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Pre-pension savings out of housing wealth: a comparative study of Italy and the Netherlands

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Abstract

This paper studies the housing wealth effect on pre-retirement savings using a comparative approach. By analysing similar survey data on household income and wealth, we estimate the housing wealth effect using the exogenous and unanticipated part of the change in home equity. Differently from previous studies, the unanticipated and exogenous part is elicited not only by filtering out previously stated expectations of future house prices from realised changes in housing wealth, but also taking into account the role of endogenous home-improvements. Our theoretical model shows that changes in future prices unlock at the same time a direct intertemporal wealth-effect that increases consumption and investments, and an indirect endogenous effect whereby investments increases future home equity. Our estimation strategy shows that disregarding home improvements could induce a bias in the estimation of the wealth effect. Our regression results suggest this bias should be very mild. We speculate that this is the case because of the low correlation between increases in house value and the costs of home improvements.[1]

JEL Codes: E21, E44, D84
Keywords: housing wealth effect, home improvements, consumption smoothing

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I – Introduction

We study the housing wealth effect on savings using a comparative empirical approach. The relevance of the topic is due to the fact that housing represents the largest wealth share in household portfolios in many advanced economies, but unlike other assets it is hard to decumulate later in the life-cycle. For this reason, while the literature on wealth effect has mainly focused on the estimation of the marginal propensity of consume, the literature on housing wealth effects has extended way beyond that in order to highlight the important implications for retirement preparation and retirement decisions.

The topic has recently gained momentum due to the recent set of unconventional monetary policies undertaken by the ECB. In fact monetary policies affect households decisions via a direct effect (inter-temporal substitution and income effects) and via indirect general equilibrium effects on asset prices. Given the limited scope of conventional monetary policy in times of low interest rates (so called liquidity trap, and thus the impossibility of further lowering the interest rates), unconventional monetary policies attempt to impact via general equilibrium effects on asset prices. Studying housing wealth effects is therefore important to understand and evaluate the effectiveness, the transmission and the consequences of monetary policies.

Despite both the macroeconomic and microeconomic literature have paid attention to this relevant topic, the two approaches have always returned different estimates and conclusions. The macroeconomic literature has identified a robust relationship between house prices and consumption at the aggregate level (Suari Andreu, 2020). The microeconomic literature instead finds very mild effects of the same relationship. Regarding consumption, Attanasio and Weber (1994) study the role of housing in the consumption boom of the UK in the late 1980's and find that housing market explanations account for much of the increase in consumption by the older cohorts, as they are more likely to be homeowners. Also Campbell and Cocco (2007) find a positive effect on consumption for older homeowners and a null effect for young renters. Browning et al (2013) instead find no statistically significant effect. Regarding savings, Rouwendal and Alessie (2002) and Engelhardt (1996) find a negative association between housing wealth changes and savings in the Netherlands and the U.S., while Suari Andreu (2020) finds no significant effect.

The main reason behind the micro/macro differences in the estimate of the marginal propensity to consume out of housing wealth[2] is that, while it is the case that the correlation between consumption growth and house price growth is very high in aggregate data (Case et al. 2005), the micro literature has focused on the causal relation, and thus on excluding competing channels (such as expectations) that could potentially make house price changes endogenous, and thus make its relation with consumption and savings spurious.

In this paper, we adopt a micro approach to also focus on the causal effect of house price changes on household savings decisions. To elicit this causal effect, we decompose the evolution of housing wealth in its exogenous and unanticipated component. Differently from previous studies (Paiella and Pistaferri, 2017) however, we elicit the unanticipated/exogenous part not only filtering out previously stated expectations of house price movements from changes in housing wealth, but also taking into account the role on home-improvements, that represents the endogenous component of housing wealth changes. To obtain a proper causal estimate of the wealth effect in fact, the change in house value must be not only unexpected but also *exogenous*, meaning that it is very important in empirical work to distinguish changes in prices (exogenous wealth effect) from changes in asset allocation (endogenous wealth effect). For financial wealth, empirical studies have proposed a decomposition of the wealth effect that, for example, takes lagged portfolio weights to exclude the portfolio reallocation component from the computation of the wealth effect (see Paiella and Pistaferri, 2017). However, while the lack of consideration of this endogenous component has been mentioned as a bias to micro estimates of the wealth effect (Cooper, 2016), this hasn't received the same attention in studies that focus on the housing wealth effect. For housing, the endogenous component of the wealth effect can be certainly attributed to home improvements, which can substantially increase the market value of a house, but are inherently unobservable due to the *indivisibility* of houses. We contribute to this literature by showing, theoretically and empirically, the role of maintenance as an

[2] Another reason behind the very mild estimates of the housing wealth effect is certainly that housing wealth is different from financial wealth at least for the following two reasons: first, housing is an illiquid asset and there are no financial instruments in the markets (such as reverse mortgages) that efficiently allow to liquidate all or part of the housing equity have; second, housing is not only an asset but is also a durable consumption good that households consume by living in their houses. Different authors have argued thus that housing wealth isn't wealth (Buiter. 2010) or could be seen as a sideshow (Skinner, 1996). These factors represent inevitable frictions that prevent households to 'consume' or 'save' the increased value of their house.

additional possible confounder to the estimate of the housing wealth effect. The results of our model show that home-improvements exert a partially endogenous effect on the dynamics of home equity, and we show that a shift in the expectations of future house prices directly affect households' convenience of undertaking home improvements. Moreover, we show that savings and home improvements are substitutable tools for inter-temporal allocations.

Importantly, while macro and micro approaches return very different estimates of the MPC, there are also large differences in the estimates across countries (Case, 2005). In this paper we adopt a comparative approach where we study the housing wealth effects on two different countries, using comparable surveys of households' income and wealth. The advantage of our approach is therefore to make sure that differences in the estimates are not due to different approach being used, or different information available in the data being used. The countries that we investigate are Italy and the Netherlands. As shown in a recent publication of the Dutch National Bank[3], these two countries are characterised by the largest difference among European countries in the estimate of the housing wealth effect. Despite diametrical differences in housing market characteristics, credit conditions and status of the business cycle, we show how these effects are actually very similar, but also relatively small. In the empirical part, we show that a 1% unexpected change in housing wealth causes a reduction in active savings in both countries by 0.03% (about 85 euro in the Netherlands and 55 euro in Italy). Also, we show that despite the theoretical relevance in considering home improvement, its' practical relevance is negligible, as we the bias generated by omitting this endogeneity is very mild.

The remaining of the study is organizes as follows. Section 2 discusses a two-period model including housing and endogenous home improvements. Section 3 discusses the data, the descriptive evidence, as well as a comparative analysis of the mortgage and real estate markets of the two countries. Section 4 shows our estimation results with low wealth effects for Italy and the Netherlands. Section 5 concludes.

[3] For an English version see https://www.dnb.nl/en/news/news-and-archive/DNBulletin2018/dnb371605.jsp

II-Theory

The proposed model builds on Piazzesi and Schneider (2016) who provide a general framework that includes 'housing' in a life-cycle model. Our model has at least two key features: first, houses are assets that provide a non-tradable dividend, the housing service, which is a consumption good that allow individuals to derive utility from living in their house and the utility is increasing in house quality. Second, houses are technologies that depreciate if essential maintenance is not performed. Since the main focus of this model (and the empirical section) is on the maintenance, here we do not investigate house purchase decisions. Instead, we focus on homeowners and we endogenize their maintenance decision. Households' lifetime utility is represented by the following function:

$$U = u\left(g\left(c_t\, , s_t(H_t)\right)\right) + \beta E_t[V(w_{t+1})] \tag{1}$$

Where u and V are the strictly concave current and future utility functions, respectively. The function $g: \mathbb{R}^2 \to \mathbb{R}$ is an aggregator function that allows to distinguish substitution across periods from substitution across goods. Households derive current utility from consumption goods c_t and from the housing services s_t, which in turn depend on overall housing quality H_t. In particular, households derive more utility by living in bigger/higher quality houses and thus $s'(H_t) > 0.$ To introduce maintenance, we assume that houses are technologies that depreciate if essential maintenance is not performed. In particular, household are endowed with a stock $\mathcal{H}$ and undertake maintenance such that:

$$H_t(h_t) = \mathcal{H}(1-\delta) + h_t \tag{2}$$

Where h_t denotes maintenance undertaken in period $t, H_t(h_t)$ is the total stock of housing quality after maintenance and δ is a constant depreciation rate with $0 < \delta < 1$. If $h_t = \delta\mathcal{H}$ only ordinary maintenance is performed and the overall housing quality stock remains constant. Households' face the following inter-temporal decision problem:

$$max_{c_t, h_t, w_{t+1}}\ u\left(g\left(c_t\, , s_t\left(H_t(h_t)\right)\right)\right) +\ \beta E_t[V(w_{t+1})] \tag{3}$$

$$s.t. \qquad c_t + \kappa h_t = w_t - a_t \quad ; \qquad w_t = y_t + a_{t-1}$$

$$w_{t+1} = Ra_t + y_{t+1} + p_{t+1}H_{t+1}(h_t)$$

In words, households choose the level of current consumption, current maintenance and future wealth that maximise lifetime utility. The period t budget constraints states that current consumption and maintenance must be paid using cash on hand w_t, given by the current labour income y_t and accumulated assets a_{t-1}. The unspent part of the available endowment is left for savings a_t. In this setting, κ is the (unitary) cost of home improvement relative to the price of *numeraire* consumption. Please note that, we do not restrict a_t and h_t to be non-negative. For the latter, this means that we allow households to (partly) dismiss their home equity in order to increases other savings and consumption. The non-necessarily non-negative a_t implicitly allows positive debt, assuming that in the economy there is a unique interest rate $R = 1 + r$ at which everybody can save or borrow. The period $t + 1$ budget constraint states that the level of future wealth is given by future savings, future labour income and future housing wealth, which is equal to $p_{t+1}H_{t+1}(h_t)$. In words, a house of quality/size H_{t+1} costs $p_{t+1}H_{t+1}$ and the unitary house price is assumed to be stochastic and, for now, independent on overall housing quality. For example, house prices may follow a random-walk process:

$$p_{t+1} = p_t + \varepsilon_{t+1} \qquad \varepsilon_{t+1} \sim IID(0, \sigma^2) \tag{4}$$

Following Piazzesi and Schneider (2016), since the housing service is increasing in house quality, we assume that the utility is equal to the house quality, that is $s_t\big(H_t(h_t)\big) = H_t(h_t)$. Substituting the budget constraints into the objective function yields:

$$max_{\,a_t,h_t,}\, u\Big(g\big(w_t - a_t - \kappa h_t\, ;\, H_t(h_t)\big)\Big) + \beta E_t\big[V\big(Ra_t + y_{t+1} + p_{t+1}H_{t+1}(h_t)\big)\big] \tag{5}$$

The first-order conditions are:

$$\frac{\partial}{\partial a_t} : \qquad u'\big(g(\,c_t\,;\, H_t(h_t)\big)\, g'_c(\,c_t\,;\, H_t(h_t)) = \beta R\, E_t[V'(w_{t+1})]$$

$$\frac{\partial}{\partial h_t} : \; u'\big(g(\,c_t; H_t(h_t)\big)\, g'_h\big(c_t\,; H_t(h_t)\big) = u'\big(g(\,c_t\,; H_t(h_t)\big)\, g'_c\big(\,c_t\,; H_t(h_t)\big)\, [\kappa - R^{-1}(1-\delta)E_t(p_{t+1})]$$

The first optimality condition is equivalent to the Euler equation in the case of full certainty, and states that households are indifferent, at the margin, between consuming and borrowing/lending at the risk-free interest rate, as long as $\beta R = 1$. The second optimality condition represents the key optimality condition of this model, and states that households are indifferent, at the margin, between consuming and doing home maintenance as long as the present expected value of the home improvement is equal to its cost. This condition shows that savings and home improvements are substitutable consumption smoothing devices, with two important differences: while savings allow households to reduce current consumption for the sake of increasing future consumption, home improvements allow them to reduce current consumption to increase both current housing services and future home equity. Also, while saving is a risk-free asset, home improvements (and houses in general) are risky assets whose value depends on the evolution of house prices, which follow a stochastic process. Combining the two FOCs, we obtain:

$$u'(g(\, c_t\, ; H_t(h_t)))\; g'_h\big(c_t\, ; H_t(h_t)\big) = \beta R\, [\kappa - R^{-1}(1-\delta)E_t(p_{t+1})]\; E_t[V'(w_{t+1})] \tag{6}$$

This condition governs the home maintenance decision of the household: when deciding whether and how much to invest in home improvements, one trades off additional current housing services and future expected home equity against less current consumption and less future income from the riskless security (the interest rate).

In order to show the analytical solution of the model, we use specific functional forms for the utility functions. For the sake of simplicity, we assume logarithmic current and future utilities u and V, and we assume a Cobb-Douglas aggregator g.[4] Given these assumptions, we derive the optimal consumption and savings choices as a function of the simultaneous home improvements decisions:

$$a_t^* = (w_t - \kappa h_t^*) - \frac{\alpha}{1-\alpha}[R^{-1}(1-\delta)E_t(p_{t+1}) - \kappa](\mathcal{H}(1-\delta) + h_t^*) \tag{7}$$

$$c_t^* = w_t - a_t^* - \kappa h_t^* = + \frac{\alpha}{1-\alpha}[R^{-1}(1-\delta)E_t(p_{t+1}) - \kappa](\mathcal{H}(1-\delta) + h_t^*) \tag{8}$$

Substituting a_t^* in the second FOC, we derive a closed-form solution for the home improvements:

$$h_t^* = \frac{(1+\beta R)w_t - \alpha y_{t+1} + \left(\frac{\alpha}{1-\alpha}[R^{-1}(1-\delta)E_t(p_{t+1}) - \kappa] - \alpha E_t(p_{t+1})(1-\delta)\right)\mathcal{H}(1-\delta)}{\left[\alpha E_t(p_{t+1})(1-\delta) + (\beta R + 1)\kappa - \frac{\alpha}{1-\alpha}[R^{-1}(1-\delta)E_t(p_{t+1}) - \kappa]\right]} \tag{9}$$

[4] Under these functional form assumptions, the two terms of the objective function become:

$$u\big(g(\, c_t\, ;\; H_t(h_t)\big) = \log({c_t}^{\alpha}\, H_t(h_t)^{1-\alpha}) = \alpha \log(c_t) + (1-\alpha)log(H_t(h_t))$$

$$E_t[V(w_{t+1})] = E_t[log(w_{t+1})]$$

This result implies a positive relation between expected future house prices $E_t(p_{t+1})$ and optimal housing investment ${h_t}^*$ in the optimal consumption-saving path. Intuitively, when house prices are expected to increase, agents undertake more home maintenance as the investment in home equity is more profitable. The effect on consumption is also positive, and is proportional to the net present value of the home improvement: a higher expected value of home equity leads agents to increase current consumption via a traditional wealth effect. On the contrary, the effect on savings is negative: as evident from the period t budget constraint, savings must diminish to finance the increase in the current expenditures in both consumption and housing investments. This implication is also embedded in the Euler equation: as home improvements become more profitable, the relative convenience of savings diminishes due to substitutability between savings and home improvements. Formally, the wealth effect on consumption is given by[5]:

$$\frac{\partial c_t^*}{\partial E_t(p_{t+1})} = \frac{\alpha}{1-\alpha}[R^{-1}(1-\delta)E_t(p_{t+1}) - \kappa]\frac{\partial h_t^*}{\partial E_t(p_{t+1})} + \frac{\alpha}{1-\alpha}[R^{-1}(1-\delta)](\mathcal{H}(1-\delta) + h_t^*) \tag{10}$$

The first term is the part directly attributable to home improvements (the endogenous component) and the second is the part attributable to house price changes (exogenous).

Extension: quality-specific pricing

Let us assume now that the pricing function is increasing in quality, meaning that houses of better quality are traded at higher prices. As an example, energy-efficient houses are more expensive than houses with low energy labels. Similarly, also houses with amenities such as car parking and elevator are also more expensive. Intuitively, this would imply that a home-improvement increases the price per square meter of the rest of the house. We therefore introduce a function $p_t(H_t)$ such that ${p'}_t(H_t) > 0$. We can therefore write the $t+1$ home equity as:

$$p_{t+1}\big(H_{t+1}(h_t)\big)H_{t+1}(h_t) \tag{11}$$

[5] The corresponding equation for the wealth effect on savings is:

$$\frac{\partial a_t^*}{\partial E_t(p_{t+1})} = -\left[\frac{\alpha}{1-\alpha}R^{-1}(1-\delta)E_t(p_{t+1}) + \kappa\left(\frac{1-2\alpha}{1-\alpha}\right)\right]\frac{\partial h_t^*}{\partial E_t(p_{t+1})} - \frac{\alpha}{1-\alpha}[R^{-1}(1-\delta)](\mathcal{H}(1-\delta) + h_t)$$

In this case, the problem becomes:

$$max_{\,a_t,h_t,}\, u\left(g\left(w_t - a_t - \kappa h_t\, ;\, H_t(h_t)\right)\right) + \beta E_t\left[V\left(Ra_t + y_{t+1} + p_{t+1}(H_{t+1}(h_t))H_{t+1}(h_t)\right)\right]$$

And yields the following first-order conditions:

$$\frac{\partial}{\partial a_t} : u'\left(g(\,c_t\,;\, H_t(h_t)\right)\, g'_c(\,c_t\,;\, H_t(h_t)) = \beta R\, E_t[V'(w_{t+1})] \tag{12}$$

$$\frac{\partial}{\partial h_t} : \frac{\overbrace{u'\left(g(\,c_t\,;\, H_t(h_t)\right)\, g'_h\left(c_t\,;\, H_t(h_t)\right)}^{u'_h}}{\underbrace{u'\left(g(\,c_t\,;\, H_t(h_t)\right)\, g'_c\left(\,c_t\,;\, H_t(h_t)\right)}_{u'_c}}$$
$$= \left[\kappa - R^{-1}\left(p'_{t+1}\left(H_{t+1}(h_t)\right)H'_{t+1}(h_t)H_{t+1}(h_t) + p_{t+1}(H_{t+1}(h_t))H'_{t+1}(h_t)\right)\right]$$

Where u'_h and u'_c denote the two partial derivatives with respect to consumption and housing, respectively. This last equation is conceptually identical to the one obtained in the baseline model, and again states that the household is indifferent between saving and investing in home improvements as long as the cost of home improvement is equal to its present expected value. However, the notable difference is that, under the assumption of quality-specific house prices, investing in home maintenance is generally more convenient, in fact investing in home-improvements (i) increases the quality stock of the house and (ii) augments the value of every unit of housing (quality).

In summary, we obtain three main results from the model. The first result is that savings and home-improvements are substitutable consumption-smoothing devices: agents are perfectly indifferent at the margin between saving and doing home improvements as long as the net present value of the investment is equal to its cost. The difference is that, unlike savings, home-improvements (i) are risky investments, as the value of the investment depends on the evolution of house prices, and (ii) allow to increase current-utility via the housing service. The second result is that increasing expectations of future house prices induce agents to do more maintenance, as this translates into expectations of future wealth. As agents invest in home-improvements, the value of their house increases due to the increased quality and, possibly, because the value for each unit of quality increases too. The third result is that a housing wealth effect, i.e. a persistent shift in the expectation of future housing wealth (due to expectations of increasing house prices) induces an increase in consumption and a decrease in savings.

III – Data and Methodology

For a description of the portfolio if Italian and Dutch households, we use the Household Finance and Consumption Survey (HFCS) data. This is an initiative coordinated by the ECB, where EU central banks gather micro data using the same survey questions. The reporting dates and questionnaire are thus aligned, which makes the comparisons across countries much easier.

The survey is based on 84,000 interviews conducted in 18 euro-area countries, as well as Poland and Hungary, mainly in 2013 and 2014. The first wave of the HFCS was conducted mainly in 2010, so before the drop in asset prices in both countries. We use this wave in the present study to describe the pre-crisis most interesting assets and liabilities.

In order to test the predictions of our model, we use additional survey data for both Italy and the Netherlands. These describe the same populations of the HFCS, but in each country additional questions are added that are nor present in the HFCS, for instance about house prices expectations. These questions are very similar in both surveys, and thus allow testing our model without concerns that results will be driven by methodological differences.

For the Netherlands, we use the DNB Household Survey (DHS). The DHS is an annual survey representative of the Dutch speaking population and contains information on income and wealth, as well as on all the psychological aspects of financial behaviour. The data is administered by Center Data, on behalf of the Dutch National Bank (DNB). In the DHS, data on expectations of future house prices are available from 2003 for homeowners, while questions about maintenance and home improvements have been asked to the respondents since 2012. In the empirical part that follows, we will concentrate on the 2012-2018 waves. Comparison with the Italian data is though only possible in the period until 2014 as these surveys contains similar questions, with particular reference to those on expectations and home improvements. In the DHS, the expectation question is straightforward and asks “How much percentage points a year will they increase/decrease on average?”.

For Italy, we use the Survey on Household Income and Wealth (SHIW) administrated by Banca d’Italia (Italian National Bank), which is a biannual survey also containing detailed information on income and wealth of a representative sample of Italian households. In the SHIW, respondents of the 2010 and 2012 wave are asked about their expectations on future house prices, while the question on extraordinary house maintenance has always been present in the questionnaire.

Regarding the question on expectations, in the SHIW there are a number of issues that we have to address. The first issue is that respondents of the 2010 questionnaire of the SHIW are not directly asked to report their own subjective expectations, but instead they have been asked the following questions:

- "*On a scale from 0 to 100, what is the probability that house prices will drop in the next 12 months?*"
- "*And what is the probability they will drop by more than 10%?*".

Let Ω_t be the information set of the individual at time t. Then, following Paiella and Pistaferri (2017) and assuming that expectations follow a standard normal distribution, it is possible to retrieve the first two moments (mean and variance) of the distribution of expectations by solving the following system of equations[6]:

$$\begin{cases} pr\ (r_{t+1} < A\ |\Omega_t\ ) = \Phi\left(\frac{E_t r_{t+1} - \mu}{\sqrt{\sigma^2}}\right) \\ pr\ (r_{t+1} < B\ |\Omega_t\ ) = \Phi\left(\frac{E_t r_{t+1} - \mu}{\sqrt{\sigma^2}}\right) \end{cases} \tag{13}$$

Where $\Phi(\dots)$ denotes the Cumulative Density Function (CDF) of the Standard Normal Distribution, and A and B are the level of returns mentioned in the expectation questions, and $pr\ (r_{t+1} < A\ |\Omega_t\ ), pr\ (r_{t+1} < B\ |\Omega_t\ )$ are the observed data points. The unknowns of this system of equations are the own expectation $E_t r_{t+1}$ and the standard deviation σ.

A second issue is that in the 2012 wave, by means of randomization, the same question was asked to a 50% subsample of respondents, while to the other 50% subsample was asked to distribute 100 points among the possibilities that in the next 12 month house prices will be (i) much higher (more than 10%), (ii) slightly higher (between 2% and 10%), (iii) about the same (between -2% and 2%), (iv) slightly lower (between -2% and -10%) or (v) much lower than today (less than -10%).

In this case, we obtain the corresponding expectation by assigning the elicited probability weights to the midpoints of each answer category, that is:

$$E_t r_{t+1} = \sum_{k=1}^{K} p_k r_k \tag{14}$$

A third issue is that the SHIW data is a biannual survey but the expectation question asks respondent to elicit their one-year-ahead beliefs. To overcome this, Paiella and Pistaferri (2017) show that it is possible to rewrite the expected change in wealth as:

[6] This procedure has also been adopted also by Paiella and Pistaferri (2017)

$$E_t(\Delta W_{t,t+2}) = W_t\, E_t[(1 + r_{t,t+1})(1 + r_{t+1,t+2}) - 1] \tag{15}$$

Due to this observation gap, $E_t(r_{t,t+1})$ is observed while $E_t(r_{t+1,t+2})$ is not. Assuming that individuals have AR(1) expectations, than $E_t(r_{t+1,t+2}) = \rho\, E_t(r_{t,t+1})$ where ρ is the autoregressive parameter. Under this assumption the change in wealth becomes:

$$E(\Delta W_{t,t+2}) = W_t\, E_t[(1 + r_{t,t+1})(1 + \rho\, r_{t,t+1}) - 1] \tag{16}$$

Suari Andreu (2020) and Brauning et al (2013) show that self-reported expectations closely match data generated via an AR(1) process. However, since the time series dimension of survey data is typically not long enough to fit a model to retrieve an estimate of ρ, we follow Paiella and Pistaferri (2017) and we assume the autoregressive parameter to be equal to one[7], given the higher persistence of house prices relative to financial assets.

Eventually a final issue is that, unlike for financial wealth, it is not possible to decompose the housing wealth effect in the endogenous and exogenous component. In fact, the change in the value of a portfolio composed by J different assets can be written as:

$$\begin{aligned} \Delta W_{t,t+1} &= \textstyle\sum_j W_{t+1}^j - \sum_j W_t^j \\ &= \textstyle\sum_j p_{t+1}^j (A_{t+1}^j - A_t^j) + \sum_j (p_{t+1}^j - p_t^j) A_t^j \end{aligned} \tag{17}$$

That is, it is possible to decompose the change in the value of the portfolio due to a change in the value of the constituent assets and due to a portfolio reallocation. This equation can be easily estimated as both price changes and changes in allocation can be observed. Similarly, using the same notation used in Section II, we can write the change in housing wealth as:

$$\Delta W_{t,t+1} = p_{t+1} H_{t+1} - p_t H_t = (p_{t+1} - p_t) H_t + p_{t+1} h_t \tag{18}$$

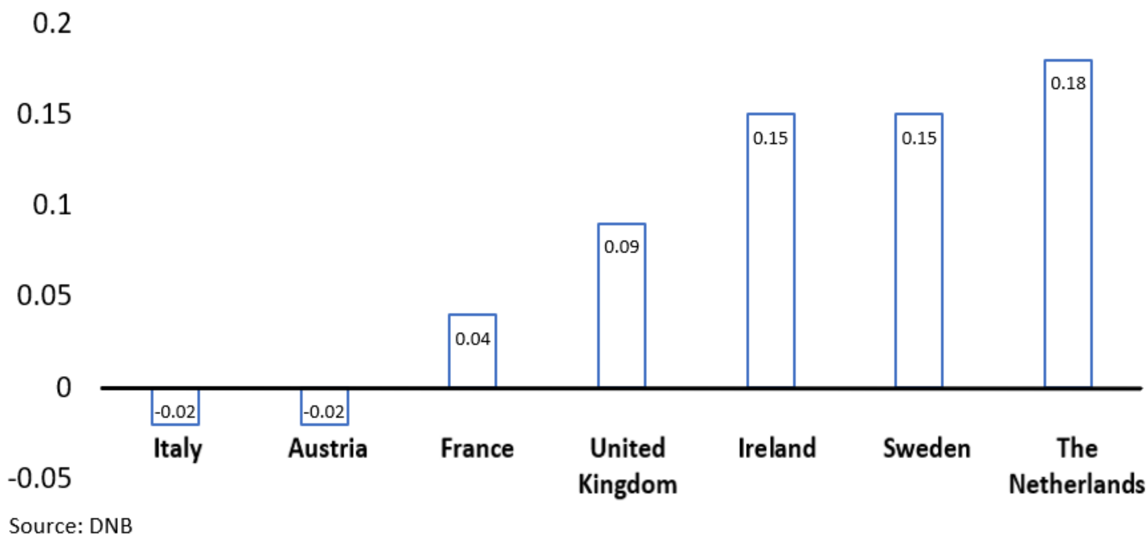
Where $p_{t+1} h_t$ is the value of the home improvement h_t, which is inherently unobservable. To overcome this, in the empirical part we use a proxy of the value of the home improvement.

[7] They also show that results are unchanged when other values for the autoregressive parameter are assumed.

IV – Background and descriptive analysis

In this paper we address the same question using a homogenous empirical strategy applied to surveys containing the same information. In such a way, we make sure that possible differences in the results are unlikely to be due to different methodologies being used, but are instead likely to reflect country-specific features.
The choice of the two countries is motivated by the difference in the recent macro estimates on the correlation between house prices and consumption. Figure 1 shows that Italy and the Netherlands are located at fringes among a selected group of EU countries. This section explores the institutional and descriptive differences among these countries to understand where such a big difference in the housing wealth effect can possibly arise from.

Figure 1: Correlation between real house prices and real consumption



The housing markets in the Netherlands and in Italy differ largely due to historical developments, institutional structures and attitudes of the agents that operate on these markets.

Italy is characterized by high home-ownership rates for all cohorts, while older cohorts in the Netherlands are more often tenants; at the same time the middle aged in the Netherlands are quickly catching up (Chiuri and Japelli, 2003). One of the factors responsible for this, is the massive production of social housing during the 1950's and 1960's in the Netherlands (van de Schoors et al, 2007) relative to Italy. Also, the widespread use of retirement homes in the Netherlands is not matched in Italy, where it is more common that overlapping generations cohabit together in the same dwelling and such practice contributes positively to household savings (Alessie et al, 2005).

At macro level, large differences exist also in the characteristics of housing supply. Regarding the supply elasticity to house prices, a OECD study shows that the growth in the stock of housing in the Netherlands was below average (about 1%) while in Italy it was 1.4% (OECD, 2011). Also, the Netherlands is characterised by expansion limits (DNB, 2017), as the share of already developed land is the highest among the OECD, while the corresponding Italian share is about half of that (Cournède et al, 2019), and housing expansions are way more common.

For these reasons, the housing market in the Netherlands is characterized by higher scarcity of houses, which in turn affect house price developments.

Private indebtedness in the two countries differs greatly as well. The average initial loan to value (LTV) ratio of Dutch households is 100% (DNB, 2015) and follows closely the LTV-cap (also equal to 100%). In Italy, such a cap is 80% and the average LTV is 59%. This does not only have strong implications for the evolution of home equity, which tends to be greater in Italy, but also for housing demand which in the Netherlands is heavily dependent on lending standards.

A final element worth noting is the fiscal treatment of the primary home. In both countries a mortgage interest deduction (though far more generous in the Netherlands) exists, and widespread exemption from wealth taxation is present. The house is taxed in both countries mostly at local level. In the Netherlands though, overall the taxation on housing wealth is negative.

When comparing the portfolios of Dutch and Italian households, large differences emerge. Table 1 shows average portfolio shares using the first wave of the HFCS data which, to the best of our knowledge, the most (across country) comparable micro datasets.

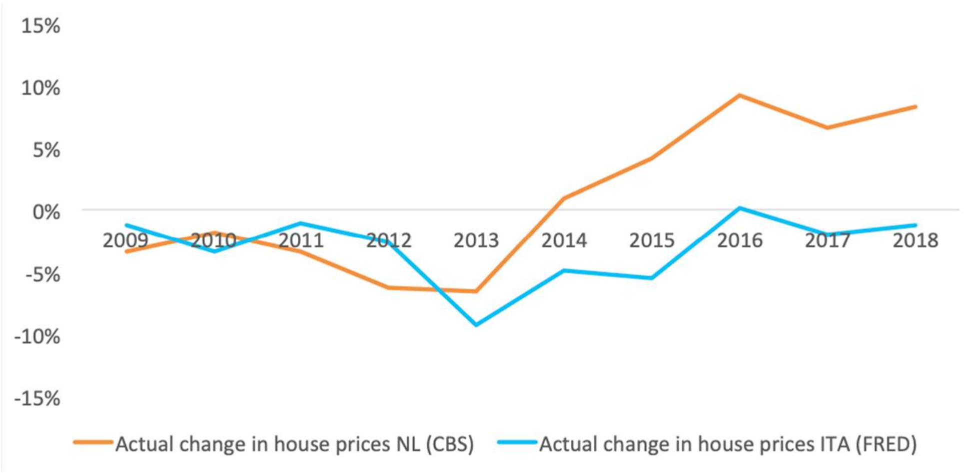
Table 1: Portfolio composition in the HFCS data

	Ownership rate		Conditional Mean		Conditional Median	
	IT	NL	IT	NL	IT	NL
Value of household's main residence	71%	74%	244 970	296 205	200 000	255 000
Value of other real estate used for business activities	3%	0%	158 765	240 639	99 000	127 500
Business wealth	18%	5%	160 557	152 041	20 000	80 000
Deposits: saving accounts	26%	87%	14 452	34 523	6 808	14 676
Mutual funds, total	7%	23%	40 676	33 569	20 000	10 724
Bonds	17%	8%	43 735	38 728	20 627	17 000
Voluntary pension/whole life insurance	14%	51%	14 560	48 884	10 000	19 474
Total outstanding balance of household's liabilities	23%	68%	40 892	141 789	13 000	107 000
Outstanding balance of mortgage debt	9%	55%	71 923	154 337	50 000	127 000
Outstanding balance of non-mortgage debt	17%	31%	16 206	36 768	5 600	12 669
Outstanding balance of credit line/overdraft	3%	18%	5 275	6 807	2 500	2 000
Payments for other property mortgages (flow)	1%	3%	712	1 559	500	1 085

Table 1 shows important differences and similarities between Italy and the Netherlands: while home-ownership and the value of the main residence are comparable across countries, financial assets holdings greatly differ. Italian households less often have a saving account, and when they do, they have less saving into it. The same is also true for mutual funds and private pensions. At the same time, the share of Dutch households with mortgage debt is almost 40% higher in the Netherlands and, conditional on having a mortgage, the outstanding debt amount tends also to be much higher in the Netherlands.

Housing market trends differ too. Despite the correlation between the two trends of the last decade, Figure 2 shows that house price growth rates in Italy always stayed behind those of the Netherlands. In the latter country price dropped after 2010-2011, and recoved after 2013. More in detail, the drop has been stronger in Italy, where yearly price growth rates have reached about -10%, than in the Netherlands where the lowest return has been close to -5%. On the contrary, the recovery has been stronger in the Netherlands where, in 2016, house price growth rate has been close to +10%. Indeed, the housing market trends in the Netherlands have always shown more volatile patterns than the corresponding trends in Italy. This is partly due to the high indebtedness of households discussed above.

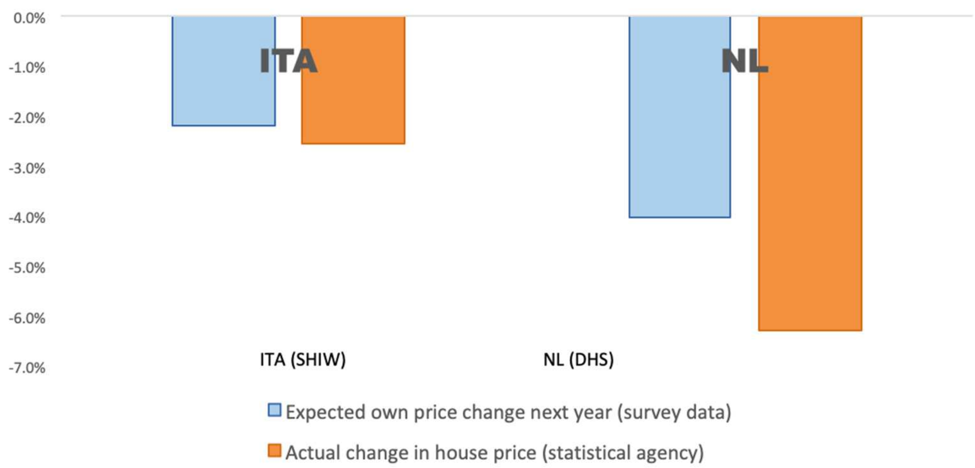
Figure 2: House Price Changes in Italy and the Netherlands



Note: The Figure compares the average house price changes in Italy and the Netherlands during the ten-year period between 2009 and 2018. Data on house price changes in the Netherlands are taken from Statistics Netherlands, while data on house price changes in Italy have been taken from the FRED dataset.

In Figure 3, we propose a descriptive comparison of the subjective expectations of changes in house prices. It shows that, on average, Italian respondents' reported expectations have matched the actual price change quite closely: the expected price change was equal to -2.2%, close to the realized price change (-2.6%).

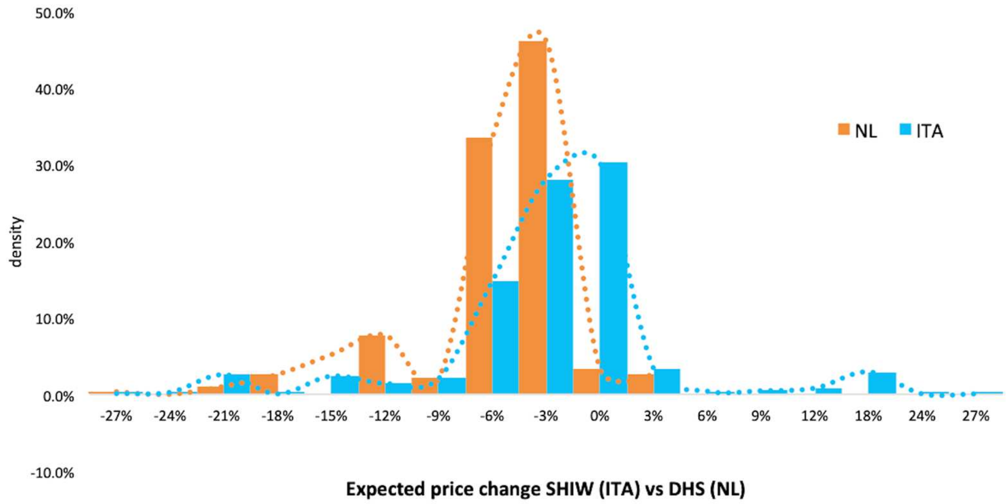
Figure 3: House Price Changes in Italy and the Netherlands



Note: The Figure compares the actual price changes and the expected price changes in Italy and the Netherlands. Actual price changes have obtained from data released by the Statistical Agencies (Istat and CBS), Expected price changes have been computed from the Survey data (SHIW and DHS).

In the Netherlands, respondents have underestimated the change in house prices: the average expectation was -4.0% while the (average and self-reported) change in the house value over the past two years (i.e. during the 2010-2012 period) was -6.3%. This does not necessarily mean that Dutch respondents are less precise, but could simply reflect the higher volatility of the Dutch housing market.

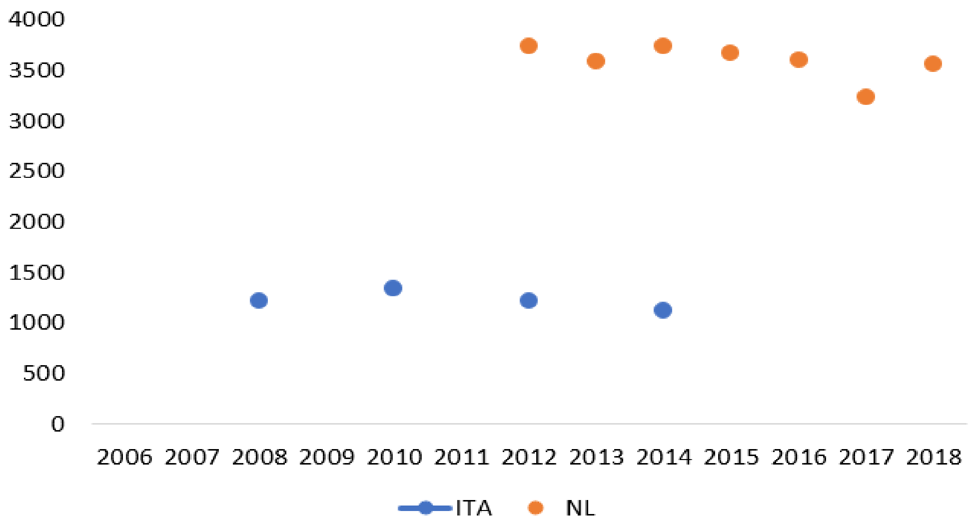
Figure 4: Expectations on House Price changes in Italy and the Netherlands (2012)



Note: The Figure compares the expected price changes in Italy and the Netherlands, as evident from the responses to the SHIW and DHS questionnaires. The dashed line is a smooth linear approximation of the distribution of expectations. The two distributions are obtained from the 2012 waves of the two questionnaires.

Concerning the distribution of expectations, Figure 4 shows that, although both expectations were negative, in 2012 Italian respondents were slightly more positive than the Dutch ones with respect to future house price developments: the average expectation is about -1% in Italy and -3.5% in the Netherlands. The figure also shows that the expectations of Italian respondents display much more variability than those of Dutch respondents. The figure shows that the house price expectations of the Dutch are more left-skewed than those of Italians, which again confirms the relative more pessimistic view of the Dutch in the 2012 survey.

Figure 5: Mean costs of home improvements in Italy and the Netherlands



Note: The Figure compares the mean costs of home improvements in Italy and the Netherlands, using the responses to the SHIW and DHS questionnaires.

Figure 5 shows the mean costs of home improvements for Dutch and Italian households. It shows that Dutch households spend on average twice as much on home improvements, conditional on having spent for maintenance. However, the share of households that do make home improvements differs greatly between the two surveys. In Italy, 20% of homeowners report maintenance, while in the Netherlands this share is about 50%. This difference could though be due to the fact that Dutch households who live in a condominium pay a periodical maintenance fee, in order to save for future maintenances. Additional summary statistics for the estimating sample are contained in Table 3 and Table 4 in the Appendix.

IV – Empirical Analysis

The aim of this section is to empirically investigate the role of maintenance in the estimation of the housing wealth effect. Our starting point, as clear from the theoretical section, is that investments in home improvements change the quality of the house and, thus, affect the return that the owner gets out of it. Since, as shown in section IV, disentangling the exogenous and endogenous component for housing wealth is not possible (unlike for financial wealth), the literature has mostly relied on the following estimating equation:

$$\ln(s_{i,t:t+1}) = \alpha + \beta \ln\left[\Delta W_{i,t:t+1} - E_t\left(\Delta W_{i,t,t+1}\right)\right] + \boldsymbol{X}'_{i,t}\gamma + \varepsilon_{i,t} \tag{19}$$

Where s represents active savings, which is elicited by asking respondents how much money has been put aside in the last 12 months. Active savings is a measure of "true savings" as it represents the savings that is not attributable to capital gains. Notice that t stands here for the time elicited between two consecutive waves: two years in Italy and one in the Netherlands. The variable $\Delta W_{i,t:t+1} - E_t\left(\Delta W_{i,t,t+1}\right)$ is the unexpected change in wealth between two adjacent waves (as reported in our data) and the parameter β identifies the housing wealth effect on active savings. However, the change in wealth used in the equation above may result from a change in house prices (exogenous wealth effect) as well as from the undertaken maintenance (endogenous wealth effect).

To show the role of maintenance, we treat the previous estimation as an omitted-variable problem, and we augment it to account for home improvements:

$$\ln(s_{i,t:t+1}) = \alpha + \beta \ln\left[\Delta W_{i,t:t+1} - E_t\left(\Delta W_{i,t,t+1}\right)\right] + \theta \ln(m_{i,t:t+1}) + \boldsymbol{X}'_{i,t}\gamma + \varepsilon_{i,t} \tag{20}$$

Where $m_{i,t:t+1}$ denotes maintenance undertaken between waves t and $t+1$. To show the role of maintenance, let us simplify the notation and rename $\Delta W_{i,t:t+1} - E_t\left(\Delta W_{i,t,t+1}\right)$ as ΔW^u, and $m_{i,t:t+1}$ as m. Assuming that the true population model is given by equation (20), then estimating equation (19) not taking into account maintenance will lead to the following bias in the estimate of the housing wealth effect:

$$bias = \hat{\beta} - \beta = (\Delta W^{u\prime} \Delta W^u)^{-1}\, Cov(\Delta W\,; m)$$

Where $\widehat{\beta}$ is the estimate of the wealth effect in eq. (19). The bias is positive (negative) if the covariance between the change in house value and the value of the undertaken maintenance is positive (negative). The estimate is instead unbiased if maintenance and changes in house value are independent. In the model presented in Section II, we show that when expectations of house prices increase, agents are more likely to undertake maintenance as housing investments are more profitable, and thus we should expect a positive relationship between the change in house values and maintenance performed. If agents make maintenance expenditures then, savings are likely to decrease due to the substitutability between savings and home improvements.

Here, we present estimates of the housing wealth effect on savings based on eq. (19) and (20) to shed more light on this mechanism. In particular, we study whether estimates of the housing wealth effect that neglect the role of maintenance may return results which are substantially different than estimates that do consider home improvements.

Tables 2a and 2b report the results of the empirical analysis estimated on both the SHIW and the DHS data, where we replace the log of the main variables of interest with their inverse hyperbolic sine. In specification (1) we estimate the traditional equation for the housing wealth effect. In specification (2) we account for the proxy for the unanticipated return on home improvements, again divided into its expected and unexpected component as done for the overall change in house values[8]. In specification (3) we use a specification analogous to (2), but that considers the cost instead of the value of the home improvement. Eventually, in columns (4) and (5) we re-estimate the specifications (2) and (3) on the balanced panel. Finally in specifications (6) and (7) we repeat the analysis in specification (3) and check whether our results differ when we exclude those who spend the most for home improvements either focusing on their subsample or using interaction terms for the cost of maintenance.

There are three main results evident from Tables 2a and 2b. The first is that despite the large difference in correlations documented above, both Italy and the Netherlands have similar responses to unexpected changes in wealth. Most importantly these are relatively low in magnitude: a 1% unexpected increase in housing wealth causes a 0.03% reduction in active

[8] In particular, we use the following proxies for the unexpected end expected value of the home improvement:

$$VHI - E_t(VHI) = m_{i,t:t-2}\left[(1 + r_{t:t+2} - E(r_{i,t+2})\right]$$
$$E_t(VHI) \cong m_{i,t:t-2}(1 + r_i^{home\ impr.}) = m_{i,t:t-2}\left(1 + E\left(r_{i,t+2}\right)\right)$$

Where $m_{i,t:t-2}$ is the amount of money spent in home improvement by respondent i between period $t-2$ and t. For these proxies, the assumptions are that the value of the home-improvement is directly proportional to (unobserved) increase in house quality.

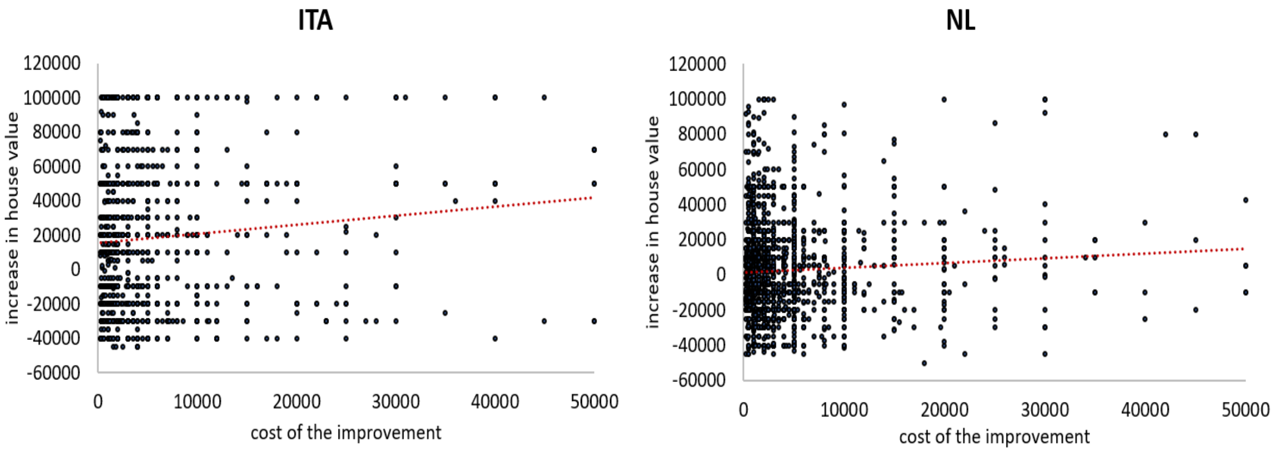
savings for both countries. Our back of the envelope calculations show that for the Netherlands (Italy) a 2800 (1800) euro increase in housing wealth causes a reduction in active savings of about 85 (55) euro. Equivalently, the exponentiated coefficient indicates a one euro unexpected change in housing wealth leads to a decrease in savings by three cents. This result is in line with the micro literature that typically finds very mild wealth effect estimates as opposed to the macro literature. Moreover, this result is also in line with the evidence that wealth effects unlocked by housing wealth tend to be smaller than those induced by financial wealth, due to the fact that (i) there are no instrument on the market that allow households to consume out of home equity and (ii) houses are consumption goods, other than assets, which make households less sensible to fluctuations in housing wealth than to fluctuations in financial wealth.

Second, as discussed in the theory section, the housing wealth effect attributable to the value of home improvements (thus active investments) should be generally small and, relatively to the 'pure' housing wealth effect, smaller. Results from all specifications confirm this. When we look at the different specifications, we never find that the unexpected value of the home improvement has a negative effect on the change on active savings. For the Netherlands we always find a zero effect. For Italy, we either see that the saving effect due to the unexpected value of home improvements is often zero or positive (suggesting a supplementary relation between the two).

When we look at the cost of the improvements for the Netherlands the effects is again generally zero. For Italy the effect is negative and significant. While this is in line with the idea that wealth effects on the change in active savings should be negative, the larger magnitude relative to the pure wealth effect (see specification 3) could be seen as supporting the discussion on quality-specific pricing in Section 2.

The third result is that, when adding the value or the cost of home improvements in specifications (2) and (3), the coefficient associated to the pure housing wealth effect (i.e. the unanticipated component) only slightly changes both for the Netherlands and Italy. Considering the value of home improvement for Italy also does not change the negative and significant effect of the expected change in wealth. This result, despite contradicting the life-cycle model that predicts that only unexpected changes should lead to a revision of consumption and savings decisions, is in line with Paiella et al (2017) that finds a positive wealth effect on consumption (and thus, a negative effect on savings) for the expected component of the change in wealth. They justify this result appealing to credit constraints. Generally speaking, the fact that magnitude of the coefficients slightly changes without leading to significantly different effects when considering or not the role of home improvements, suggests that the size of the bias is very mild. Figure 6 shows that in the data the correlation between the cost of home improvement and the change in housing wealth is positive (as expected) but very mild.

Figure 6: Expectations on House Price changes in Italy and the Netherlands



Note: The Figure shows the monetary cost of the home improvement on the horizontal axis, and the difference of between two adjacent waves of the subjective estimation of housing value. Sources: SHIW and DHS, own computations.

Notice that when accounting for the cost of home improvements, the fact that its associated coefficient is negative and significant for Italy is perfectly consistent with our theoretical model that suggests that investment in home improvements and savings are substitutable assets. Therefore, an increase in the expenses for home improvements should lead to lower savings. Specifications (6) and (7) confirm a negative and significant housing wealth effect (the unanticipated component) for the Netherlands and Italy. This means that the results are not driven by those making large investments in home-improvements only.

V – Concluding remarks

This paper sheds light on the role of home improvements in the estimation of the housing wealth effect, by means of a comparative study for Italy and the Netherlands. In particular, our contribution is to highlight an endogenous element in the estimation of the housing wealth effect. We first propose a theoretical model in which we endogenize the decision of the household to invest in home improvements. The model shows that savings and home improvements are substitutable consumption smoothing devices, and that expectations of increasing house prices not only induce households to consume more and save less (via a traditional inter-temporal substitution) but induces agents to undertake more home improvements as housing investments are relatively more convenient than savings in periods of increasing house prices. The endogeneity stems from the fact that, by undertaking more maintenance, agents also induce a higher wealth change via an increase in quality and, possibly, via an increase in the intrinsic value of the house (i.e. conditional on quality).

In the empirical part, we show how ignoring home improvements can bias the estimate of the housing wealth effect. The value added of our comparative approach is that we apply the same methodology to two very different housing markets, and the resulting estimate that we provide reflects the response to the pure exogenous and unanticipated component of the housing wealth change.

We first show that the size of the bias is proportional to the covariance between the cost of home improvements and the change in wealth and, we show that the size of this bias is rather small because of the mild correlation between these two. Also, our results show that despite the fact that Italy and the Netherlands are very distant in the spectrum of European countries in terms of the correlation between house prices and consumption, their housing wealth effect is similar and small, about 3%.

These results have important policy implications. The first important implication is that the consumption (and savings) stimuli unlocked by unconventional monetary policies that induce housing wealth increases are be quite limited. Our results suggest a very limited pass-through of unexpected housing wealth changes to individuals' consumption and savings. This can be possibly explained by the fact that, in both countries, housing is the dominant share of households' wealth and there are credit market frictions for the of home equity extraction.

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Tables

Table 2a: Regressions for Italy

	(1) standard	(2) with value H	(3) with cost H	(4) bal. panel 1	(5) bal. panel 2	(6) H < €10.000	(7) dummy low H
Expected change in housing wealth	-0.0496***	-0.0433***	-0.0503***	-0.0259	-0.0302*	-0.0467***	-0.0508***
	0.0155	0.0164	0.0155	0.0183	0.0175	0.0155	0.0155
Unexpected change in housing wealth	-0.0340***	-0.0437***	-0.0342***	-0.0381***	-0.0299**	-0.0304**	-0.0344***
	0.0129	0.0140	0.0129	0.0145	0.0135	0.0129	0.0129
Expected value of home improvement		-2.595***		-1.673			
		0.882		1.143			
Unexpected value of home improvement		2.524***		1.622			
		0.879		1.130			
Cost of maintenance (improvement)			-0.0741**		-0.0393	-0.0319	-0.167***
			0.0362		0.0396	0.0418	0.0610
Cost of maintenance (improvement), low maintenance							0.134*
							0.0711
Age head 18-34	-0.417	-0.664	-0.495	-0.538	-0.376	-0.665	-0.496
Age head 45-44	-0.594	-0.739	-0.620	-0.525	-0.427	-0.833*	-0.626
Age head 45-54	-0.187	-0.227	-0.217	-0.294	-0.206	-0.484	-0.225
Age head 55-64	-0.108	-0.288	-0.139	0.074	0.197	-0.247	-0.156
Married	-0.111	-0.091	-0.091	-0.109	-0.117	-0.007	-0.076
Divorced	0.082	-0.062	0.101	-0.069	0.050	0.095	0.085
Head employee	0.229	0.236	0.234	0.373	0.354	0.343	0.232
Head unemployed	-0.017	-0.040	-0.014	0.000	-0.012	-0.020	-0.034
Head low education	0.223	0.179	0.187	0.238	0.235	0.017	0.198
Head high education	1.054**	1.166***	1.111***	1.045**	0.906**	0.755*	1.138***
Male head	0.037	0.012	0.056	0.009	0.093	0.104	0.058
Household disposable income	-0.069	-0.028	-0.044	-0.016	-0.037	-0.059	-0.043
Net financial wealth	-0.049***	-0.049***	-0.048***	-0.051***	-0.051***	-0.056***	-0.048***
Constant	0.857	0.598	0.683	0.626	0.760	1.033	0.667
Observations	2,741	2,571	2,741	2,127	2,268	2,653	2,741
R-squared	0.011	0.016	0.013	0.012	0.011	0.012	0.014
ll	-8730	-8203	-8727	-6727	-7156	-8405	-8726

Table 2b: Regressions for the Netherlands

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	standard	with value H	with cost H	bal. panel 1	bal. panel 2	H < €10.000	dummy low H
Expected change in housing wealth	0.00913	0.00821	0.00884	-0.0222	-0.0200	0.00412	0.00719
	0.0104	0.0109	0.0107	0.0220	0.0218	0.0111	0.0107
Unexpected change in housing wealth	-0.0276***	-0.0270**	-0.0275***	-0.0353**	-0.0412***	-0.0259***	-0.0269***
	0.00910	0.0108	0.00911	0.0152	0.0139	0.00944	0.00910
Expected value of home improvement		0.301		2.753			
		1.738		2.928			
Unexpected value of home improvement		-0.298		-2.736			
		1.737		2.919			
Cost of maintenance (improvement)			0.00317		0.00916	0.0224	-0.0583
			0.0257		0.0451	0.0273	0.0362
Cost of maintenance (improvement), low maintenance							0.0820**
							0.0340
Age head 18-34	0.216	0.221	0.213	0.975	0.976	0.356	0.238
Age head 45-44	0.312	0.321	0.311	0.778	0.783	0.435	0.327
Age head 45-54	0.022	0.026	0.021	0.064	0.071	0.045	0.028
Age head 55-64	0.034	0.030	0.033	-0.023	-0.011	0.033	0.038
Married	-0.070	-0.083	-0.084	-0.040	-0.043	-0.047	-0.104
Divorced	-0.157	-0.160	-0.166	0.246	0.202	-0.183	-0.225
Head employee	0.092	0.090	0.095	0.574	0.584	0.042	0.081
Head unemployed	-0.039	-0.041	-0.038	0.601	0.635	-0.090	-0.055
Head low education	0.029	0.025	0.029	0.201	0.193	-0.034	0.013
Head high education	-0.109	-0.106	-0.108	-0.385	-0.391	-0.160	-0.097
Male head	0.013	0.015	0.017	-0.445	-0.438	0.023	0.023
Household disposable income	-0.037*	-0.037*	-0.037*	-0.017	-0.017	-0.044**	-0.035
Net financial wealth	0.013	0.013	0.013	0.056**	0.056**	0.021	0.013
Constant	-0.084	-0.098	-0.097	-1.119	-1.113	-0.127	-0.135
Observations	3,605	3,598	3,605	1,527	1,528	3,368	3,605
R-squared	0.005	0.005	0.005	0.016	0.015	0.006	0.007
ll	-10865	-10846	-10865	-4609	-4612	-10148	-10862

Table 3: Descriptive Statistics within estimating sample (Italy)

	Mean	Std.Dev	Min	Max
Household active savings	645	5 445	-100 000	100 000
Delta household active savings	25	6 963	-130 000	110 000
Value of property (subjective)	179 126	125 459	10 000	2 000 000
Change housing wealth between adjacent waves	8 632	33 323	-47 000	100 000
Unexpected change in housing wealth	2 459	70 020	-828 000	590 285
Expected change in housing wealth	6 173	61 696	-590 285	828 000
Unexpected value of the home improvement	1 269	7 096	0	150 000
Expected value of the home improvement	1 130	6 196	0	150 000
Cost of maintenance (improvement)	1 143	6 241	0	150 000
Household disposable income	30 482	22 278	-11 595	440 199
Net financial wealth	12 301	72 402	-1 036 000	1 146 429
Age head 18-34	5%	22%	0	1
Age head 45-44	14%	34%	0	1
Age head 45-54	21%	41%	0	1
Age head 55-64	21%	40%	0	1
Married	60%	49%	0	1
Divorced	9%	28%	0	1
Head employee	32%	47%	0	1
Head unemployed	60%	49%	0	1
Head low education	61%	49%	0	1
Head high education	10%	30%	0	1
Male head	53%	50%	0	1
Observations		2741		

Note: The Table shows descriptive statistics of the respondents of the 2012 and 2014 wave of the SHIW. For each attribute, the table reports the mean, the median, the standard deviation, the maximum, the minimum and the number of observations.

Table 4: Descriptive Statistics within estimating sample (Netherlands)

	Mean	Std.Dev	Min	Max
Household active savings	4 958	9 495	-60 868	112 500
Delta household active savings	-34	9 678	-112 500	112 500
Value of property (subjective)	278 368	123 427	13 000	1 000 000
Change housing wealth between adjacent waves	1 974	18 434	-50 000	100 000
Unexpected change in housing wealth	2 099	19 080	-53 259	135 922
Expected change in housing wealth	-126	9 903	-100 000	70 000
Unexpected value of the home improvement	2 702	7 135	0	158 442
Expected value of the home improvement	2 708	7 030	0	152 971
Cost of maintenance (improvement)	2 688	6 957	0	150 000
Household disposable income	14 506	19 604	0	316 299
Net financial wealth	59 391	157 325	-1 634 501	4 117 287
Age head 18-34	4%	21%	0	1
Age head 45-44	13%	34%	0	1
Age head 45-54	16%	37%	0	1
Age head 55-64	25%	43%	0	1
Married	56%	50%	0	1
Divorced	4%	20%	0	1
Head employee	48%	50%	0	1
Head unemployed	44%	50%	0	1
Head low education	49%	50%	0	1
Head high education	18%	38%	0	1
Male head	85%	36%	0	1
Observations		3605		

Note: The Table shows descriptive statistics of the respondents of the 2012 through 2018 wave of the DHS. For each attribute, the table reports the mean, the median, the standard deviation, the maximum, the minimum and the number of observations.