



The Effect of the Proportions of Housing Wealth and Financial Wealth on Consumption

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ABSTRACT

This note offers a theoretical model to prove that the proportions of housing wealth and financial wealth may play a key role in estimating and analyzing the marginal propensities to consume (MPCs) out of housing wealth and financial wealth and analyzing the effects of volatilities on both MPCs. Additional interesting result is that the higher proportions of housing wealth and financial wealth reduce the certainty effect of the preference for housing wealth.

Keywords: Housing Wealth, Financial Wealth, Marginal Propensities to Consume

1. Introduction

In this note, we build a theoretical model and analyze the consumption behavior through the optimal marginal propensities to consume from housing wealth and financial wealth under uncertainty to show an approach to resolve why the marginal propensities to consume (MPCs) of housing wealth and financial wealth are different in empirical tests.

There is extensive literature exploring the magnitudes of the marginal propensities to consume from housing wealth and financial wealth and reporting the different views on the wealth effects of both types of wealth. Benjamin,

Chinloy, and Jud (2004), Case, Quigley, and Shiller (2005), Sousa (2008), Grant and Peltonen (2008), Bostic, Gabriel, and Painter (2009), and Gan (2010) found relatively large and significant housing wealth effects

However, there is also some evidence that the wealth effect of housing asset is insignificant. Skinner (1989), Dvornak and Kohler (2003), Buiter (2008), Calomiris, Longhofer, Miles (2009) found that housing wealth has a small and insignificant effect on consumption. Son (2011) offered a theoretical model on the preference for housing wealth under uncertainty, proving that the marginal propensity to consume out of housing wealth may be smaller than that of financial wealth.

There is no consensus on the magnitude and effectiveness of the wealth effect of housing wealth. The purpose of this paper is to introduce the model that the proportions of housing wealth and financial wealth make the wealth effects of both types of wealth different. As a result, the Son's (2011) model is extended. This model adds the proportions of both types of wealth in the Son's (2011) model framework in order to analyze the role of the proportions on the behavior of both MPCs.

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The reminder of this study is presented as follows. In section 2, the basic model is described, and the optimal marginal propensities to consume from housing wealth and financial wealth are derived. Section 3 analyzes the effects of the proportions of housing wealth and financial wealth, the volatility, and the preference for housing asset on the MPCs. Concluding remarks are found in the last section.

II. The Model

A. Consumption and Asset Accumulation

Suppose that our representative consumer invests in financial wealth (F_t) and housing wealth (H_t). Her consumption functions are

$$C_{Ht} = \eta_1 H_t \quad (1)$$

$$C_{Ft} = \eta_2 F_t \quad (2)$$

where η_1 and η_2 are the marginal propensities to consume of housing wealth and financial wealth. The proportions of housing wealth and financial wealth in total wealth (W_t) are

$$\phi_1 = \frac{H_t}{W_t} \quad (3)$$

$$\phi_2 = \frac{F_t}{W_t} \quad (4)$$

where $\phi_1 + \phi_2 = 1$. The flows of financial wealth (F_t) and housing wealth (H_t) follow the stochastic processes:

$$dH_t = \mu_1 H_t dt + \sigma_{H_t} H_t dz_{H_t} \quad (5)$$

$$dF_t = \mu_2 F_t dt + \sigma_{F_t} F_t dz_{F_t} \quad (6)$$

where μ_1 and μ_2 are the expected growth rates of both wealth, respectively; σ_{H_t} and σ_{F_t} are the instantaneous standard deviations of the innovations; dz_{H_t} and dz_{F_t} are the increment to the standard-normal Wiener process. The rates of return to both types of wealth are

$$r_{H_t} = \mu_1 dt + \sigma_{H_t} dz_{H_t} \quad (7)$$

$$r_{F_t} = \mu_2 dt + \sigma_{F_t} dz_{F_t} \quad (8)$$

The accumulations of both housing wealth and financial wealth over time period are as follows:

$$dH_t = (\mu_1 - \eta_1) H_t dt + \sigma_{H_t} H_t dz_{H_t} \quad (9)$$

$$dF_t = (\mu_2 - \eta_2) F_t dt + \sigma_{F_t} F_t dz_{F_t} \quad (10)$$

Therefore, the flow budget constraint is

$$\begin{aligned} dW_t = dH_t + dF_t = & ((\mu_1 - \eta_1)\phi_1 \\ & + (\mu_2 - \eta_2)\phi_2) W_t dt \\ & + \sigma_{H_t}\phi_1 W_t dz_{H_t} + \sigma_{F_t}\phi_2 W_t dz_{F_t} \end{aligned} \quad (11)$$

B. Preference

A form of Generalized Isoelastic (GIE) preferences defined over the two “goods,” consumptions from financial and housing wealth and housing wealth (H_t), in the Son’s (2011) model is adopted.

In order to analyze our model, the magnitudes of the elasticity of intertemporal substitution ($\varepsilon = \frac{1}{1-\theta}$) and the coefficient of relative risk aversion (γ) are crucial.

$$(1-\gamma) U_t = \lim_{\Delta t \rightarrow 0} e^{-\rho \Delta t} \left\{ \left((C_{H_t} C_{F_t})^\alpha H_t^\beta \right)^\theta \Delta t + e^{-\rho \Delta t} [(1-\gamma) E_t U_{t+\Delta t}]^{\frac{\theta}{1-\gamma}} \right\}^{\frac{1-\gamma}{\theta}} \quad (12)$$

$$\begin{aligned} \eta_1^* = \frac{\rho}{2\alpha + \beta} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon + 2\alpha(1-\varepsilon)\varepsilon)} \frac{1}{\phi_1} + \frac{\alpha(1-\varepsilon)}{\varepsilon + 2\alpha(1-\varepsilon)} & \left(\mu_1 \phi_1 + \mu_2 \phi_2 + \frac{1}{2} ((2\alpha + \beta)(1-\gamma) - 1) \right. \\ & \left. (\phi_1^2 \sigma_{H_t}^2 + \phi_2^2 \sigma_{F_t}^2 + 2\phi_1 \phi_2 \sigma_{H_t} \sigma_{F_t} \Omega_{HF}) \right) \end{aligned} \quad (13)$$

$$\begin{aligned} \eta_2^* = \frac{\rho}{2\alpha + \beta} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon + 2\alpha(1-\varepsilon)\varepsilon)} \frac{1}{\phi_2} + \frac{\alpha(1-\varepsilon)}{\varepsilon + 2\alpha(1-\varepsilon)} & \left(\mu_1 \phi_1 + \mu_2 \phi_2 + \frac{1}{2} ((2\alpha + \beta)(1-\gamma) - 1) \right. \\ & \left. (\phi_1^2 \sigma_{H_t}^2 + \phi_2^2 \sigma_{F_t}^2 + 2\phi_1 \phi_2 \sigma_{H_t} \sigma_{F_t} \Omega_{HF}) \right) \end{aligned} \quad (14)$$

According to the empirical research, there is a consensus that $\gamma > 1$, and there is a plausible case that $\varepsilon > 1$, while the conventional wisdom is that $\varepsilon < 1$ (See Smith and Son, 2005).

Our representative consumer's problem is to choose two consumption policies to maximize (12) subject to flow budget constraints, (11), over an infinite planning horizon. The optimal MPC functions are where Ω_{HF} is the correlation coefficient between dz_{H_i} and dz_{F_i} .

III. The Analysis of the Model

A. MPCs (η_1^* and η_2^*) and Proportions (ϕ_1 and ϕ_2)

Equations (13) and (14) show that the difference between the two MPCs depends on ϕ_1 and ϕ_2 . The proportions may have a crucial role in explaining the difference between the MPCs in empirical tests.

$$\eta_1^* \gtrless \eta_2^* \text{ if } \phi_2 \gtrless \phi_1 \quad (15)$$

The higher the proportions, the smaller the MPCs are. Next explored is the impact of the proportions (ϕ_1 and ϕ_2) on MPCs (η_1^* and η_2^*). The effects of the proportions on MPCs are

It is possible to have both negative and positive association between the MPCs and proportions of both

financial wealth and housing wealth, depending on the magnitudes of the elasticity of intertemporal substitution (ε), risk aversion (γ), the expected growth rate (μ_1 and μ_2), risk, and the proportions.

In Equations (16) and (17), the first term is differentiated by signs and proportions with the same second term. Interestingly, the impact of the proportion of housing wealth on both MPCs depends on the proportions.

$$\left| \frac{\partial \eta_1^*}{\partial \phi_1} \right| \gtrless \left| \frac{\partial \eta_2^*}{\partial \phi_1} \right| \text{ if } \phi_2 \gtrless \phi_1 \quad (20)$$

When $\phi_2 > \phi_1$, the impact of the change of ϕ_1 on η_1^* is larger than that on η_2^* . However, if $\phi_2 < \phi_1$, the impact of the change of ϕ_1 on η_1^* is smaller than that on η_2^* .

There is the similar result between $\left| \frac{\partial \eta_1^*}{\partial \phi_2} \right|$ and $\left| \frac{\partial \eta_2^*}{\partial \phi_2} \right|$. That is, the impact of the proportion of financial wealth (ϕ_2) on η_1^* is higher (smaller) than that on η_2^* if $\phi_2 > \phi_1$ ($\phi_2 < \phi_1$).

$$\left| \frac{\partial \eta_1^*}{\partial \phi_2} \right| \gtrless \left| \frac{\partial \eta_2^*}{\partial \phi_2} \right| \text{ if } \phi_2 \gtrless \phi_1 \quad (21)$$

As the proportion of financial (housing) wealth is larger than that of housing (financial) wealth, the MPC of housing (financial) wealth tend to be more sensitive.

$$\frac{\partial \eta_1^*}{\partial \phi_1} = -\frac{\rho}{2\alpha + \beta} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon + 2\alpha(1-\varepsilon))\varepsilon} \frac{1}{\phi_1^2} + \frac{\alpha(1-\varepsilon)}{\varepsilon + 2\alpha(1-\varepsilon)} \left[(\mu_1 - \mu_2) + ((2\alpha + \beta)(1-\gamma) - 1)(\phi_1 \sigma_{H_i}^2 - (1-\phi_1) \sigma_{F_i}^2 + (1-2\phi_1) \sigma_{H_i} \sigma_{F_i} \Omega_{H_i F_i}) \right] \quad (16)$$

$$\frac{\partial \eta_2^*}{\partial \phi_2} = -\frac{\rho}{2\alpha + \beta} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon + 2\alpha(1-\varepsilon))\varepsilon} \frac{1}{\phi_2^2} + \frac{\alpha(1-\varepsilon)}{\varepsilon + 2\alpha(1-\varepsilon)} \left[(\mu_1 - \mu_2) + ((2\alpha + \beta)(1-\gamma) - 1)(\phi_1 \sigma_{H_i}^2 - (1-\phi_1) \sigma_{F_i}^2 + (1-2\phi_1) \sigma_{H_i} \sigma_{F_i} \Omega_{H_i F_i}) \right] \quad (17)$$

$$\frac{\partial \eta_1^*}{\partial \phi_2} = -\frac{\rho}{2\alpha + \beta} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon + 2\alpha(1-\varepsilon))\varepsilon} \frac{1}{\phi_1^2} + \frac{\alpha(1-\varepsilon)}{\varepsilon + 2\alpha(1-\varepsilon)} \left[(\mu_2 - \mu_1) + ((2\alpha + \beta)(1-\gamma) - 1)(\phi_2 \sigma_{F_i}^2 - (1-\phi_2) \sigma_{H_i}^2 + (1-2\phi_2) \sigma_{H_i} \sigma_{F_i} \Omega_{H_i F_i}) \right] \quad (18)$$

$$\frac{\partial \eta_2^*}{\partial \phi_2} = -\frac{\rho}{2\alpha + \beta} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon + 2\alpha(1-\varepsilon))\varepsilon} \frac{1}{\phi_2^2} + \frac{\alpha(1-\varepsilon)}{\varepsilon + 2\alpha(1-\varepsilon)} \left[(\mu_2 - \mu_1) + ((2\alpha + \beta)(1-\gamma) - 1)(\phi_2 \sigma_{F_i}^2 - (1-\phi_2) \sigma_{H_i}^2 + (1-2\phi_2) \sigma_{H_i} \sigma_{F_i} \Omega_{H_i F_i}) \right] \quad (19)$$

In short, the sizes of proportion may be a critical factor when analyzing or estimating the MPCs. In addition, the MPCs of smaller proportion of total wealth are more sensitive to some changes of proportions.

B. MPCs and Volatility

Next discussed is how the MPCs from both types of wealth respond to risk and the role of proportions of both wealth.

$$\frac{\partial \eta_1^*}{\partial \sigma_H^2} = \frac{1}{2} \frac{\alpha(1-\varepsilon)}{\varepsilon+2\alpha(1-\varepsilon)} ((2\alpha+\beta)(1-\gamma)-1) \phi_1^2 \quad (22)$$

$$\frac{\partial \eta_1^*}{\partial \sigma_F^2} = \frac{1}{2} \frac{\alpha(1-\varepsilon)}{\varepsilon+2\alpha(1-\varepsilon)} ((2\alpha+\beta)(1-\gamma)-1) \phi_2^2 \quad (23)$$

$$\frac{\partial \eta_2^*}{\partial \sigma_H^2} = \frac{1}{2} \frac{\alpha(1-\varepsilon)}{\varepsilon+2\alpha(1-\varepsilon)} ((2\alpha+\beta)(1-\gamma)-1) \phi_1^2 \quad (24)$$

$$\frac{\partial \eta_2^*}{\partial \sigma_F^2} = \frac{1}{2} \frac{\alpha(1-\varepsilon)}{\varepsilon+2\alpha(1-\varepsilon)} ((2\alpha+\beta)(1-\gamma)-1) \phi_2^2 \quad (25)$$

In equations (22), (23), (24), and (25), the impact of the volatility on both MPCs is identical given the proportions as illustrated in equations (26) and (27).

$$\begin{aligned} \frac{\partial \eta_1^*}{\partial \sigma_H^2} &= \frac{1}{2} \frac{\alpha(1-\varepsilon)}{\varepsilon+2\alpha(1-\varepsilon)} ((2\alpha+\beta)(1-\gamma)-1) \phi_1^2 \\ &= \frac{\partial \eta_2^*}{\partial \sigma_H^2} \end{aligned} \quad (26)$$

$$\begin{aligned} \frac{\partial \eta_1^*}{\partial \sigma_F^2} &= \frac{1}{2} \frac{\alpha(1-\varepsilon)}{\varepsilon+2\alpha(1-\varepsilon)} ((2\alpha+\beta)(1-\gamma)-1) \phi_2^2 \\ &= \frac{\partial \eta_2^*}{\partial \sigma_F^2} \end{aligned} \quad (27)$$

Another outcome is that the volatility of higher proportion of wealth leads larger impact on both MPCs.

$$\left| \frac{\partial \eta_1}{\partial \sigma_H^2} \right| \geq \left| \frac{\partial \eta_1}{\partial \sigma_F^2} \right| \text{ if } \phi_1 \geq \phi_2 \quad (28)$$

$$\left| \frac{\partial \eta_2}{\partial \sigma_H^2} \right| \geq \left| \frac{\partial \eta_2}{\partial \sigma_F^2} \right| \text{ if } \phi_1 \geq \phi_2 \quad (29)$$

In sum, when the effect of volatilities of both wealth on the MPCs is analyzed, the magnitude of the elasticity of intertemporal substitution (ε) is crucial to govern the sign given $\gamma > 1$ and the proportions of both types of wealth is important to determine the magnitude.

C. The Preference for Housing Wealth

Next analyzed is how the proportions of both types of wealth influence the effect of the preference of housing wealth (β) on the MPCs in terms of magnitude.

$$\begin{aligned} \frac{\partial \eta_1^*}{\partial \beta} &= -\frac{\rho}{(2\alpha+\beta)^2} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon+2\alpha(1-\varepsilon))\varepsilon} \frac{1}{\phi_1} \\ &\quad + \frac{1}{2} \frac{\alpha(1-\varepsilon)(1-\gamma)}{\varepsilon+2\alpha(1-\varepsilon)} \\ &\quad (\phi_1^2 \sigma_H^2 + \phi_2^2 \sigma_F^2 + 2\phi_1 \phi_2 \sigma_H \sigma_F \Omega_{HF}) \end{aligned} \quad (30)$$

$$\begin{aligned} \frac{\partial \eta_2^*}{\partial \beta} &= -\frac{\rho}{(2\alpha+\beta)^2} \frac{\alpha(1-\varepsilon)^2}{(\varepsilon+2\alpha(1-\varepsilon))\varepsilon} \frac{1}{\phi_2} \\ &\quad + \frac{1}{2} \frac{\alpha(1-\varepsilon)(1-\gamma)}{\varepsilon+2\alpha(1-\varepsilon)} \\ &\quad (\phi_1^2 \sigma_H^2 + \phi_2^2 \sigma_F^2 + 2\phi_1 \phi_2 \sigma_H \sigma_F \Omega_{HF}) \end{aligned} \quad (31)$$

The first terms in Equations (30) and (31) show the effect on impatience of an increase in the taste for housing wealth (certainty effect): as the preference of housing wealth (β) increases, the MPCs of both types of wealth are unambiguously reduced. Interestingly, this certainty effect depends on the proportions of both types of wealth in terms of magnitude. The higher proportion of housing (financial) wealth in equation (30) (equation (31)), the smaller the certainty effect is. In other words, the magnitude of the certainty effect depends on the proportions.

The sign of the second term in Equations (30) and (31) (risk effect) depends on the sign of the product $(1-\varepsilon)(1-\gamma)$. Given $\gamma > 1$, the last term is negative if $\varepsilon < 1$, it is positive.

The preference for housing wealth may increase or decrease the marginal propensities to consume of both types of wealth depending on the certainty effect and the risk effect.

In summary, it is possible for the preference for housing wealth to increase or decrease both MPCs and the proportions of both wealth are an important factor in terms of magnitude of the effect.

IV. Concluding Remarks

In this note, how the proportions of financial and housing wealth affect the marginal propensities to consume of both housing wealth and financial wealth under uncertainty is analyzed.

According to the empirical tests, the MPCs are wide-ranging. The proportions may have a crucial role to explain the difference between the MPCs of housing wealth and financial wealth. The wide-ranging proportions may be generated by the degree of financial market development, liquidity constraints, culture, and so on. The volatility of higher proportion of wealth leads to a larger impact on both MPCs. In order to stabilize the market, the government may adopt a well-designed property and land tax system as well as implement a strict credit market. Finally, the higher proportion of housing (financial) wealth reduces the certainty effect even though the proportions of both types of wealth are an important factor in terms of magnitude of the effect of the preference of housing wealth.

The findings provide an important insight that the proportions of housing wealth and financial wealth may play a key role to describe the behavior of both MPCs.

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