**

**Methodology**

In order to access and store housing information, Python web scraping techniques, such as Beautifulsoup, were deployed. Beautifulsoup creates the possibility for the efficient extraction of information from webpages, which can be stored in comma separated files or Microsoft Excel files. To reduce the load on the server that contains the information, only text fields were extracted. Additionally, to maximize the scraping speed, TOR network I.P. rotation was deployed. This technique prevents that the server might block the I.P address from which scaping is performed as the server observed load per I.P address is reduced to normal single user load (a maximum of 200 pages are scraped before the I.P address is changed). In the case that the I.P address is blocked, the I.P. address is automatically changed, and the scraping process continues. The TOR network provides access to 7000 proxies worldwide, which makes the scraper very robust against anti-bot technologies. In total 72000 pages were scraped for 35 different house characteristics.

In addition to the scraping of information, the information was used to construct a prediction model for house pricing. This model uses characteristics of the house, like the size of the house and the type of the house to estimate the selling price. In order to estimate this model, a multiple linear regression model with White’s Standard Errors was used. This particular model was chosen to correct for the violation of the Gauss Markov assumption for orderly least square regression and to aim for the best linear unbiased estimators. The final model obtained an R2 of 0.87 and therefore provides an overall good estimation.

With the aim of using the estimated model to improve the sellers position in the real-estate market, the model was embedded in a Shiny application. This allows house owners to determine the selling price of their based on their house characteristics.

**Results**

In order to estimate the value of a house within the Netherlands and to cross validate the valuation model, multiple houses are selected from [www.funda.nl](http://www.funda.nl), which is most famous housing website in the Netherlands and represents 80% of the available houses on the housing market (<https://www.emerce.nl/nieuws/concurrenten-funda-winnen-marktaandeel>). From this website 5 randomly chosen houses were selected for estimation. The table below presents the results from the price estimation and indicates that the model predicts in line with expectations, considering the R2 of 0.87. In most cases the model is overestimating the value of the house, except for houses in the higher price range, as indicated by house nr. 5. Overall it can be concluded that having access to market information allows for a close approximation of the sales price of houses. This implies that for the valuation of houses that are considered average for the Dutch housing market, a real estate broker is no longer required, assuming that market information is available.

Table 1: Price estimation for 5 random selected houses in the Dutch real estate market

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | House 1 | House 2 | House 3 | House 4 | House 5 |
| Type | One familiy between house | Farmhouse | Two under one roof | Free standing | Villa |
| Zipcode | 1966 | 9842 | 3315 | 2181 | 1921 |
| Surrounding | Quiet road | Quiet road | Residential | Quiet road | Quiet road |
| Living space | 90 | 280 | 179 | 196 | 290 |
| Ground area | 144 | 1020 | 229 | 590 | 1165 |
| Type of garden | Front and back yard | Side garden | Front and back yard | Surrounding garden | Surrounding garden |
| Number of floors | 1 | 2 | 3 | 2 | 2 |
| Number of bathrooms | 1 | 1 | 1 | 2 | 3 |
| Insulated | No | No | Yes | Yes | Yes |
| Parking | Public parking | Public parking | Public parking | Public parking | Garage |
|  |  |  |  |  |  |
| Estimated price | € 266,204.00 | € 354,203.00 | € 395,271.00 | € 673,367.00 | € 1,015,375.00 |
| Actual Price | € 249,000.00 | € 345,000.00 | € 389,000.00 | € 650,000.00 | € 1,149,000.00 |
| Difference | 7% | 3% | 2% | 4% | -12% |

**Conclusion**

Nowadays house owners are selling their house without the assistance of a real estate broker, but are still dependent for the valuation of their house. This dependency exists as market information is not easily accessible for the public and house comparisons cannot be performed. Research has indicated that, with access to market information, it is possible to closely estimate the selling price of the house without the intervention of real estate brokers. Consequently, removing the dependency on real estate brokers and improving the position of sellers on the market, as a valuation fee is no longer required. Therefore, it is possible to conclude that the elimination of asymmetric information does improve the sellers position in the Dutch real estate market; however, only applies to houses that are considered average in contrast to the existing housing market.

*Disclaimer*

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