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# Choosing annuities in a home reversion

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## The case of the viager market

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### **Abstract**

In this article, we analysed the preference for annuitization when retired people extract cash from their home. Based on 2,608 viager (home reversion) transactions closed in France between 2010 and 2018, we used a three-stage least squares (3SLS) model and a moderation model to study the relations among annuitization, negotiation, extraction, age, gender, and matrimonial status. We found that difficulties in selling the property result, generally, in increases in the annuitization. However, for the group of older sellers, if negotiations are more difficult, they nevertheless tend to sign contracts with lower annuities. The single men's group endures a gender inequality, suffering a limitation on their possibility to extract wealth and to annuitize, as well as an additional price discount while negotiating. Young single men, compared to young single women and young couples, must consent to a substantial price reduction when they prefer high down-payment, and limited price reduction when they prefer annuities. Elderly single men, compared to young single men, have less capacity to negotiate, a concern that is reinforced when they prefer annuities.

Keywords: Viager, Home reversion, Annuitization puzzle, Lifetime annuity, Ageing

## 1. Introduction

Over the last two decades, the increase in life expectancy, along with the massive cohort of baby-boomers entering retirement, has caused an ageing shock in numerous developed countries. To live long is a chance, but financing pensions has become increasingly challenging, whether for the public system, with the relative evolution of the retired and the active populations, or for the privately funded system, given the very low level on the bond markets, for instance. At the same time, the illiquid housing stock value represents an important wealth, of which the retired population possesses a significant part (1,060 over 5,660 billion euros for France (Lefebvre & Simon, 2018)).

In this situation, the home equity extraction products (e.g., reverse mortgage, equity withdrawal, home reversion, etc.) offer to the elderly homeowner a means to complete their retirement. Home reversion, in particular, enables the extraction of cash while staying at home until death, or entry into a care home. A *viager* is a specific kind of home reversion, in which the extracted amount is a direct function of the seller's age. Extracted wealth is paid through annuities and a down-payment, in a proportion negotiated and freely decided between buyers and sellers.

Favouring annuities is a way to hedge against the risk of insufficient revenue in case of longevity, so it appears suitable or rational to elderly individuals as a risk-reducing strategy. However, annuitizing is neither as obvious nor as rational as it seems, and there may be reluctance; in fact, Benartzi et al. (2011) talked about an annuitization puzzle. In this article, by studying 2,608 viager transactions closed in France between 2010 and 2018, we can document the factors that influence the preference for annuities over lump-sum transactions. In particular, we explore the effects of age, gender, and matrimonial status on this preference. We highlight the significant effect of interactions between annuitization, expected length, and gender in the context of explaining the negotiation.

The rest of this article is organized as follows. Section 2 is devoted to the literature review. Section 3 presents the principle of a viager, the database, and descriptive statistics. Section 4 presents the models and the estimation strategy: a three-stage least squares (3SLS) approach and an interaction model. Section 5 presents the results and the relevant interpretation. Section 6 concludes.

## 2. Literature Review

During the 1990s, an important debate emerged, discussing whether the baby-boom, and later, the elder-boom, would affect housing prices (Mankiw & Weil, 1989; Holland, 1991; Peek & Wilcox, 1991; Ohtake & Shintani, 1996). Based on the life-cycle theory, the hypotheses under consideration explained that the large cohorts of baby-boomers would first raise prices by a demand effect, and upon arriving at retirement age, would contribute to decrease prices, by a supply effect. This conversation has gained reinforced attention today, in a context of high real estate prices and ageing societies (for Canada, Fortin & Leclerc, 2002; for the Netherlands, Neuteboom & Brounen, 2007; for Japan, Nakamura & Saita, 2007; for Scotland and England, Levin et al., 2009; for France, Simon & Essafi, 2017). Published in the *Journal of Housing Economics*, the article of Takáts (2012), a panel approach to 21 countries over the period 1970–2009, deserves special attention.

Whether renters or homeowners, retired people, in general, wish for “ageing in place” (Costa-Font et al., 2009). However, issues about the suitability or unsuitability of places must be considered (Severinsen et al., 2016), along with home maintenance difficulties (Coleman et al., 2016). Child proximity (Lee & Painter, 2014) and widowhood (Bonnet et al., 2010) are also discussed in the literature to better understand housing choices made by the elders.

For retired homeowners, one way to finance ageing in place consists of using home equity conversion products, such as reverse mortgage, home reversion, or sale of the bare ownership, especially for those with the profile of “house-rich, cash-poor” (Shan, 2011). Such interest in those products was identified very early (Higgins & Folt, 1992), and sometimes presented as a way to reduce poverty among elders (Kutty, 1998). Obstacles to the developments of these products were discussed by Leviton (2002), by Weber and Chang (2006) in the context of ethical concerns, and by Tsay et al. (2014) in the context of pricing issues.

The viager is a member of the family of home equity conversion product and is a kind of home reversion. Rather, it is oriented toward lifetime annuities; in that sense, it meets the annuitization puzzle issue documented by Benartzi et al. (2011). Annuities should indeed be popular for many reasons, but people are often reluctant to annuitize a substantial share of their wealth and tend to prefer lump sums. This preference for the present is a well-known subject in the economic literature, as surveyed by Frederick et al. (2002) and explored by Warner and Pleeter (2001). Personal discount rate differences between rich and poor households have been studied, for instance, by Lawrance (1991) and, more recently, by Klawitter et al. (2013). If Lahav et al. (2010) found differences between teenagers and adults regarding their subjective time discount rates, we may consider that elders also express specificities in this regard. This is all the more relevant in the case of the viager; the choice between a lifetime annuity and a lump sum is made in a context of mortality salience (Kasser & Sheldon, 2000; Fransen et al., 2008; Partouche-Sebban & Guiot, 2018). It is also interesting to keep in mind that this kind of transaction involves something that may unconsciously be associated with an illusion of immortality: a home (Erbs, 2015).

### 3. The viager: Principle, database, and descriptive statistics

#### a. Principle of the viager

A *viager* is a home reversion transaction, in which the extracted amount is fixed. It consists of selling a property in return for a down-payment and a lifetime annuity that the buyer must pay until the seller's death (Février et al., 2012). Older than 200 years of age, the viager product is used and standardized in many countries, such as France, Belgium, Germany ('leibrente'), Italy ('vitalizio'), the UK ('home reversion') and Spain ('vitalicio'). It belongs to the family of structured products that allows retired homeowners to increase their pensions by extracting cash from their home equity. It differs from a reverse mortgage in that it consists of a true sale of a property, without bank involvement or issues related to interest rates.

France is an interesting case study for this kind of product. On one hand, about 75 % of the French retired population are homeowners (compared to a national average of 58%), but a significant proportion receives low pension. On the other hand, the total housing wealth can be estimated at 5,660 billion euros (Lefebvre & Simon, 2018), of which around 1,060 billion euros are owned by the retirees. As in numerous OECD countries, retired individuals are often in the "house rich, cash poor" situation.

A viager sale functions as follows. First, an occupied discount is applied to the estimated market value of the property. This discount reflects the fact that the property is occupied and that the seller retains the *usufruct* (*fructus* and *usus*), or more simply, the *right of use and habitation* (*usus*), which permits them to continue living in their home until death. The remainder, the bare ownership (*abusus*), is transferred to the buyer at the contract signature. The economic value of the bare ownership, purchased by the buyer, corresponds to the wealth extracted by the seller. The payment is split into two parts: a down-payment at the signature (*bouquet* in French), and a commitment to a lifetime annuity (*rente* in French), which is often paid monthly. The occupied discount, or equivalently, the extracted amount, derives from an actuarial table. It is supposed to depend solely on the seller's age and should rely neither on the preferences of the buyer nor the preferences of the seller. However, as we shall see, practice differs from theory. In terms of the split between down-payment and annuities, it is freely determined by the parties. When the seller dies, the buyer becomes full owner of the property and ceases to owe further annuities.

## b. Database

Our database comprises 2,608 transactions, 55% apartments and 45% houses, from January 2010 to April 2018, provided by *Renée Costes Viager*, the main French brokerage chain for this product (market share around 25%). We included in the study apartments with a surface area between 8 and 200 m<sup>2</sup>, houses with a surface area between 20 and 300 m<sup>2</sup> and associated land of less than 10,000 m<sup>2</sup>. Properties were all built after 1700, have a minimum value of 10,000 euros and fewer than 10 rooms. We excluded properties for which the asking price was revised more than five times and that had a time-on-market longer than three years (71 properties removed). We also filtered out observations when the ratio of the final total estimated value of the property and the initial total estimated value was lower than 50% or higher than 115% (70 properties removed).

First results showed that the expected length of the viager is, on average, approximately 11–12 years, higher for houses than for apartments (Table 1). If the seller is single, the expected length is equal to the residual life expectancy. If the sellers are a couple, the length corresponds to their joint residual life expectancy (cf. Appendix 1). Computation of these lengths is based on the mortality tables TH/TF 00-02<sup>1</sup>. The time-on-market is quite important, compared to basic housing sales, and should be around 8–10 months. The price/m<sup>2</sup> is twice as high for apartments, compared to houses. Most sellers of apartments are single women, whereas distribution is more homogenous for houses. Globally, two-thirds of the sellers were single.

**Table 1: Descriptive statistics**

|  | APARTMENTS |          |       |        | HOUSES |          |       |        |
|--|------------|----------|-------|--------|--------|----------|-------|--------|
|  | Mean       | St. Dev. | Min   | Max    | Mean   | St. Dev. | Min   | Max    |
| Expected length (TF/TH 00-02)                              | 11.21      | 4.42     | 2.49  | 28.40  | 12.18  | 4.83     | 3.05  | 31.09  |
| Time-on-market (days)                                      | 251        | 161      | 22    | 1 056  | 299    | 193      | 23    | 1 086  |
| Year of construction                                       | 1 956      | 41       | 1 700 | 2 015  | 1 954  | 46       | 1 700 | 2 015  |
| % owners in the municipality                               | 47         | 15       | 22    | 92     | 67     | 16       | 19    | 96     |
| Median income in the municipality (€)                      | 23 977     | 5 657    | NA    | 43 350 | 20 951 | 4 189    | NA    | 41 236 |
| Price/m <sup>2</sup>                                       | 4 132      | 2 658    | 415   | 17 785 | 1 857  | 1 047    | 363   | 12 979 |
| % single males   | 23         | 42       | -     | -      | 23     | 42       | -     | -      |
| % single females   | 57         | 50       | -     | -      | 38     | 48       | -     | -      |
| % couples  | 21         | 40       | -     | -      | 40     | 49       | -     | -      |
| Final estimated value/Initial estimated value<br>FEV/IEV   | 0.86       | 0.11     | 0.50  | 1.15   | 0.84   | 0.12     | 0.50  | 1.13   |
| Extracted wealth /Final estimated value<br>EXTRACT/FEV     | 0.59       | 0.09     | 0.30  | 0.78   | 0.57   | 0.10     | 0.28  | 0.80   |
| Present value of annuities/Extracted wealth<br>PVA/EXTRACT | 0.64       | 0.21     | 0.00  | 1.00   | 0.69   | 0.20     | 0.00  | 1.00   |

<sup>1</sup> These tables are life tables, commonly used in France, built from INSEE 2000–2002 tables, for males and females, respectively.

### c. Intermediate price measures

The observable financial elements in the database are the initial estimated value of the full property (**IEV**), the agreed down-payment and the agreed monthly amount of the annuity. The initial estimated value is generally proposed by the broker and indicated in the first version of the listing. Down-payment and annuities are the results of a negotiation. To decompose the selling process and analyse its steps, we reconstruct the three implicit measures that correspond to the viager's logic:

- **FEV** (final estimated value): the estimation of the value of the full property at the contract signature
- **PVA** (present value of annuities): the present value of annuities at the contract signature
- **EXTRACT**: the amount of wealth extracted at the contract signature

The **PVA** is calculated for each transaction from the agreed annuity by discounting the value of annuities over the average residual lifetime of the individual (or the joint residual lifetime for couples). This average residual lifetime is derived from the mortality tables TH/TF 00-02, depending on the age and on the gender of the individual (available in the database). An annual inflation of the annuity amount of 1% per year is applied – it is indeed a common practice in the viager market to adjust the annual amount according to inflation. The discount rates for each month derive from the zero-coupon curves provided by the French Institute of Actuaries. For each viager, we use the zero-coupon curve at the contract signature, and we actualize the monthly amount paid on a given date, by the corresponding rate for the same date (cf. Appendix 2).

The amount of wealth extracted, **EXTRACT**, is obtained by adding the down-payment to the present value of annuities:

$$\mathbf{EXTRACT} = \mathbf{PVA} + \text{Down-payment}$$

At last, we reconstruct the final estimated value (**FEV**), reversing the Daubry scale. This scale serves as the reference for the viager agencies in France. It gives, for each viager, the occupied discount<sup>2</sup>, depending on the age and gender of the seller(s). More precisely, we calculate:

$$\mathbf{FEV} = \frac{\mathbf{EXTRACT}}{1 - \text{occupied discount}}$$

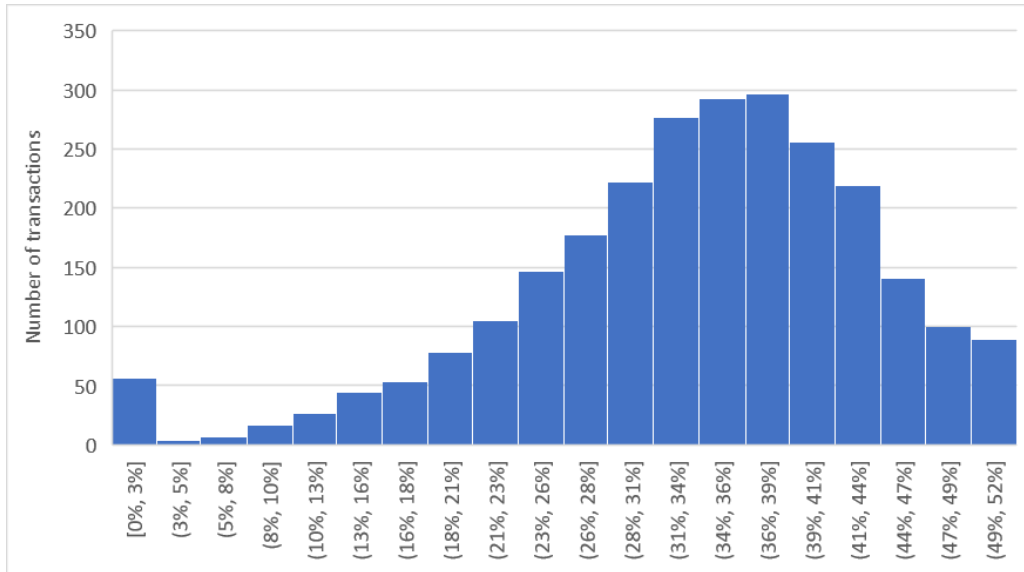
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<sup>2</sup> The occupied discount corresponds to the right of use and habitation or the usufruct.

#### d. Financial horizon for the payments

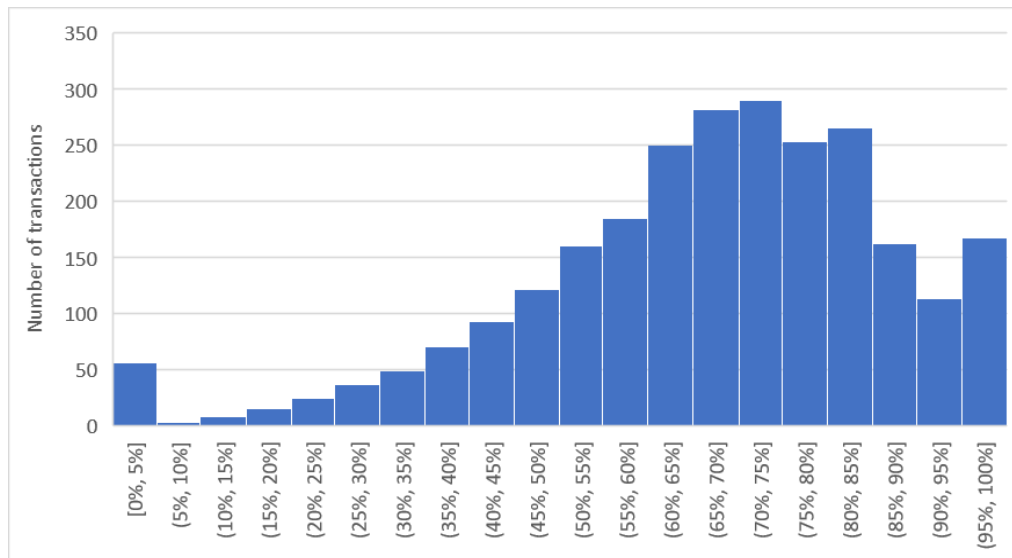
To better qualify the temporal structure of the cash-flows paid by the buyer, for each viager, we also calculate the Macaulay duration, assuming the viager ends at its expected horizon (cf. Appendix 3). Figure 1 presents the distribution of the ratio between duration and expected length. The temporal cash flow structure is strongly compressed, with a mean around 35% and a discontinuity at zero that corresponds to the viager with a 100% down-payment (2% of the whole set). If the expected length of the viager is around 11 years, the financial horizon for the payments is actually much smaller.

**Figure 1: Distribution of the ratio Macaulay duration/Expected length**



It is also interesting to compare, for each viager, the Macaulay duration of the signed transaction with its equivalent, assuming that all payments would be due in lifetime annuities (Figure 2). It stems from that down-payments, on average, reduce by 30% the duration, compared to the full-annuities choice. Discontinuities at 0% and 100% again suggest that the extreme choices (full down-payment (2% of the whole set) or full annuities (4%)) constitute two specific sub-segments.

**Figure 2: Distribution of the ratio Macaulay duration/Macaulay duration all annuities**





## 4. Models

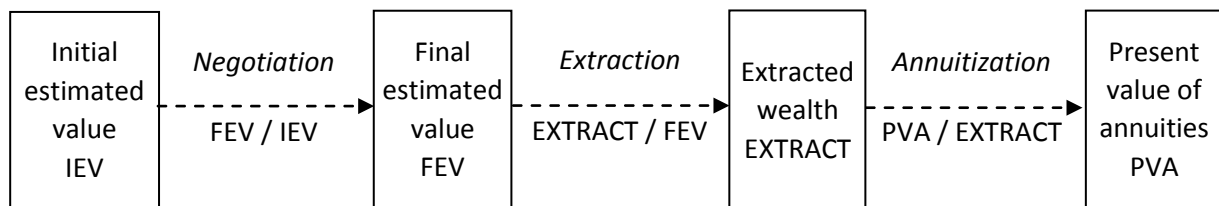
### a. Decomposition of the viager transaction

We decompose the transaction process in three fictitious stages (Figure 3). First, we consider **negotiation** by dividing the final estimated value (FEV) by the initial estimated value (IEV). On average, this ratio is around 85%, which means that the price reduction due to negotiation is high, around 15%. The closer to 100% this ratio is, the greater the seller's capacity for negotiation.

We then consider **extraction**, dividing the extracted wealth (EXTRACT) by the final estimated value (FEV). The extracted amount is important, and it is, on average, around 60%, and ranges between 30% and 80%.

The last element, **annuitization**, consists of an arbitrage between the down-payment and the lifetime annuities. We consider this stage by dividing the present value of annuities (PVA) by the extracted wealth (EXTRACT). If annuities are generally preferred and represent, on average, 70%, the ratio, however, varies between 0% (full down-payment) and 100% (full annuities); the greater the ratio, the stronger the preference for annuitization.

**Figure 3: Decomposition of the viager transaction**



Regarding the annuitization ratio, as discussed above, individuals are often reluctant to choose annuities instead of direct cash extraction, what Benartzi et al. (2011) called the annuitization puzzle. As the choice between down-payment and lifetime annuities is free, the viager provides an interesting opportunity to better understand the determinants of this choice in a context of mortality salience. The extraction ratio reflects the consumption-investment duality of housing. Those two sides interact dynamically over the life-cycle and it is well-known that household wealth has a significant effect on consumption. This balance is particularly interesting to study among retired people. Based on a survey, Dillingh et al. (2017) documented that reverse mortgage in the Netherlands is more consumption-oriented for people under 65 years, whereas the bequest motivation increased after that age. In theory, for the viager, the extracted wealth percentage is not freely decided; it is directly and uniquely determined by the seller's age, using actuarial tables. However, as the three phases (negotiation, extraction, annuitization) are realized simultaneously, interaction effects may exist. As for the negotiation ratio, it is centrally associated with the commercialization process, but without necessarily representing the all commercialization aspects, as discussed hereafter. The literature has documented a strong relation between price reduction and time-on-market. For instance, Martel (2018) proposed a theoretical model, incorporating quality, price, and time-on-market, in which sale prices fall along with time-on-market. It is also possible to refer to the state of the art, realized by Benefield et al. (2014) about the (property price – marketing time) tradeoff.

### **b. A 3SLS model explaining negotiation, wealth extraction and annuitization**

Our objective is to explore the factors that influence those three dimensions. Here, an important point should be discussed. Figure 3 may suggest that negotiation, extraction, and annuitization are decided sequentially, one after the other. However, this is fictitious and, in practice, they are decided simultaneously. This may produce interaction effects; for instance, a full down-payment may be easier to commercialize, resulting in a smaller discount and a greater negotiation ratio. To document those potential crossed effects, we introduce, in the annuitization equation, the negotiation ratio, and in the negotiation equation, we introduce the annuitization ratio. The annuitization and negotiation ratios are also introduced in the extraction equation. Regarding the extraction ratio, it is not included in the two other equations because they already include the expected length, which is strongly correlated with the extraction ratio (-0.98).

Given the interaction between equations and variables, we jointly estimate those three equations with a three-stage least squares procedure (3SLS). Using a 3SLS further deals with the potential correlation's issues between the exogenous variables<sup>3</sup>. At last, as mentioned in Section 3.d, the full down-payment and the full lifetime annuities viagers may constitute specific sub-segments. Therefore, we also test the robustness of our results by removing each of these segments separately.

The explanatory variables are as follow. The time-on-market is introduced using dummy variables per quarter (the removed reference variable corresponds to the less-than-three-months commercialization). We also control for market conditions with dummies for each year (removed reference 2018). Dwellings characteristics are the year of construction (removed reference 'before 1945'), the number of rooms, the apartment/house distinction, and the price per square meters. Local conditions are rendered by the percentage of owners, and the median income in the municipality. Information on sellers is captured with the expected length of the viager based on sellers' age, and the single/couple distinction, crossed with gender (removed reference 'couple').

### **c. Moderation analysis for the capacity of negotiation**

In a second step, we conduct a more in-depth investigation of our results regarding negotiation, by implementing a moderation model. A moderator variable *W* is a variable that alters the strength of the causal relationship between *X* and *Y*. It consists of including an interaction effect between *W* and *X* in the regression model. Studying the effect of annuitization on negotiation, we propose a moderation model that allows for the impact of two moderators: length and status. This model has been undertaken with *Process* modelling and a bootstrap technique ( $n = 5000$ ) to identify simple and interaction effects (Preacher et al., 2007).

We designed the following equation to explain negotiation:

$$\begin{aligned} NEGOTIATION = & a_0 + a_1 \times ANNUITIZATION + a_2 \times LENGTH + a_3 \times STATUS + \\ & a_4 \times ANNUITIZATION \times LENGTH + a_5 \times ANNUITIZATION \times STATUS + a_6 \times LENGTH \times STATUS \\ & + a_7 \times ANNUITIZATION \times LENGTH \times STATUS \end{aligned}$$

With:

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<sup>3</sup> The correlations between those variables are low: with a minimum of -0.53 and a maximum of 0.61.

- NEGOTIATION representing the *capacity to succeed in a negotiation*, i.e. the negotiation discount (FEV / IEV)
- ANNUITIZATION representing the *preference for annuitization* (PVA / EXTRACT)
- LENGTH representing the *expected length (referring to the age(s) of the decision-maker(s))*
- STATUS as a control variable to avoid potential confounding effects. It corresponds to the *household status (single man vs. not-single man (= single woman, or couple))*

And:

- $a_1$  referring to the *simple effect* of ANNUITIZATION on NEGOTIATION
- $a_4$  referring to a *moderation effect*, the effect of ANNUITIZATION on NEGOTIATION, moderated by LENGTH
- $a_7$  referring to a *moderation effect*, the effect of ANNUITIZATION on NEGOTIATION, moderated by both LENGTH and STATUS

## 5. Results and interpretations

### a. 3SLS estimation results

Table 2 presents the results for the full dataset, the sample without the full down-payment viager, and the sample without the full annuities viager. In theory, according to the viager's practice, the extracted amount should be defined as a direct and unique function of the sellers' age (alternatively referring to the expected length). However, it is surprising to observe that several other variables also have an effect, although this is not supposed to occur. This means, in particular, that the seller's capacity for extraction exists and may fluctuate.

**Table 2: 3SLS estimations for annuitization, extraction and negotiation**

|                                    | Full dataset                   |                                    |                          | Without full down-payment viager |                                    |                          | Without full lifetime annuities viager |                                    |                          |
|------------------------------------|--------------------------------|------------------------------------|--------------------------|----------------------------------|------------------------------------|--------------------------|--|------------------------------------|--------------------------|
|                                    | Annuitization<br>PVA / EXTRACT | Wealth extraction<br>EXTRACT / FEV | Negotiation<br>FEV / IEV | Annuitization<br>PVA / EXTRACT   | Wealth extraction<br>EXTRACT / FEV | Negotiation<br>FEV / IEV | Annuitization<br>PVA / EXTRACT         | Wealth extraction<br>EXTRACT / FEV | Negotiation<br>FEV / IEV |
| (Intercept)                        | 1.13 ***                       | 8.16e-01 ***                       | 9.39e-01 ***             | 1.06 ***                         | 8.14e-01 ***                       | 9.44e-01 ***             | 1.14 ***                               | 8.17e-01 ***                       | 9.47e-01 ***             |
| Expected length                    | 1.33e-02 ***                   | -2.05e-02 ***                      | 8.67e-03 ***             | 1.41e-02 ***                     | -2.06e-02 ***                      | 9.26e-03 ***             | 1.27e-02 ***                           | -2.06e-02 ***                      | 8.69e-03 ***             |
| Time-on-market 3-6 months          | -1.81e-02                      | 2.54e-03                           | -1.44e-02                | -2.50e-03                        | 2.65e-03                           | -1.37e-02                | -1.85e-02                              | 2.57e-03                           | -1.51e-02                |
| Time-on-market 6-9 months          | -3.19e-02                      | 3.08e-03                           | -3.04e-02 *              | -1.04e-02                        | 3.10e-03                           | -2.97e-02 *              | -3.17e-02                              | 3.31e-03                           | -2.99e-02 *              |
| Time-on-market 9-12 months         | -6.64e-02 *                    | 3.64e-03 .                         | -5.54e-02 ***            | -4.58e-02                        | 3.53e-03 .                         | -5.50e-02 ***            | -6.62e-02 *                            | 3.80e-03 .                         | -5.70e-02 ***            |
| Time-on-market >12 months          | -1.04e-01 **                   | 3.52e-03 .                         | -9.78e-02 ***            | -7.86e-02 **                     | 3.59e-03 .                         | -9.86e-02 ***            | -9.96e-02 **                           | 3.72e-03 .                         | -9.82e-02 ***            |
| Year of construction 1945-1980     | -7.39e-03                      | -3.61e-04                          | -9.44e-03 .              | -1.13e-02                        | -9.13e-05                          | -1.01e-02 *              | -2.70e-03                              | -1.75e-04                          | -8.88e-03 .              |
| Year of construction 1980-2000     | -1.34e-02                      | -7.14e-04                          | -1.28e-02 *              | -1.63e-02                        | -7.74e-04                          | -1.37e-02 *              | -1.35e-02                              | -5.57e-04                          | -1.25e-02 *              |
| Year of construction 2000-2018     | 1.95e-02                       | -7.73e-04                          | -2.39e-03                | 6.78e-03                         | -4.51e-04                          | -3.69e-03                | 1.92e-02                               | -1.28e-03                          | 2.09e-04                 |
| Year of construction not indicated | -2.13e-03                      | -4.94e-04                          | 5.59e-03                 | -1.34e-02                        | -3.28e-04                          | 3.96e-03                 | 2.21e-03                               | -2.52e-04                          | 5.77e-03                 |
| % owners in the municipality       | 2.89e-02                       | -2.87e-03                          | 3.21e-02 *               | 2.13e-02                         | -2.89e-03                          | 3.10e-02 *               | 2.49e-02                               | -2.75e-03                          | 2.94e-02 *               |
| Median income in the municipality  | -1.24e-06                      | 6.51e-08                           | -2.69e-06 ***            | -9.23e-07                        | 4.55e-08                           | -2.51e-06 ***            | -1.35e-06                              | 4.99e-08                           | -2.65e-06 ***            |
| Price/m2                           | -1.63e-05 ***                  | -3.32e-07 .                        | 1.22e-05 ***             | -1.65e-05 ***                    | -2.51e-07                          | 1.13e-05 ***             | -1.41e-05 ***                          | -2.67e-07                          | 1.17e-05 ***             |
| Is single man                      | -4.93e-02 ***                  | -1.03e-02 ***                      | -2.86e-02 ***            | -3.09e-02 **                     | -1.05e-02 ***                      | -2.70e-02 ***            | -4.63e-02 ***                          | -1.02e-02 ***                      | -2.61e-02 ***            |
| Is single woman                    | -2.76e-02 **                   | 4.28e-04                           | 4.86e-04                 | -2.40e-02 **                     | 4.59e-04                           | 4.68e-04                 | -2.24e-02 *                            | 4.17e-04                           | 2.00e-03                 |
| Is year of signature 2010          | -1.43e-01 ***                  | 4.56e-02 ***                       | -1.06e-01 ***            | -1.43e-01 ***                    | 4.58e-02 ***                       | -1.10e-01 ***            | -1.51e-01 ***                          | 4.55e-02 ***                       | -1.05e-01 ***            |
| Is year of signature 2011          | -1.21e-01 ***                  | 4.58e-02 ***                       | -1.09e-01 ***            | -1.19e-01 ***                    | 4.59e-02 ***                       | -1.12e-01 ***            | -1.29e-01 ***                          | 4.60e-02 ***                       | -1.07e-01 ***            |
| Is year of signature 2012          | -1.37e-02                      | 1.68e-03                           | -3.30e-02 ***            | -3.37e-02 .                      | 1.78e-03                           | -3.68e-02 ***            | -1.28e-02                              | 2.15e-03                           | -3.12e-02 **             |
| Is year of signature 2013          | -4.38e-02 *                    | 3.60e-03 **                        | -7.28e-02 ***            | -4.78e-02 *                      | 3.98e-03 **                        | -7.41e-02 ***            | -4.63e-02 *                            | 3.59e-03 **                        | -6.96e-02 ***            |
| Is year of signature 2014          | -1.88e-02                      | 3.67e-04                           | -5.65e-02 ***            | -2.31e-02                        | 1.52e-04                           | -5.98e-02 ***            | -3.30e-02 .                            | 3.01e-04                           | -5.98e-02 ***            |
| Is year of signature 2015          | -4.41e-03                      | 9.12e-04                           | -3.05e-02 ***            | -1.47e-02                        | 1.07e-03                           | -3.22e-02 ***            | -1.02e-02                              | 9.81e-04                           | -3.16e-02 ***            |
| Is year of signature 2016          | 1.60e-02                       | 1.19e-03                           | 1.90e-04                 | 1.18e-02                         | 1.19e-03                           | 6.08e-04                 | 8.50e-03                               | 1.32e-03                           | -1.43e-03                |
| Is year of signature 2017          | -1.14e-02                      | 1.50e-03                           | 1.67e-03                 | -2.88e-02 .                      | 1.62e-03                           | 2.36e-04                 | -1.97e-02                              | 1.42e-03                           | -3.11e-06                |
| Is an apartment                    | -1.19e-02                      | 1.09e-05                           | -6.33e-03                | -1.12e-02                        | 1.73e-04                           | -5.81e-03                | -1.28e-02                              | 4.96e-05                           | -7.10e-03                |
| Number of rooms                    | -4.59e-03                      | -1.65e-04                          | -3.97e-03 *              | -5.88e-03 .                      | -1.12e-04                          | -5.53e-03 ***            | -2.91e-03                              | -1.37e-04                          | -4.05e-03 *              |
| PVA/EXTRACT                        | Not applicable                 | -5.17e-03 ***                      | -1.03e-01 ***            | Not applicable                   | -3.96e-03 **                       | -1.11e-01 ***            | Not applicable                         | -5.81e-03 ***                      | -1.15e-01 ***            |
| FEV / IEV                          | -4.99e-01 ***                  | -1.52e-03                          | Not applicable           | -4.24e-01 ***                    | -5.75e-04                          | Not applicable           | -5.22e-01 ***                          | -2.80e-03                          | Not applicable           |

Signif. codes: '\*\*\*' : < 0.001, '\*\*' : < 0.01, '\*' : < 0.05, '.' : < 0.1

Ref. variables: Time-on-market 0-3 months; Year of construction<1945; Is couple; Is year of signature 2018; Is a house

Expected length (thus, the sellers' age) also affects annuitization significantly. When the seller is one year older, the portion of annuities in the extracted amount decreases by 1.33%. As for negotiation, when the seller is one year older, the price decreases by 0.87%, relative to the initial estimated value (IEV).

The time-on-market logically affects negotiation: after one year, the price decreases by 9.78%. However, at the same time, it also reduces the lifetime annuities portion by 10.4%. When a property is difficult to sell, adjustments are made by reducing the financial horizon, increasing the down-payment part.

In terms of the characteristics of the dwelling, the period of construction is non-significant or has very limited effects and the apartment/house distinction has no impact, whereas a greater number of rooms tends to increase the negotiation discount slightly. The market conditions of each year mainly and unsurprisingly affect negotiation. The magnitude of the effects of the local conditions (ownership rate and median income in the municipality) is very limited. A more expensive price per square meter tends to slightly decrease annuities, in favour of down-payment, thereby moderately reducing the negotiation discount, whereas the impact on extraction is negligible.

More interesting are the effects of matrimonial status and gender. Among singles, the portion of annuities decreases by 2.76% for women, this decrease is even greater for men, at 4.93%. Additionally, compared to couples and single women, the amount extracted by single men is 1.03% less, and they also must consent to an additional price reduction of 2.86%.

We must discuss the crossed effects. Although negotiation has no effect on extraction, an indirect relationship still obtains between them: The greater the negotiation discount is, the higher the annuitization: an additional price reduction of 1% does, in fact, increase the portion of annuities by 0.50%. The impact of the annuitization ratio on extraction is almost null, but not on negotiation: The dwelling price for a full annuities viager ( $PVA/EXTRACT = 1$ ) is 10.3% lower, compared to the same property sold through a full down-payment viager. This result is an estimation of the risk premium associated with the riskiest viager cash flows (full annuities), compared to the non-risky cash flows case (full down-payment).

**b. Moderation analyses**

To deepen our understanding of the interactions between negotiation and annuitization, this section discusses the results of the moderation model presented in section 4.c. The mean, standard error, and correlations of the variables of interest are shown in Table 3. Results of the regressions models are presented in Table 4; Model 1 is a regression without moderation effects, Model 2 includes the moderation effects. The R<sup>2</sup> difference with and without moderation effects is significant (0.017\*\*\*).

**Table 3 – Mean, standard error, and correlations**

|                              | Mean  | SD    | Expected length | Single man |
|------------------------------|-------|-------|-----------------|------------|
| Preference for annuitization | 66.3% | 0.208 | 0.214**         | -0.060**   |
| Expected length              | 11.7  | 4.63  | 1               | -0.160**   |
| Single man                   | 23.0% | 0.419 |                 | 1          |

Preference for annuitization shows a negative direct effect: Sellers who prefer annuitization negotiate less well than those who prefer down-payment, as seen in the previous section. By contrast, the expected length has a positive effect: Younger sellers negotiate more successfully, obtaining higher prices than older sellers. This positive effect is reinforced by the preference for annuitization: Young sellers who want to annuitize more negotiate even more successfully.

**Table 4 – Effects of annuitization, expected length, and gender on negotiation**

| Capacity of negotiation                      | Model 1   | Model 2   |
|--|-----------|-----------|
| R  | 0.395     | 0.416     |
| R <sup>2</sup>                               | 0.156     | 0.173     |
| Adjusted R <sup>2</sup>                      | 0.155     | 0.170     |
| Difference of R <sup>2</sup>                 |           | 0.017***  |
| Constant                                     | 78.4***   | 84.9***   |
| Annuitization                                | -0.063*** | -0.160*** |
| Expected length                              | 0.920***  | 0.338*    |
| Single man (1)                               | -2.01***  | ns        |
| Single woman (1)                             | 1.34**    | 1.31**    |
| Annuitization x Expected length              |           | 0.009***  |
| Annuitization x Single man                   |           | -0.161**  |
| Expected length x Single man                 |           | -0.617*   |
| Annuitization x Expected length x Single man |           | 0.014**   |

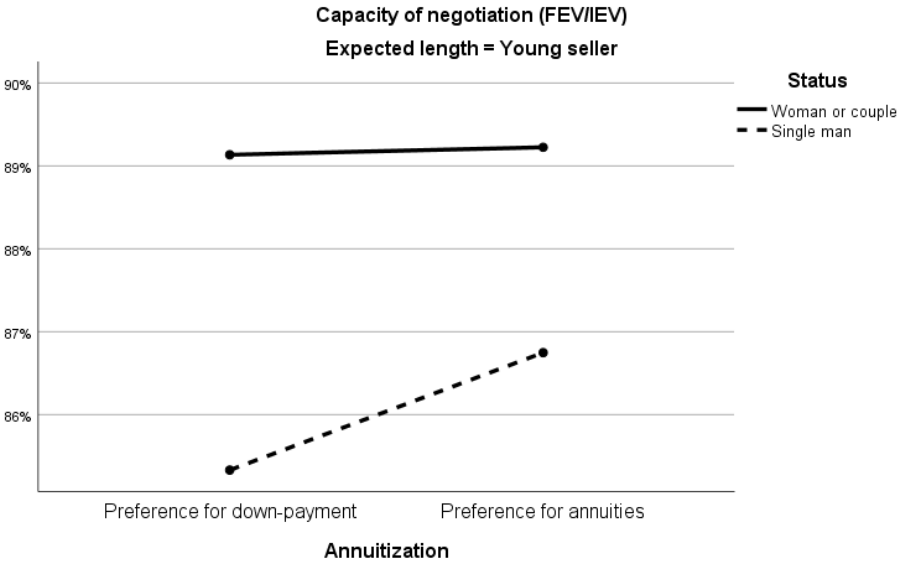
\*\*\*<0.001, \*\*<0.01, \*<0.05; ns: not significant; (1) ref variable: couple

Regarding status, we find that single women negotiate more successfully than couples, who negotiate more successfully than single men (Model 1). Gender strongly influences the capacity to negotiate: Women show more negotiation power than single men, alone or in a couple. By contrast, being a single man is detrimental to the capacity of negotiation, directly but also as a moderation factor: If a single man prefers annuities and wants to annuitize more, the negotiation is even more difficult (Model 2):

Among the young sellers' group (Figure 4), single men encounter significantly greater difficulty to get a high price if they want a higher down-payment, compared to women or couples (negotiation =

85%, versus 89%<sup>4</sup>). This difference is reduced when annuitizing more ( $a_7$  positive and significant in Model 2), but single men are still less capable of negotiating the price (negotiation = 86%, versus 89%<sup>5</sup>).

**Figure 4: Capacity of negotiation for young sellers, according to the household status and the preference for annuitization<sup>6</sup>**



Among the single men’s group (Figure 5), the capacity for negotiation is, on average, lower for older men. The magnitude of this effect depends on the preference for annuitization: When old single men prefer annuitizing, this effect is clearly reinforced ( $M = 76%$  versus  $M = 81%$ <sup>7</sup> for higher down-payment). For young single men, their annuitization choice does not significantly impact their negotiation capacity. As a consequence, when male sellers get older, they have an interest in choosing greater down-payment to secure a higher price. In this case, the difference observed with young men is limited (negotiation = 81%, versus 85%<sup>8</sup>), compared to the annuitization cases (negotiation = 76%, versus 86%<sup>9</sup>).

<sup>4</sup>  $t(535) = 3.9, p < 0.000$

<sup>5</sup>  $t(728) = 2.6, p = 0.011$

<sup>6</sup> To facilitate the understanding of these interaction effects, we dichotomized expected length and preference for annuitization, relative to their median point (Figure 4 and Figure 5).

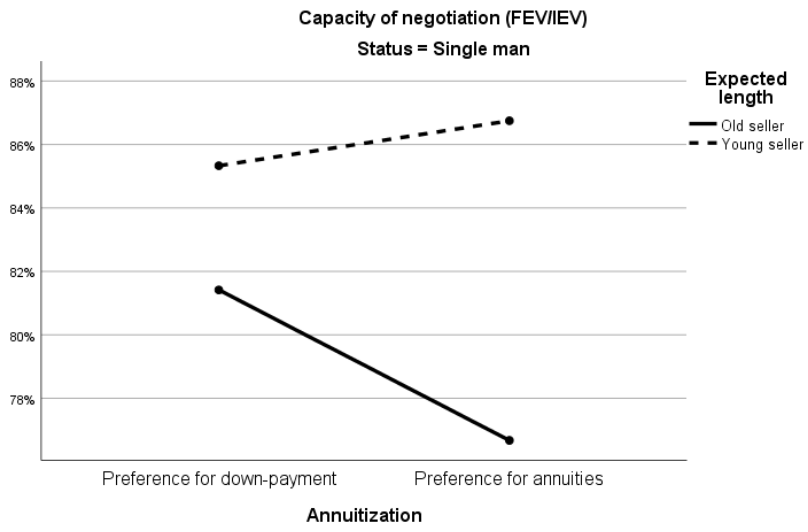
<sup>7</sup>  $t(351) = 4.2, p < 0.000$

<sup>8</sup>  $t(328) = -3.2, p = 0.002$

<sup>9</sup>  $t(259) = -7.4, p < 0.000$



**Figure 5: Capacity of negotiation for single men, according to the expected length and the preference for annuitization**



## 6. Conclusion

In this article we analysed the determinants of viager transactions, considering horizon, negotiation, extraction, and annuitization. We first established that the financial horizon of the cash-flows paid by the buyer is much lower than the expected horizon: It is approximately 35% of the expected horizon. Moreover, the effect of down-payment on the financial horizon is substantial, imposing a decrease of 30%. Although the extracted amount of wealth in a viager is intended to depend solely on the sellers' age, we found evidence indicating that several other variables bear influence and that bargaining, in this respect, is a reality.

However, the main point in a viager's transactions is the relation between the annuitization choice and negotiation. When a property is difficult to sell, and has substantial time-on-market, a price discount logically emerges, but the negotiation also involves an increase of the annuity part. Therefore, to a seller aiming at a significant portion of down-payment, this result suggests that it may be advantageous to avoid deploying overly aggressive commercialization strategies with a high initial asked price. Negotiations are generally more difficult for older sellers, and they tend to sign the viager's contract with lower annuities.

The single men's group appears as very specific and subject to a gender inequality. On average, they receive lower annuities (-4.93%), they extract less wealth (-1.03%), and they must suffer an additional price discount in the negotiation (-2.86%). Young single men, compared to young single women and young couples, must consent to a substantial price reduction when they prefer high down-payment, and to a limited price reduction when they prefer annuities. Old single men, compared to young single men, have less capacity to negotiate, a deficit that is reinforced when they prefer annuities. In that sense, when single men grow older, they find it advantageous to choose a higher down-payment if they want to limit their losses.

At last, the global negative effect of annuitization on negotiation may open a path to further research. We may hypothesize that, when the seller is reluctant to consider the idea of their death, to refuse the salience of mortality, they tend to ask for greater annuities. However, as a consequence, they must consent to additional price reductions. We observe that point indirectly in our article, with young sellers and couples preferring annuities, compared to more elderly sellers and singles. Indeed, for young retirees, the idea of death is probably still distant, whereas older sellers may have a clearer awareness of their finitude. Likewise, singles, who are often widows and widowers, have already endured the death of their partner and also may have a clearer awareness of their own mortality.

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## Appendix 1: Joint life expectancy

The joint life expectancy is the life expectancy of two sellers until the last survivor. It has been calculated using a mortality table with the following formula (with two weeks neglected to simplify calculations):

$$e_x = \frac{1}{12} \sum_{k=1}^{12(w-x)} \frac{l_{x+\frac{k}{12}}}{l_x} + \frac{0.5}{12} \approx \frac{1}{12} \sum_{k=1}^{12(w-x)} \frac{l_{x+\frac{k}{12}}}{l_x}$$
$$e_{\overline{xy}} = e_x + e_y - e_{xy}$$

With:

- $e_x$ : life expectancy (x: individual)
- $e_{\overline{xy}}$ : life expectancy until the last survivor (x, y: individuals)
- $l_x$ : number of age x individuals in the mortality table (we assume that at time w, all individuals are dead in the mortality table).
- $l_0 = 100\ 000$  and  $l_w = 0$

## Appendix 2: Present value of annuities (PVA)

For each viager, we have calculated the following: the residual life expectancy (single or joint); the term annuity coefficient on a monthly basis, paid until the last survivor with the zero-coupon curve and an inflation of 1% per year; as well as, the present value of annuities and the economic value.

The extracted wealth is calculated at the contract signature with the following formula:

$$\text{EXTRACT} = \text{DownPayment} + \text{PVA}$$

$$v^k = \frac{(1+i)^k}{(1+r)^k}$$

$$a_x = \sum_{k=1}^{w-x} \frac{l_{x+k}}{l_x} v^k$$

$$a_x^{(12)} = \frac{1}{12} \sum_{k=1}^{12(w-x)} \frac{l_{x+\frac{k}{12}}}{l_x} v^{\frac{k}{12}} \approx a_x + \frac{11}{24}$$

$$a_{\overline{xy}} = a_x + a_y - a_{xy}$$

$$\text{PVA} = (12 \times R_s^{(12)}) \times a_{\overline{xy}}^{(12)}$$

With:

- $a_{\overline{xy}}^{(12)}$ : annuity coefficient until the last survivor ( $x, y$ : individuals), on a monthly basis
- $R_s^{(12)}$ : lifetime annuity at the contract signature, on a monthly basis
- $l_x$ : number of age  $x$  individuals in the mortality table (we assume that at time  $w$ , all individuals are dead in the mortality table.
- $l_0 = 100\,000$  and  $l_w = 0$
- $v^k$ : real discount rate
- $i$ : inflation (1%)
- $r$ : discount rate obtained from the zero-coupon curve observed at the contract signature until the maturity of the investment (maturity = contract signature's date + residual life expectancy  $\times 365.25$ )

Note: On a yearly basis and for a single individual, we would have  $\text{PVA} = \sum_{k=1}^{w-x} R_k \frac{l_{x+k}}{l_x} v^k$

### Appendix 3: Durations

The Macaulay duration for a given viager is calculated with the following formula:

$$Duration = \frac{\sum_{k=0}^{12(w-x)} k CF_k v^{\frac{k}{12}}}{\sum_{k=0}^{12(w-x)} CF_k v^{\frac{k}{12}}}$$

- $CF_k$  : cash-flow at time  $k$ 
  - o lifetime annuity  $R_s^{(12)}$  for  $k \geq 1$
  - o down-payment for  $k = 0$
- $v^k$ : real discount rate

The Macaulay duration for its equivalent with full annuities is calculated with the following formula:

$$Duration \text{ all annuities} = \frac{\sum_{k=1}^{12(w-x)} k CF2_k v^{\frac{k}{12}}}{\sum_{k=1}^{12(w-x)} CF2_k v^{\frac{k}{12}}}$$

- $CF2_k = R_s^{(12)} + DP_s^{(12)}$
- $DP_s^{(12)} = \frac{DownPayment}{12 \times a_{\overline{xy}|}^{(12)}}$  : equivalent in monthly lifetime annuities of down-payment at the contract signature.