Problem Set #1

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1 Problem 1

1.1 Journal Citation

The theoretical model is derived from *Macroeconomic Model of Price Swings in the Housing Market* by Garriga, Carlos, Rodolfo Manuelli, and Adrian Peralta-Alva, 2019.[1]

1.2 The Mathematical Model and Analysis

Authors begin with building a simple asset pricing model to highlight two dimensions of their approach: market segmentation and the expected duration of the period of relaxed financial conditions. They use these dimensions to account for the increase in house prices. Then, they generalize the conditions and build a general macroeconomic model. Here I focus on the simple model, which is clearer to identify the exogenous and endogenous variables.
The long run equation:

$$r^d P_L = R_L + \phi_L(r^d - r_L^*)P_L$$

The short run equation:

$$r^d P_S = R_S + \phi_S(r^d - r_S^*)P_S + \frac{1}{T}(P_L - P_S)$$

R_j is the implicit rent associated with a unit of housing, which is defined as

$$R_j = (y - v\phi_j {r^*}_j)(1 - \alpha_c)/\alpha_c$$

Simple calculations show that the price $P = PS/PL$, which is given by

$$P = \frac{r^d + \frac{1}{T} - \phi_L(r^d - {r^*}_L) + \frac{1-\alpha}{\alpha} v\phi_L r_L^*}{r^d + \frac{1}{T} - \phi_S(r^d - r_S^*) + \frac{1-\alpha}{\alpha} v\phi_S r_S^*}$$

This theoretical model is static, nonlinear and stochastic. The variable classification and the description of each variable are showed below:

[1] Garriga, Carlos, Rodolfo Manuelli, and Adrian Peralta-Alva. 2019. "A Macroeconomic Model of Price Swings in the Housing Market." American Economic Review, 109 (6): 2036-72.

Table 1: Variable Classification and Description

	Discription
Exogenous Variables	
$\phi_j, j \in \{S, L\}$	the maximal loan-to-value ratio
$\mathrm{r}_j^*, j \in \{S, L\}$	the effective cost of mortgages in that regime
P	house price
T	the expected duration of the low interest rate period
r^d	the domestic return on capital
Endogenous Variables	
α_c	the land value-housing value
v	the fraction of all mortgages held by foreigners

1.3 Suggestion

In the asset pricing equations (the long run and short run equations), I suggest adding a variable of house depreciation ($D_j, j \in \{S, L\}$) on the right side of the equation in order to take the capital loss into consideration. Thus, the equation will be like:

$$r^d P_L = R_L + \phi_L (r^d - r_L^*) P_L - D_L$$

and

$$r^d P_S = R_S + \phi_S (r^d - r_S^*) P_S + \frac{1}{T}(P_L - P_S) - D_S$$

2 Problem 2

2.1 Model

Since the variable of whether someone decides to get married is a dummy variable, I build a logit model to analyze the factors that affect people's decisions on getting married. Here is the model:

$$y^*{}_i = \beta_0 + \beta_1 * Gender_i + \beta_2 * Age_i + \beta_3 * Income_i + \beta_4 * Educ_i + \beta_5 * Riskratio_i + \beta_6 * Family_i + \epsilon_i$$

$$y_i = \begin{cases} 0 & ,y^*{}_i \leq 0 \\ 1 & ,y^*{}_i > 0 \end{cases}$$

$i \in 0, 1, 2, ...$, denoted to each of person. The descriptions of variables are showed in Table 2.

Table 2: Variables

Variables	Discription
y*	latent variable, defined as $y^* = log(\frac{P}{1-P})$, where P is the probability
y	dummy variable, y = 1 if get married, y = 0 if not get married
Gender	dummy variable, Gender = 0 if is male, Gender = 1 if is female
Age	dummy variable, Age = $\begin{cases} 1 & ,\text{age under 30} \\ 2 & ,\text{age between 30 and 42} \\ 3 & ,\text{age between 40 and 60} \\ 4 & ,\text{age over 60} \end{cases}$
Income	metric variable, the logarithm of annual income after tax
Educ	dummy variable, Educ = $\begin{cases} 1 & ,\text{ the highest education level is or under middle school} \\ 2 & ,\text{ the highest education level is high school} \\ 3 & ,\text{ the highest education level is undergraduate} \\ 4 & ,\text{ the highest education level is or over graduate} \end{cases}$
Riskratio	objective risk appetite ratio, defined as the ratio of risk assets in net assets
Family	dummy variable, Family = $\begin{cases} 1 & ,\text{if i has a complete normal family}^2 \\ 0 & ,\text{otherwise} \end{cases}$
ϵ	endogenous error

2.2 Model Analysis

I think Gender, Age, Educ ,and Family are the key factors that influence the outcome. I decided to build up this model after three stages of the consideration process. Firstly, I think about the factors on myself. I listed all of the factors that I think would affect one's choice on decision of whether get married. Then, I did an investigation in my family and friends, asking for their opinions on this question. I summarized the results

and build up an initial model. Then, I went through the relevant research papers on this topic, looking for inspirations from their models and theories. For example, the variable of Riskratio is the factor that I was inspired from *Why investor's objective risk preference is different from subjective preference: Evidence from CHFS2011*[3]. Finally, I built this model. I decided using those factors and not others because they are the most conspicuous factors that were recognized by most of the people. In addition, those factors are verified to be related to this question and some of them are significant in the previous studies.

2.3 Preliminary Test

I will firstly constitute a sample database and then do a correlation analysis (using Pearson correlation coefficient, etc.). Then, I will use the sample data to do a logic regression and evaluate their significance.

[3]Li Xuan, Yang Zhen, Zhang Yaqian. Why investor's objective risk preference is different from subjective preference: Evidence from CHFS2011[J]. South China Journal of Economics, 2015, 33(11): 16-35.