Explaining Price Rigidities on the Housing Market with Prospect Theory

Lars Vandrei

June 30, 2017

Single-family home of the Schultes in Voerde (Lower Rhine)

"The Schultes have anything but excessive price expectations. They have reduced their original claim of €269,000 by €39,000 to €230,000. [...] In 2009, they paid €255,000, invested €30,000 in the renovation and installed the chic kitchen for around €5,000. The bottom line is a loss of €50,000 – if they find a buyer. "It was clear to me that the house would not just sell like that," says Claudia Schulte. Only that it would be so difficult, she had not expected."

– WELT.de, 2013, own translation

Introduction

Observations on the housing market

- Positive correlation between transaction quantity and house prices
- Negative correlation between house prices and time on the market
- Existence of vacant houses with prices above zero

$\Rightarrow$ Suppliers seem to hesitate to adjust prices to changes in demand (both ways).

$\Leftrightarrow$

For low (high) prices, suppliers are reluctant (rash) to sell.

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- Reference point: Utility is measured in gains and losses relative to a reference point rather than absolute values.
- Kink: Losses are perceived stronger than gains of equal size.
- Diminishing sensitivity: The marginal utility of gains and losses diminishes in their size.

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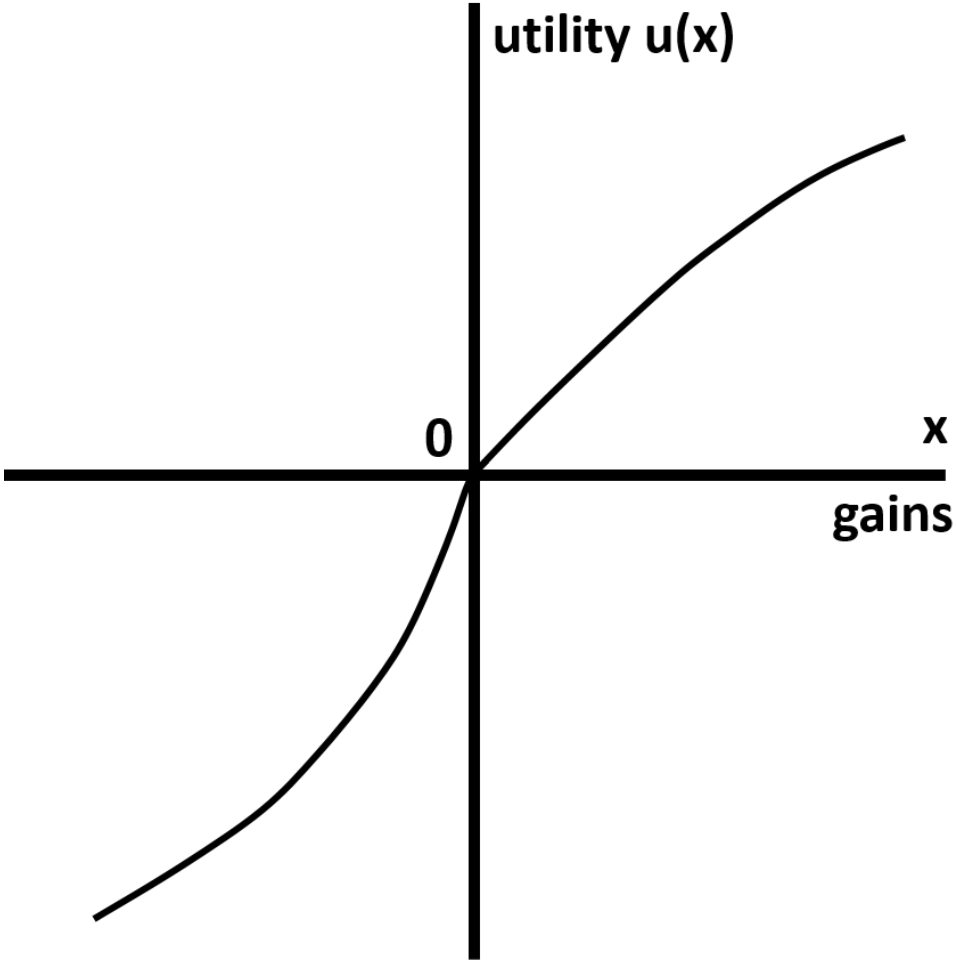

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Financial market

- Disposition effect:
  Investors . . .
  - tend to sell stocks whose price has gone up,
  - tend to keep stocks whose price has gone down.
- Mainly explained by Prospect Theory

Prospect Theory applicable on the housing market?

- Houses are investment objects
- Private investors stronger affected
- House price very tangible

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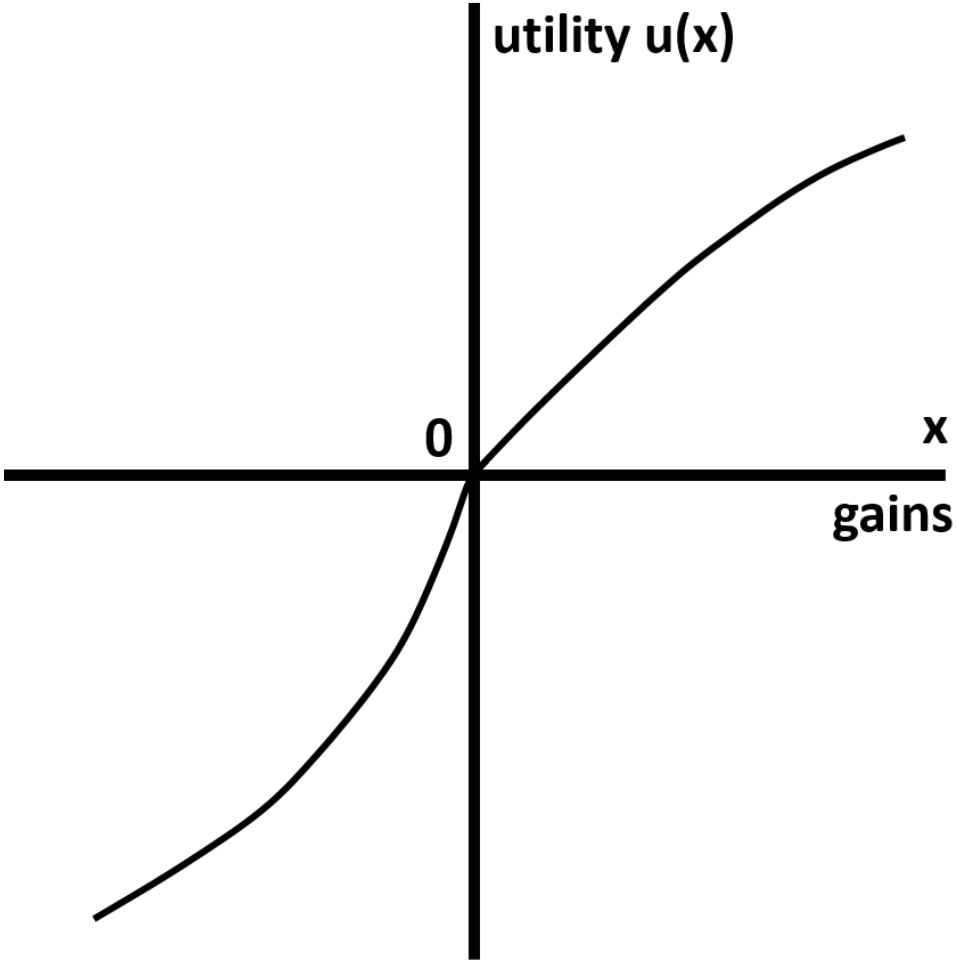

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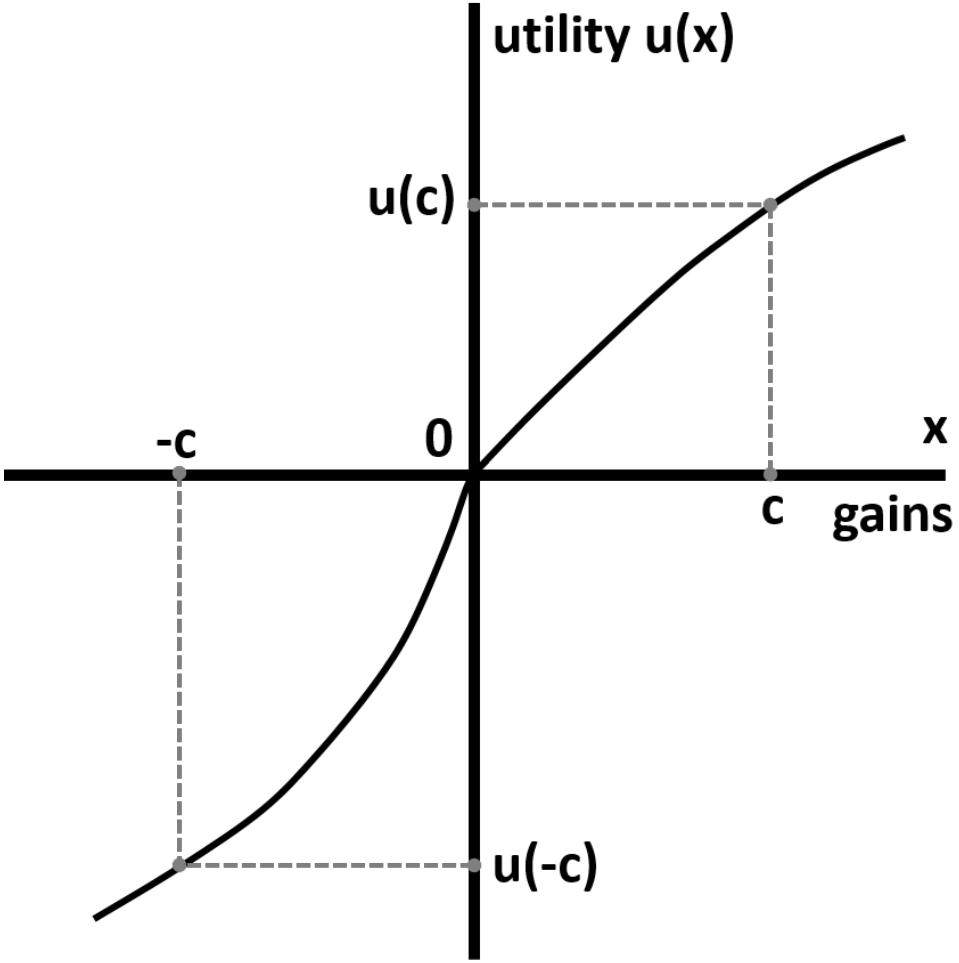

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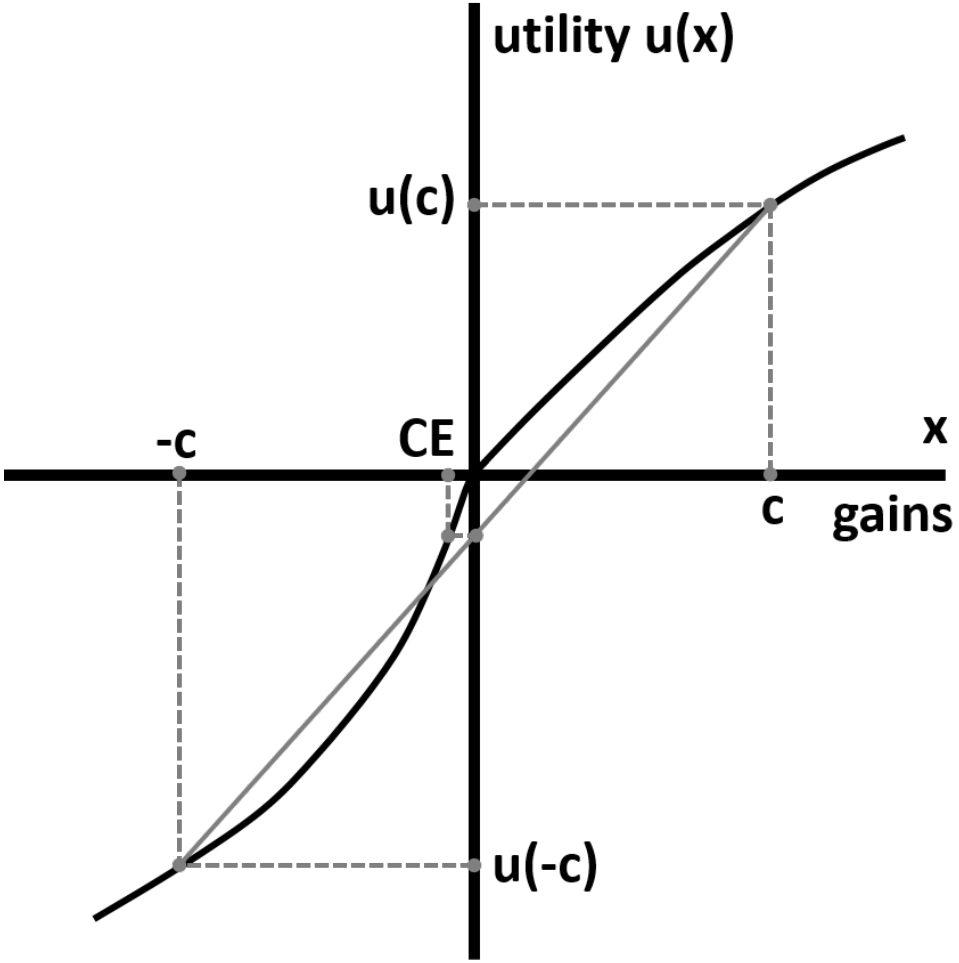

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Contribution of this work:

- Provide theoretical model for the empirical observations.
- Extend the implications of loss aversion by specifics of prospect theory:
  - Stronger effects on markets with shorter residences.
  - Stronger effects on markets with upturns or downturns of smaller dimensions.
- Insight into behavior of non-professionals on the housing market.

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Model Setup

Individual choice under risk in a partial equilibrium model [following Krainer (2001)]

- Two goods in the economy:
  - Housing good
  - Composite consumption good

Consumption good:

- Serves as numeraire good.
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- Fixed stock of houses: no construction, no depreciation
- No rental market.
- Houses yield housing services x_t and ϵ_i for every period the agent stays in the house: $d_{i,t} = \epsilon_i + x_t$
  - x_t determines the fundamental value of houses in a region. x_t evolves according to a Brownian motion with a drift of zero.
  - ϵ_i is the idiosyncratic match quality of agent i with any house. ϵ_i is equally distributed on the unit interval.

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Agents...

- can move in and out of area freely,
- can only live in one house at a time,
- are financially unconstrained,
- live infinitely,
- have full information on the parameters of the risky price evolution.

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Search Market

The potential seller inhabits a house and loses the match with that house with probability $1 - \pi$.
$\rightarrow$ In that case he puts the house up for sale.

The potential buyer is looking to buy a house and visits one house each period.
$\rightarrow$ He learns his match quality ϵ_i and the sales price p upon visiting.

- ✓ Transaction $\Rightarrow$ The buyer moves in and receives $\epsilon_i + x_t$ for as long as his match persists.
- ✗ Transaction $\Rightarrow$ Potential buyer keeps looking in the next period, the owner keeps the house vacant for that round.

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Decision of the Buyer

Buyer bases his willingness to pay on (1) the expected housing services and (2) the expected utility from the risky sales price.

(1) Expected housing services in t:

$$u_d = \sum_{k=0}^{\infty} \beta^k \pi^k \left(\mathbb{E}[x_{t+k}] + \epsilon_i \right),$$

which can be simplified to:

$$u_d = \frac{x_t + \epsilon_i}{1 - \beta\pi}$$

$\beta \in [0, 1]$ ... discount factor

$\pi \in [0, 1)$ ... probability of match persistence

$\epsilon_i \sim \mathcal{U}(0, 1)$ ... individual match quality

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(2) Utility from sales price:

- Realized sales price is translated into utility via the prospect theory value function:

$$u_p(\dot{p}_z) = v(\dot{p}_z) = \begin{cases} \dot{p}_z^{\alpha} & , \dot{p}_z \geq 0 \\ -\lambda(-\dot{p}_z)^{\alpha} & , \dot{p}_z < 0 \end{cases}, \ \alpha \in (0,1), \ \lambda > 1$$

- The sales price has a higher variance for higher values of π:

$$\dot{p}_z \sim \mathcal{N}(0, z\sigma^2)$$

- Time preference is accounted for by subtracting the product of the discount factor with the absolute sales price: $(1-\beta^z)p_{t+z}$.

$$z := \frac{1}{1-\pi} \ldots \text{expected duration of residence} \qquad \dot{p}_z := p_{t+z} - p_t \ldots \text{gains/losses}$$

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The willingness to pay is thus:

$$W = u_d + u_p - (1 - \beta^z) p_{t+z}$$

→ Willingness to pay increases with the expected duration of residence.

- Effects by intuition:
  - Expected housing utility increases in z.
  - Expected utility from the sales price decreases.
    - Variance of x_{t+z} increases.
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Decision of the Seller

Seller chooses a price to maximize the expected utility from having the house on the market.

- He is either in a state with a prospective loss or a gain.
- The duration of his preceding residency is vastly larger than one period of speculation.
  - → He is most likely not able to change that state.

→ He bases his decision either on risk-seeking or risk-averse behavior.

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Decision of the Seller

Seller maximizes his expected utility U_S by setting the price p:

$$U_S(p) = \gamma(p)v(p) + (1 - \gamma(v(p))\,\beta\mathbb{E}[v(p(x_{t+1}))] \rightarrow max!$$

Mechanism:

- For higher values of p, the sales price increases but the sales probability decreases.
- Buyers differ in their match quality ϵ_i with the sales object.
- For given price p, there is a certain ϵ^* at which buyers are indifferent to transact.
- Since $\epsilon_i \sim \mathcal{U}(0,1)$, the probability of sale is: $\gamma(p) = 1 - \epsilon^*(p)$.

$\gamma \in [0,1]$ ... probability of sale $\quad$ $v(\cdot)$ ... prospect theory function

Decision of the Seller

Seller maximizes his expected utility U_S by setting the price p:

$$U_S(p) = \gamma(p)v(p) + (1 - \gamma(v(p))\,\beta\mathbb{E}[v(p(x_{t+1}))] \rightarrow max!$$

Mechanism:

- For higher values of p, the sales price increases but the sales probability decreases.
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Expected utility from future sales price depends on the preceding price evolution:

$$\mathbb{E}\left[v(p(x_{t+1})) \mid \dot{p}_t > 0\right] < \mathbb{E}\left[v(p(x_{t+1})) \mid \dot{p}_t < 0\right]$$

→ Higher prices for prospective losses than for prospective gains.

$$\mathbb{E}\left[v(p(x_{t+1})) \mid \dot{p}_t > 0\right] < \mathbb{E}\left[v(p(x_{t+1})) \mid \dot{p}_t \gg 0\right]$$

→ Higher prices for losses of smaller size.

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Conclusion

Prospect theory helps to better understand the behavior on real estate markets and yields implications different to those of models with budget constraints or option value aspects.

- Price rigidities on down-turning markets.
- Stronger risk-aversion effects on markets with shorter expected duration of residence or weaker market changes.
  - Stronger price rigidities at market downturns.
  - Weaker price rigidities at market upturns.
- Price rigidities lead to longer time on the market and higher vacancy rates.

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Thank You for Your Attention!

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