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HOUSING WEALTH ISN'T WEALTH

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ABSTRACT

A fall in house prices due to a change in fundamental value redistributes wealth from those long housing (for whom the fundamental value of the house they own exceeds the present discounted value of their planned future consumption of housing services) to those short housing. In a representative agent model and in the Yaari-Blanchard OLG model used in the paper, there is no pure wealth effect on consumption from a change in house prices if this represents a change in fundamental value. There is a pure wealth effect on consumption from a change in house prices if this reflects a change in the speculative bubble component of house prices. Two other channels through which house prices can affect aggregate consumption are (1) redistribution effects if the marginal propensity to spend out of wealth differs between those long housing and those short housing and (2) collateral or credit effects due to the collateralisability of housing wealth and the non-collateralisability of human wealth. A decline in house prices reduces the scope for mortgage equity withdrawal. For given sequences of future after-tax labour income and interest rates, this may depress consumption in the short run while boosting it in the long run.

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Introduction

The bold statement “Housing wealth isn’t wealth” was put to me about ten years ago by Mervyn King, now Governor of the Bank of England, then Chief Economist of the Bank of England, shortly after I joined the Monetary Policy Committee of the Bank of England as an external member in June 1997. Like most bold statements, the assertion is not quite correct; the correct statement is that a decline in house prices does create a negative wealth effect on aggregate consumption demand. On average, consumers are neither worse off nor better off.

The argument is elementary and applies to coconuts as well as to houses. When does a fall in the price of coconuts make you worse off? Answer: when you are a net exporter of coconuts, that is, when your endowment of coconuts exceeds your consumption of coconuts. A net importer of coconuts is better off when the price of coconuts falls. Someone who is just self-sufficient in coconuts is neither worse off nor better off.

As regards wealth effects, houses are like durable coconuts, or indeed like any consumer durable. The fundamental value of a house is the present discounted value of its current and future rentals, actual or (in the case of owner-occupiers) imputed. Anyone who is ‘long’ housing, that is, anyone for whom the value of their home exceeds the present discounted value of the housing services they plan to consume over their remaining lifetime will be made worse off by a decline in house prices. Anyone ‘short’ housing will be better off. So the young and all those planning to trade up in the housing market are made better off by a decline in house prices. The old and all those planning to trade down in the housing market will be worse off. Another way to put this is that landlords are worse off as a result of a decline in house prices, while current and future tenants are better off. On average, the inhabitants of a country own the houses they live in; on average, every tenant is his/her own landlord and vice versa. So in a representative agent model, there is no net housing wealth effect. You need a model with heterogeneous agents in which a change in house prices causes redistribution between agents with different marginal propensities to spend in order to get an aggregate wealth effect from a change in house prices.

Most econometric or calibrated numerical models I am familiar with treat housing wealth just like the value of stocks and shares as a determinant of household consumption. Their designers appear to forget that households consume housing services (for which they pay or impute rent) but not stock or bond services. A prominent example is the FRB/US model (see Brayton and Tinsley, eds. (1996), Brayton, Levin, Tryon, and Williams (1997), and Brayton, Mauskopf, Reifschneider, Tinsley and Williams(1997)). It is used frequently by participants in the debate on the implication of developments in the US housing market for US consumer demand. A recent example is Frederic S. Mishkin's (2007) paper "Housing and the Monetary Transmission Mechanism". The FRB/US model *a-priori* constrains the wealth effects of housing wealth and other financial wealth to be the same. The long-run marginal propensity to consume out of non-human wealth (including housing wealth) is 0.038, that is, 3.8 percent.

In several simulations, Mishkin increases the value of the long-run marginal propensity to consume out of housing wealth to 0.076, that is, 7.6 percent, while keeping the long-run marginal propensity to consume out of non-housing financial wealth at 0.038.

The argument for an effect of a change in house prices on consumption other than the pure wealth effect, is that housing wealth is collateralisable. Households-consumers can borrow against the equity in their homes and use this to finance consumption. If they are credit-constrained, a boost to housing wealth would relax the credit constraint and temporarily boost consumption spending. Of course, the increased debt will have to be serviced, and eventually consumption will have to be below the level it would have been at in the absence of the mortgage equity withdrawal (MEW). At market interest rates, the present value of current and future consumption will not be affect by the MEW channel.

Ben Bernanke (2008), Don Kohn (2008), Fredric Mishkin (2007), Randall Kroszner (2007) and Charles Plosser (2007) all have made statements to the effect that the credit effect, collateral effect or MEW effect of a change in house prices is on top of, that is, in addition to, the 'normal' wealth effect. The message of this paper is that the benchmark model should instead by one in which there is no pure wealth effect from a change in house prices and in which therefore the collateral effect is instead of, not in addition to, the normal wealth effect. By overestimating the contractionary effect on consumer demand of the decline in house prices, the Fed may have been convinced to cut rates too fast and too far.

The insight that housing wealth isn't wealth has the status of a folk theorem in macro consumer demand theory and empirics (see e.g. Buchanan and Fiotakis (2004), Edelstein and Lum (2004), Case, Quigley, and Shiller (2005) and Carroll, Otsuka, and Slacalek (2006)). A rigorous statement and formal model of the proposition is not, as far as I know, available. The representative agent special case of the model presented in this paper can be found in the Appendix to Buiter (2008).

1. The model

Individual household behaviour

For sake of brevity, I consider an integrated household-consumer-home owner-construction firm, rather than the separate household and business entities. The structure of preferences is irrelevant to the result, as long utility is increasing in consumption of housing services and consumption of non-housing goods and services. What matters for the result are first the assumption of housing autarky for the economy under consideration and second the absence of life-cycle-related effects on the demand for housing services.

Housing autarky means that there are no foreign owners of domestic housing. As regards age-related variations in the demand for housing services, in the Yaari-Blanchard OLG model used in what follows (for expositional simplicity), every surviving household has the same remaining life expectancy, regardless of the age of the household (see Yaari (1965), Blanchard (1985) and Buiter (1988)). In addition, the current housing stock and the all future contributions to the flow of rental income from housing are fully owned by those currently alive. This is in contrast to human capital, where the future wages earned (net of taxes on labour income paid) by the unborn are not owned by any private agent currently alive today. This is a consequence of the implicit assumption of the absence of hereditary slavery. When combined with the assumption of no (operative) intergenerational gift and bequest motive, it generates absence of debt neutrality in the Yaari-Blanchard OLG model as in the Allais-Samuelson OLG model. From the perspective of the ownership of financial assets (as opposed to the ownership of human capital), the Yaari-Blanchard OLG model is, however, like a representative agent model. There are therefore no redistributional effects from house price changes. Combined with the assumption of housing autarky (there is no foreign ownership of the housing stock), this means that any equilibrium is indistinguishable from an equilibrium in which every household always consumes its own endowment of housing services.

Once born, each household has a constant, age-independent instantaneous probability of. dying, $\mu \geq 0$. The birth rate, $\beta \geq 0$, is constant. With $\beta = 0$ the model reduces to the representative agent model, regardless of whether μ is positive or zero. At time t a surviving household born at time $v \leq t$ earns an exogenous wage income $w(t,s) \geq 0$ (for simplicity, each household's labour supply is assumed inelastic and scaled to unity), pays lump-sum taxes $\tau(t,v)$, consumes an amount of non-housing goods and services $z(t,v) \geq 0$, and an amount of housing services $\rho(t,v) \geq 0$. The rest of its income is either saved in the form real financial assets earning the instantaneous risk-free real interest rate $r(t)$ plus a competitive annuity rate (to be discussed) or spent on acquiring housing equity at a price $p^k(t)$ for an ownership claim to one unit of physical housing capital. Here $k(t,v)$ is the number of housing shares owned by generation v at time *t.* A unit of real housing capital earns real rental income or dividend $x(t)$. Real financial wealth held by the household, excluding the value of the stock of housing it owns, is denoted *f(t,v).* Non-housing goods and services are the num*é*raire. The price of a unit of housing services in terms of non-housing goods and services is $p(t)$.

There are efficient competitive annuities markets. Surviving households earn an annuity premium rate r^ℓ on their non-human wealth (including housing wealth). When a household dies, all its non-human wealth (which can be negative) accrues to the life-insurance company that has sold them the annuity. There is free entry into the annuities market; therefore $r^\ell = \mu$.

A utility-maximising competitive representative household born at time $v \le t$ and having survived until time t, maximizes the time-additive objective function in (1) subject to the instantaneous budget identity (2) and the solvency constraint (3). The expectation operator conditional on information at time *t* is E_t, θ is the subjective rate of pure time preference and σ is the reciprocal of the intertemporal substitution elasticity.

$$
\begin{aligned}
W(t,v) &= E_t \int_t^{\infty} e^{-\theta(s-t)} v\left(\rho(s,v) z(s,v)\right) ds, \;\; \theta > 0 \\
v(\rho, z) &= \frac{1}{1-\sigma}\left(\rho^{\eta} z^{1-\eta}\right)^{1-\sigma} ; \; 0 < \eta < 1; \; \sigma > 0, \; \sigma \neq 1 \\
&= \ln\left(\rho^{\eta} z^{1-\eta}\right) ; \; \sigma = 1
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
\frac{df(t,v)}{dt} + q(t)\frac{dk(t,v)}{dt} &= \left(r(t)+\mu\right) f(t,v) + \left(x(t) + \mu p^k(t)\right) k(t,v) \\
&\quad + w(t,v) - \tau(t,v) - z(t,v) - p(t)\rho(t,v)
\end{aligned}
\tag{2}
$$

$$
\lim_{s\to\infty} e^{-\int_t^s (r(u)+\mu) du} \left(f(s,v) + p^k(s) k(s,v)\right) \ge 0 \tag{3}
$$

We assume that the (expected) rates of return on housing equity and on other financial assets are the same, so

$$
r = \frac{x}{p^k} + \frac{\dot{p}^k}{p^k} \tag{4}
$$

It follows that the instantaneous budget identity can be rewritten as:

$$
\begin{aligned}
\frac{d}{dt}\left(f(t,v) + p^k(t) k(t,v)\right) &= \left(r(t)+\mu\right)\left(f(t,v) + p^k(t) k(t,v)\right) \\
&\quad + w(t,v) - \tau(t,v) - z(t,v) - p(t)\rho(t,v)
\end{aligned}
\tag{5}
$$

The only uncertainty in the model is uncertain life expectancy, if the probability of death μ is positive. The objective functional *W(t,v)* in (1) can therefore be rewritten as

$$
W(t,v) = \int_t^{\infty} e^{-(\theta+\mu)(s-t)} v\left(\rho(s,v), z(s,v)\right) ds \tag{6}
$$

Let the present discounted value of current and future after-tax labour income or human capital of a household of generation v at time $t \ge v$ be denoted *h(t,v)*:

$$
h(t,v) = \int_t^{\infty} e^{-\int_t^s (r(u)+\mu) du} \left(w(s,v) - \tau(s,v)\right) ds \tag{7}
$$

The solvency constraint (3), the instantaneous budget identity (2) and (7) permit us to write the intertemporal budget constraint of the household as follows:

$$f(t,v)+p^k(t)k(t,v)+h(t,v)\geq\int_t^{\infty}e^{-\int_t^s(r(u)+\mu)du}\left[z(s,v)+p(s)\rho(s,v)\right]ds \tag{8}$$

The first-order conditions for housing and non-housing consumption imply that, for all $s\geq t$:

$$\frac{\rho(s)}{z(s)}=\left(\frac{\eta}{1-\eta}\right)p(s)^{-1} \tag{9}$$

$$z(s,v)=z(t,v)e^{\int_t^s\left(\frac{r(u)-\theta}{\sigma}\right)du}\left(\frac{p(s)}{p(t)}\right)^{\eta\left(\frac{\sigma-1}{\sigma}\right)} \tag{10}$$

$$\lambda(t,v)=(1-\eta)\left(\frac{\eta}{(1-\eta)\,p(t)}\right)^{\eta(1-\sigma)}z(t,v)^{-\sigma} \tag{11}$$

$$\dot{\lambda}=-(r+\mu)\lambda \tag{12}$$

Here $\lambda(t,v)$ is the co-state variable of real private non-human wealth at time *t* for a household born at time v (measured in units of utility), whose equation of motion is given in (2), that is, the present value shadow price for a household of generation v of private financial wealth and housing wealth.

From equations (8) to (12), we can obtain the following individual decision rules for consumption or consumption functions. Total consumption of both housing services and non-housing goods and services is denoted $c = p\rho+z$:

$$z(t,v)=(1-\eta)c(t) \tag{13}$$

$$\rho(t,v)=\frac{\eta}{p(t)}c(t) \tag{14}$$

$$c(t,v)=\xi(t)\left[f(t,v)+p^k(t)k(t,v)+h(t,v)\right] \tag{15}$$

where $\xi(t)$, the marginal propensity to consume out of comprehensive wealth, is independent of generation-specific parameters and variables.

$$\xi(t) = \left[\int_t^{\infty} e^{-\int_t^s \left[\left(\frac{\sigma-1}{\sigma} \right) r(u) + \mu + \frac{\theta}{\sigma} \right] du} \left(\frac{p(s)}{p(t)} \right)^{\eta \left(\frac{\sigma-1}{\sigma} \right)} ds \right]^{-1} \tag{16}$$

Equations (2), (7), (8) (holding with equality) and (15) imply:

$$\frac{dc(t,v)}{dt} = \left(r(t) + \mu + \frac{\dot{\xi}(t)}{\xi(t)} - \xi(t) \right) c(t,v) \tag{17}$$

For the logarithmic instantaneous felicity function $\sigma = 1$, this simplifies to

$$\xi(t) = \xi = \theta + \mu \tag{18}$$

and the familiar consumption Euler equation

$$\frac{dc(t,v)}{dt} = \left(r(t) - \theta \right) c(t,v) \tag{19}$$

Aggregation

For any individual household flow or stock variable $y(t,v)$ we define the population aggregate $Y(t)$ as follows: for $\beta > 0$,

$$Y(t) = \int_{-\infty}^{t} y(t,v) S(t,v) dv \tag{20}$$

where $S(t,v)$ is the number of households born at time *v* that are still alive at time *t*. Let $O(t) > 0$ be the size of the population (the size of the labour force or the number of households) at time *t.*

$$S(t,v) = \beta O(v) e^{-\mu(t-v)} \tag{21}$$

and

$$O(v) = O(0) e^{(\beta-\mu)v} \tag{22}$$

Without loss of generality let $O(0) = 1$. So

$$S(t,v) = \beta e^{-\mu t + \beta v} \qquad \text{if } \beta > 0 \tag{23}$$

and

$$Y(t) = \beta e^{-\mu t} \int_{-\infty}^{t} y(t,v) e^{\beta v} dv \tag{24}$$

We cover the case of a zero birth rate as follows:

$$\begin{aligned}&\text{When } \beta = 0,\\ &y(t,v) = y(t)\\ &\text{and}\\ &Y(t) = e^{-\mu t} y(t)\end{aligned} \tag{25}$$

I also assume that you are born just with your endowment of human wealth – there are no intergenerational gifts and bequests – and therefore:

$$a(t,t) + p^k(t)k(t,t) = 0 \tag{26}$$

Also, for simplicity, assume that everyone alive earns the same wage and pays the same taxes, so

$$\begin{aligned}w(t,v) &= w(t)\\ \tau(t,v) &= \tau(t)\end{aligned} \tag{27}$$

It follows that each surviving member of every generation has the same human wealth:

$$h(t,v) = h(t) \tag{28}$$

The aggregate consumption function is given by:

$$C(t) = \xi(t)\left[F(t) + p^k(t)K(t) + H(t)\right] \tag{29}$$

$$Z(t) = (1-\eta)C(t) \tag{30}$$

$$R(t) = \frac{\eta}{p(t)}C(t) \tag{31}$$

With

$$\frac{d}{dt}\left(F(t) + p^k(t)K(t)\right) = r(t)\left(F(t) + p^k(t)K(t)\right) + W(t) - T(t) - Z(t) - p(t)R(t) \tag{32}$$

$$\dot{H}(t) = [r(t) + \beta]H(t) - W(t) + T(t) \tag{33}$$

If follows that the aggregate consumption 'Euler equation' is given by:

$$\dot{C} = \left(r + \beta - \xi + \frac{\dot{\xi}}{\xi}\right)C - \beta\xi\left(F + p^k K\right) \tag{34}$$

With the logarithmic utility function, $\sigma = 1$, the aggregate consumption Euler equation simplifies to:

$$\dot{C} = \left(r + \beta - \mu - \theta\right)C - \beta(\theta + \mu)\left(F + p^k K\right) \tag{35}$$

The accumulation of housing capital

There is a continuum of competitive home construction firms on the unit circle who maximize profits by accumulating housing capital and letting it out. Each firm maximises the following objective function:

$$V(t) = \int_{t\infty}^{\infty} e^{-\int_t^s r(u)du} \left(p(s)\alpha(s)K(s) - A(s)\right) ds \tag{36}$$

subject to the constraint that the resource cost of housing capital formation is quadratic in the investment rate,

$$A(t) = I(t) + \frac{\gamma}{2}\frac{\left(I(t) - (\delta + n)K(t)\right)^2}{K(t)} \tag{37}$$

and the capital stock adjustment identity

$$\dot{K} = I - \delta K \tag{38}$$

Here $\gamma \geq 0$ measures the severity of the housing capital adjustment costs and $\delta \geq 0$ is the constant proportional deprecation rate of the stock of housing capital. When $\gamma \to \infty$ we have the case of unaugmentable capital. When $\gamma \to \infty$ and $\delta = 0$ we have the case of housing as 'land' in the sense of the unaugmentable and indestructible contribution of nature. When γ is positive but finite, the housing stock is fixed in the short run but augmentable in the long run.

Note that, unlike its owners, this enterprise does not die. Its discount rate is therefore the risk-free real interest rate, without the annuity premium added (see Buiter (1989). The production function for housing services is assumed to be linear in the capital stock and is given by $\alpha(s)K(s)$.

The first-order conditions for an optimum imply that optimal investment is governed by equations (39) and (40):

$$I = \left(\delta + n + \frac{1}{\gamma}\left(q(t) - 1\right)\right)K(t) \tag{39}$$

$$q(t)=\int_t^{\infty} e^{-\int_t^s ((r(u)+\delta))du}\left[p(s)\alpha(s)+\gamma(\delta+n)\left(\frac{I(s)}{K(s)}-(\delta+n)\right)+\frac{\gamma}{2}\left(\frac{I(s)}{K(s)}-(\delta+n)\right)^2\right]ds \quad (40)$$

or

$$\frac{\dot{q}}{q}+\frac{p\alpha+\gamma(\delta+n)\left(\frac{I}{K}-(\delta+n)\right)+\frac{\gamma}{2}\left(\frac{I}{K}-(\delta+n)\right)^2}{q}=r+\delta \quad (41)$$

The shadow price of the capital stock (the current value co-state variable of $K(t)$ in (38), is Tobin's 'marginal *q'*. The market value of the equity held in the construction companies is also given by (36).

Because the investing firm is assumed to be a price taker, and because the production function of housing services is linear in the capital stock and the investment adjustment cost function is linear homogeneous in the investment rate and the capital stock, Tobin's marginal *q* also equals Tobin's average *q*, which is the fundamental value of a unit of installed housing capital.

This result, first established by Hayashi (1982), implies that

$$V(t)=q(t)K(t) \quad (42)$$

The intuition is, as stated in Hayashi (1982), that average Tobin's *q* (and marginal Tobin's *q*) are independent of the initial capital stock if the production and installation functions are linear homogeneous and if the firm is a price-taker.

I write the market value of a unit of installed housing capital as

$$p^k=q+b \quad (43)$$

The first term on the RHS of (43) is the fundamental value of a unit of installed housing, defined by (40) and (39), that is, its shadow price. When p^k is interpreted not as a shadow price in a dynamic optimisation problem, where the boundary conditions for optimality ensure that the shadow price supports the optimum (that is, $b(t)=0$), but rather as an asset market price set in a market where there is no invisible transversality-condition-imposing hand, there can also be a bubble term *b(t)* in (43). If the bubble is (myopically) rational, then

$$\dot{b}=(r+\delta)b \quad (44)$$

The competitive rental rate for housing services, x, earned by households as dividends from their ownership of housing capital (see equation (2)) is given by

$$x = p\alpha + \gamma(\delta+n)\left(\frac{I}{K} - (\delta+n)\right) + \frac{\gamma}{2}\left(\frac{I}{K} - (\delta+n)\right)^2 - \delta p^k . \tag{45}$$

Equilibrium in the housing market or housing autarky

We now impose economy-wide equilibrium in the housing market:

$$R(s) = \alpha(s)K(s), \quad s \geq t \tag{46}$$

It follows from (46), (43), (42), (36) and (32), that

$$\begin{aligned}\int_t^\infty Z(s)e^{-\int_t^s r(u)du} ds &= F(t) + p^k(t)K(t) - \int_t^\infty p(s)R(s)e^{-\int_t^s r(u)du} ds + \int_t^\infty \big(W(s) - T(s)\big) e^{-\int_t^s r(u)du} ds \\ &= F(t) + b(t)K(t) - \Lambda(t) + \int_t^\infty \big(W(s) - T(s)\big) e^{-\int_t^s r(u)du} ds\end{aligned} \qquad (47)[3]$$

where the present discounted value of all future costs of housing investment, $\Lambda(t)$ is given by:

$$\begin{aligned}\Lambda(t) &= \int_t^\infty e^{-\int_t^s r(u)du} A(s)ds \\ &= \beta e^{-\mu t} \int_{-\infty}^t \int_t^\infty e^{-\int_t^s (r(u)+\mu)du} a(s,v)e^{\beta v} ds dv \text{ if } \beta > 0 \\ &= e^{-\mu t} \int_t^\infty e^{-\int_t^s (r(u)+\mu)du} a(s,v)ds \quad \text{if } \beta = 0\end{aligned} \tag{48}$$

The key point to note is that the aggregate intertemporal budget constraint (47) does not depend on the fundamental value of the current housing stock, qK. Housing variables enter the budget constraints only through the cost of future investment in housing, Λ, and through the bubble term in the house price equation, if there is one, bK.

Once we impose the housing market equilibrium or housing autarky condition, given by the first equality in (46), we can rewrite the three consumption functions in the following manner:

---

3 Similarly, $\int_t^\infty p(s)R(s)e^{-\int_t^s r(u)du} ds = \frac{\eta}{1-\eta}\left(F(t) + b(t)K(t) - \Lambda(t) + \int_t^\infty \big(W(s) - T(s)\big) e^{-\int_t^s r(u)du} ds \right)$ and

$\int_t^\infty C(s)e^{-\int_t^s r(u)du} ds = \frac{1}{1-\eta}\left(F(t) + b(t)K(t) - \Lambda(t) + \int_t^\infty \big(W(s) - T(s)\big) e^{-\int_t^s r(u)du} ds \right)$.

$$
\begin{aligned}
&C = \left(\frac{1}{1-\eta}\right)\xi\left(F + bK - \Lambda + H\right) \\
&Z = (1-\eta)C \\
&pR = \eta C = \alpha K
\end{aligned} \tag{49}
$$

where

$$\dot{F} = rF + W - T - (1-\eta)C - A \tag{50}$$

$$\dot{\Lambda} = r\Lambda - A \tag{51}$$

$$\dot{H} = \left(r + \beta\right)H - W + T \tag{52}$$

$$\frac{d}{dt}(bK) = rbK \tag{53}$$

Equation (53) constrains the bubble and/or the housing investment process. If the bubble is rational that is, it satisfies the homogeneous equation of the equation of motion driving the fundamental valuation q, as given by equation (44), it follows that either there is no bubble, $b(t) = 0$ or gross housing investment is zero, $I(t) = 0$.

Equations (49), (50), (51) and (53) permit the consumption function to be written as

$$
\begin{aligned}
&C = \left(\frac{1}{1-\eta}\right)\xi\left(N + H\right) \\
&Z = (1-\eta)C \\
&pR = \eta C = \alpha K
\end{aligned} \tag{54}
$$

$$N = F + bK - \Lambda \tag{55}$$

$$\dot{N} = rN + W - T - (1-\eta)C \tag{56}$$

The human capital of the generations currently alive, H is given by:

$$H(t) = \int_t^{\infty} e^{-\int_t^s (r(u)+\beta)du} \left(W(s) - T(s)\right)ds \tag{57}$$

The presence of the birth rate as an augmentation factor for the discount rate applied to future aggregate after-tax labour income is due to the assumption, built into the model, that the human wealth of future generations is not owned by anyone currently alive. This assumption about property rights (effectively the absence of hereditary slavery), together with the assumption that there are no operative intergenerational gift and bequest motives, makes for the absence of debt neutrality that is a property of all OLG models that make the same two key assumptions.

2. The pure wealth effect of house price changes on consumption

The OLG structure does not destroy the absence of wealth effects from a change in house prices, because the aggregate demand for housing services is not affected by a change in the distribution of wealth between the young and the old. If there were age-specific propensities to consume housing services, this would not in general be the case.

The aggregate consumption Euler equation with the housing autarky condition imposed is

$$\dot{C} = (r + \beta + \frac{\dot{\xi}}{\xi} - \xi)C - \frac{\beta}{1-\eta}\xi N \tag{58}$$

Note that $\Lambda(t) = L(t)$ if and only if $\beta = 0$. This is because $\Lambda(t)$ is the present discounted value at time t of the real resource cost of current and future investment in housing by all generations currently alive and yet to be born, all of which is reflected in the forward-looking valuations of the existing housing stock, while $L(t)$ is just the present discounted value of the real resource cost of current and future housing investment by all generations currently alive (see footnote 2).

It is clear from equations (49), (50), (51) and (52) that, provided there is no housing bubble ($b(t) = 0$), current aggregate consumption of housing services plus non-housing services $C(t)$ is independent of the value of the current housing stock, $p^k K$. In other words, consumption is independent of the fundamental value of the housing stock, $q(t)K(t)$. Likewise, current consumption of housing services, $p(t)R(t)$ is independent of the value of the current housing stock, and so is aggregate consumption of non-housing goods and services, $Z(t)$.

The present discounted value of the real resource cost of *future* investment in housing $\Lambda(t)$, given in equation (48) may of course be affected by the same factors that cause a change in the value of the existing housing stock, but that is a quite separate matter from a wealth effect on consumption of a change in the value of the existing housing stock. This effect of house prices on investment in housing is recognized through the housing investment function, given in equation (39), which makes gross housing investment an increasing function of Tobin's *q*. So $\Lambda(t)$ is a function not of the current price of housing capital but of the sequence of future (expected) prices of housing capital.

I summarise this as a Proposition:

Proposition 1: *In the Yaari-Blanchard OLG model, a change in the fundamental value of a unit of installed housing,* ϕ *, has not wealth effect on aggregate consumption demand, the demand for housing services or the consumption demand for non-housing goods and services.*

It also follows immediately from the consumption functions in (49), that the following holds:

Proposition 2: *In the Yaari-Blanchard OLG model, a change in the bubble component of the price of a unit of installed housing, b, is associated with a wealth effect on aggregate consumption demand, on the demand for housing services and on the consumption demand for non-housing goods and services.*

Why the common error?

How did so many of students of consumption behaviour and wealth effects miss the obvious point of Proposition 1?

The most likely reason is that the standard consumption function is the decision rule of an individual, or an aggregation of such individual decision rules. When studying consumption behaviour, equilibrium conditions are not normally imposed on these decision rules. On the whole this is good practice – the fact that prices and economy-wide aggregate quantities taken as parametric by individuals are in fact endogenously determined by the interaction of these price-taking economic agents, does not mean that it is not helpful to treat individual decision rules and equilibrium conditions conceptually distinct. But when we deal with general equilibrium responses to policies or shocks, the equilibrium conditions do of course have to be imposed. This was obviously not done in such papers as Mishkin (2007).

Without imposing the (‘in the aggregate, you own the house you rent’ or ‘housing autarky’ assumption (46) and using equations (36), (42) and (43), total consumption, non-housing consumption and housing consumption can, respectively, be written as in equations (29), (30) and (31) respectively, that is, as functions of total non-human wealth, $F + p^k K$ and human wealth, H , and with the equations of motion for non-human wealth and human wealth given by (32) and (33) respectively. In this version of the consumption function, non-housing financial wealth, F and housing wealth $p^k K$ enter with the same marginal propensities to spend, ξ.

The equation $C = \xi\left(F + p^k K + H\right)$ is the standard 'permanent income' consumption function where aggregate consumption is proportional to the sum of aggregate non-human and human wealth, and where aggregate non-human wealth includes the value of the housing stock on the same terms as other non-human wealth. However, when we impose the housing autarky assumption, that same consumption function can be written as $C = \left(\frac{1}{1-\eta}\right)\xi\left(F + bK - \Lambda + H\right)$ and the absence of a pure wealth effect of fundamental housing wealth on aggregate consumption demand is confirmed. When housing is pure 'land', that is non-augmentable and indestructible, then $\Lambda = 0$ and the consumption function simplifies to

$$C = \left(\frac{1}{1-\eta}\right)\xi\left(F + bK + H\right).$$

This makes it even clearer that in the model under consideration, a change in housing wealth affects consumption if and only if it is due to a change in the speculative bubble component of house prices.

Qualifications of the housing wealth irrelevance result

Wealth isn't well being

At the risk of belabouring the obvious, Proposition 1 says that a change in the fundamental value of a unit of housing does not lead to any change in consumption demand model. However, since $R(t) = \alpha(t)K(t)$, a larger physical stock of housing capital increases equilibrium consumption of housing services raises utility - makes you better off. Wealth (the value of your endowments) bears no obvious relation to utility in any case, as wealth values the infra-marginal units of assets at the marginal contribution to lifetime utility of the last unit: in a world without scarcity, all endowments would be valued at zero and wealth would be zero, but utility would be maximal.

Changes in housing wealth due to a housing bubble

Proposition 2 points out that when the change in the house price is due to a bubble rather than to a change in fundamental value, that is, $b(t) \neq 0$ in equation (49), the change in house prices does represent a pure wealth effect. Even if the economy is autarkic in housing, bubble-inclusive price of the house exceeds the value of their endowment of current and future housing services by the amount of the bubble. Whether the housing market in the US or elsewhere has been characterised by a speculative bubble between, say, 2000 and 2007 is a hotly debated issue (see e.g. Case and Shiller (2003) and Himmelberg, Mayer, and Sinai (2005)). In the simple model of the paper, the marginal propensity to spend out of a change in house prices due to a change in the bubble component of the house price is the same as the marginal propensity to consume out of any other component of non-human or human wealth.

Distributional effects, including intergenerational distribution

In more general OLG models, especially those with systemic variations in household size over the life cycle and with age-dependent propensities to consume (among other reasons because remaining life expectancy is negatively related to age after some point), a decline in house prices redistributes wealth from those for whom the value of the housing stock they own is greater than the present discounted value of their future consumption of housing services to those for whom the value of the housing stock they own is less than the present discounted value of their future planned consumption of housing services. That is, a house price decline redistributes wealth from homeowners to tenants.

This means that the young, and all others planning to trade up in the housing market in the future will benefit from a decline in house prices. The old and all others planning to trade down in the housing market in the future will lose when house prices fall. The size or even the sign of the net effect on aggregate consumption demand of such redistributional changes are, as far as I know, not well established. An Allais-Samuelson overlapping generations model is the natural vehicle for analyzing these intergenerational distributional effects. Other distributional effects can occur in open economies where the residents are tenants of non-resident landlords.

Credit or collateral effects

Finally, unlike human capital, housing wealth is collateralisable. This means that households can borrow using the value of the homes they own as security. Unsecured borrowing is more expensive than secured borrowing and may often not be possible on any terms. With free labour (no slavery or indentured labour), future labour earnings cannot legally be collateralised and, unless reputational concerns are a powerful motivator, commitments to use future after-tax labour income to service unsecured debt may not be credible. Housing wealth therefore permits credit constraints to be relaxed (see e.g. Hurst and Stafford (2004) and Klyuev and Mills (2006)). A decline in house prices reduces the amount households can borrow (through 'mortgage equity withdrawal' or MEW). Assuming that human wealth is not collateralisable at all, a simple way to bring the housing collateral role into the model of this paper is to introduce the further constraint on individual household optimisation that net financial wealth cannot be negative:

$$-f(t,v) \leq p^k(t)k(t,v) \tag{59}$$

or, in the aggregate version:

$$-F(t) \leq p^k(t)K(t) \tag{60}$$

This constrains net debt not to exceed the value of the housing stock. If this constraint is binding, a fall in house prices will clearly lower aggregate consumption, regardless of whether housing price changes have a pure wealth effect.

In his simulation of the effect of a house price decline on consumption and investment demand in the US, Mishkin (2007) captured this credit effect of a change in house prices by assigning to housing wealth twice the long-run marginal propensity to consume (0.076) than that assigned to other financial wealth (0.038). This is incorrect for two reasons.

First, because of the housing autarky argument, the model of this paper suggests that, without the collateral/credit effect, the marginal propensity to consume out of housing wealth would be zero, not 0.038. At most therefore, Mishkin should, when he added the collateral effect to the benchmark FRB/US model, have assigned the value 0.038 to the marginal propensity to consume out of housing wealth, not 0.076.

However, even 0.038 is likely to be an overestimate of the long-run marginal propensity to consume out of housing wealth. The debt incurred through MEW has to be serviced. Although current consumption will be higher as a result of a household's ability to relax a borrowing constraint by increasing the size of its mortgage, the present discounted value of future consumption will have to be lower. At market interest rates, the present discounted value of current and future consumption does not change as a result of a decline in house prices and the associated tightening of the credit constraint. Modelling the credit effect of a house price decline properly would introduce it as a tightening of a borrowing constraint, but with the household's intertemporal budget constraint satisfied both in the benchmark (with borrowing collateralised against property) and in the counterfactual simulation (with lower MEW). It may not be easy to determine reliably when the consumption-reducing effect of increased debt service will kick in and dominate the consumption-increasing effect of higher borrowing potential for a credit-constrained household, but to assume, as Mishkin does, that it never kicks in surely makes no sense.

3. Conclusion

The value of a house is its fundamental value – the present discounted value of its future actual or imputed rentals – plus a speculative bubble component, if any. A fall in house prices due to a change in its fundamental value redistributes wealth from those long housing (for whom the fundamental value of the house they own exceeds the present discounted value of their planned future consumption of housing services) to those short housing (from whom the fundamental value of the house they own is less than the present discounted value of their planned future consumption of housing services. In a closed economy representative agent model and in the Yaari-Blanchard

OLG model used in the paper, there is no pure wealth effect on consumption from a change in house prices if this represents a change in their fundamental value.

There is a pure wealth effect on consumption from a change in house prices if this reflects a change in the bubble component of house prices.

Two other channels, not considered in the formal model, through which a fall in house prices can affect aggregate consumption are (1) redistribution effects if the marginal propensity to spend out of wealth is different between those long housing (the old, say) and those short housing (the young, say) and (2) collateral or credit effects due to the collateralisability of housing wealth and the non-collateralisability of human wealth. A decline in house prices reduces the scope for mortgage equity withdrawal. For given sequences of future after-tax labour income and interest rates, this may depress consumption in the short run while boosting it in the long run.

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