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HOUSING PRICE, FAMILY STRUCTURES AND HOUSEHOLD CONSUMPTION: EMPIRICAL EVIDENCE OF TAIWAN

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Abstract. The housing price affects the allocation of family budget on consumption. We use regression analysis to confirm whether Taiwan's housing prices have a significant influence on household consumption based on the questionnaire survey on household income and expenditure in 2018. We find that housing prices have the greatest impact on household consumption, possibly because housing accounts for the largest proportion of household assets, implying a significant wealth effect. In addition, the impact of interest of deposit on consumption is also found to be greater than that of household income as it is related to the level of total assets. The housing prices for single-person household with female gender have a negative and significant impact on household consumption. Finally, housing prices are found to have a significantly negative effect on non-consumption and current transfer expenditure. The possible reason is that the households who hold the house believe that the appreciation of housing price can provide more protection for the family from suffering from possible economic risks in the future and thus crowd out non-consumption expenditures.

Keywords: housing price, family structures, household consumption, wealth effect, non-consumption expenditure, current transfer expenditure.

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1. Introduction

Housing is usually regarded as one of the most important assets in households' asset alocation. Therefore, housing price has a significant impact on household consumption. However, the degree to which the impact of housing price on consumption may vary across the factors like the size of household, education level, gender, age, etc. Furthermore, in comparison with the consumption expenditure, the impact of housing price on non-consumption and current transfer expenditures needs to be examined so as to deliver insights to the households' budget alocation in reaction to the ever-increasing housing prices.

Private consumption is the most important item in GDP and capable of supporting economic growth and improving industrial structure. The changes in private consumption are related to the value of assets held by households, which can be further divided into financial and fixed assets in household assets. Financial assets are investments in financial related assets and products, while fixed assets are those with service life longer than one year, of which the highest proportion is the value of real estate. Factors that affect consumption besides household assets include the size of of households, education level, marital status, gender, and the head of household, especially the number of adults in the family. The employability of adults in the family is strongly related with the consumption of the family and the accumulation of household assets. In addition, the difference in family structures may also affect the level of consumption. Different family types will have different needs and consumption habits.

As consumption is one of the indispensable components in GDP, we need to consider factors that will affect private consumption. Bhatia (1987) and Lettau and Ludvigson (2004) showed that housing wealth deeply affects consumption regardless of changes in economic conditions, and Case et al. (2005) later derived the wealth effect on consumption. Wealth effect refers to changes in consumption habits due to changes in the value of assets held in household's investment portfolio. The wealth effect is mainly aimed at the financial markets and real estate markets in developed economies (Benjamin et al., 2004; Chen,

2006; Bostic et al., 2009; Guo & Hardin, 2014, 2017). With the real estate value accounting for the largest proportion of household assets, the impact is substantial (Poterba, 2000; Xie & Jin, 2015). The observation in Taiwan reveals that in comparison with investment in housing assets, the proportion of households with financial assets is relatively small (Benjamin et al., 2004; Case et al., 2005; Bostic et al., 2009; Wachter & Yogo, 2010; Guo & Hardin, 2014). Some empirical researches confirm that the increase in the value of real estate has a positive response to consumption (DeFusco, 2018; Aladangady, 2017; Mian et al., 2013). However, some people believe that the increase in the value of real estate will inhibit other consumption of commodities (Sheiner, 1995; Attanasio et al., 2009). There are still other factors that may change household consumption, such as household income, financial assets, marital status and so on. In the previous researches, financial assets are financial related vehicles held as part of household's wealth and the accumulated deposits also constitute part of it (Chen et al., 2020). Therefore we define investment income and interest of deposits separately to account for their effects on household consumption.

It is evident that market conditions will affect housing prices (Hui & Wang, 2014), and then many researchers began to discuss the relationship between housing prices and household consumption in the market. For example, different financial structures and different proportions of housing ownership will change housing prices, which influences on marginal consumption (Catte et al., 2004). The cultural differences between eastern and western countries are huge especially in family education, individualism, family consumption, etc. The traditional culture in eastern countries, for example, China, has preference for sons over daughters, which may cause men and women to have unequal family status and different levels of consumption based on gender. They will teach their children "filial piety first" from an early age. Therefore, in order to fulfill filial piety, the country's family structure is more complicated than that in western countries, such as three generations living under one roof and grandchildren living in one house with their grandparents. As a result, we need to explore here is whether housing prices will affect the consumption habits across different family organizational structures, and whether head of household plays an important role in the family consumption.

The relationship between household wealth and household consumption has been widely documented in the literature (Hall & Mishkin, 1982; Campbell & Mankiw, 1991; Gourinchas & Parker, 2002), showing that the increase in household income will increase household consumption, but not all household income has a significant impact on household consumption. A short-term or temporary income will not cause a significant increase in household consumption. On the contrary, a long-term income significantly does (Elliott, 1980; Carroll, 1997). Family wealth can be simply divided into assets, liabilities, and equity. Not only household income can increase assets and promote consumption, but liabilities and equity also have a significant impact on household consumption. The level of debt will limit the financial liquidity for household, and in order to repay debtors will curb household's expenditures (Bloemen & Stancanelli, 2005; Ogawa & Wan, 2007). The equity part is the proportion of ownership acquisition related to the value of the house. Different methods of acquisition of house ownership will have different effects on household consumption. For example, the methods of acquiring a house include market rent, joint ownership, sole ownership, private rent and free rent. Joint ownership is to share ownership of house with people who live in the same place; sole ownership can be divided into self-built and self-purchased. Private rent refers to renting houses from family, relatives or friends. The difference from market rent is that the house can be rented at a lower price. Free rent is not literally free but that people can rent houses provided by government or employers, usually at a much lower price or without rental costs. In this paper, different methods of housing acquisition will be considered to test whether they have an impact on household consumption. Among them, we find that households that jointly own the house tend to have a higher level of consumption, while households that own house ownership alone will increase consumption after the appreciation of the house value, a result consistent with Chen et al. (2020).

The effect of housing prices on household consumption is further confirmed by Campbell and Cocco (2007) who analyzed various regions in the UK and then proposed the wealth effect of housing prices. As housing prices account for the largest proportion of household wealth, its wealth effect is more pronounced than other factors (Poterba, 2000; Xie & Jin, 2015). However, the rising house prices are usually accompanied by economic expansion and higher commodity prices as well. In other words, the increase in housing wealth will also increase the cost of living, which in turn mitigate the wealth effect with rising costs (Buiter, 2010; Berger et al., 2018). Other studies showed that the housing assets held by different age groups have different effects on household consumption. The increase in housing prices has a positive and stronger impact on household consumption of young people than that of older people. The reason is that young people are expected to have salary income and salary may go rising in the future (Case et al., 2005; Attanasio et al., 2009). The subprime mortgage crisis in 2008 is even more striking (Bostic et al., 2009; Guo & Hardin, 2014; Fereidouni & Tajaddini, 2017; Caporale et al., 2018). Many people borrowed money from bank to buy houses at that time, and when the house price rises, it will cause a lot of debt to most people. When the housing price is lower than the loan amount that must be paid at the beginning of the period, many people will choose to default, even though those people will have the ability to repay. Such behavior is also called "strategic default" (Pavan &

Barreda-Tarrazona, 2020). The complete life cycle assumption is that homeownership has a buffering effect on adverse shocks, thereby achieving stable consumption. The subprime mortgage crisis in 2008 caused many people to lose their jobs, and people who actually own houses have a greater consumption under unemployment than those who buy houses with loans (Carroll et al., 2011).

The value of a house has an important impact on household consumption, whether it is the wealth effect of the house or the problem of housing loans. We focus on Taiwan's housing prices to explore whether Taiwan's housing prices have a clear positive relationship with household consumption, or have a crowding effect on other factors. As there are studies on the different effects on household consumption by different age groups and ways of acquiring houses, we further distinguish groups according to different family structures and explore their impact on family consumption. In addition, by taking into account of various financial factors like investment and deoposits that may affect the household consumption, we find that the the interest income from deposits has significantly positive effect on household consumption in Taiwan, a result consistent with Mitroshin (2022) that interest income can potentially lead to increased overall spending within a household in Russia from 1995 to 2019.

2. Data and methodology

Figure 1 shows the relationship between the housing price index of major cities in Taiwan and its GDP growth rate. We find that the GDP growth rate and the housing price index both show an uptrend similar trends from 2010–2016 whereas the financial crisis in 2008–2009 has somehow smoothed the uptrend in housing price, a result quite different from the period before 2008. By excluding the data during financial crisis, the positive relationship between GDP and housing price tends to warrant a strong relationship between consumption and housing price.

2.1. The data source

Part of the data in Table 1 is procured from the Survey of Family Income and Expenditures by Directorate-General of Budget, Accounting and Statistics (DGBAS)[1] of the Executive Yuan of Taiwan (see the Supplementary material for further information), and can be freely sourced from the database SRDA[2] (Survey Research Data Archive, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, 2019). The survey is an ongoing, nationally representative, longitudinal data conducted by DGBAS since 1973. The data includes personal data of each county and city in Taiwan, and the household consumption, income, and family structure. The scope covers the main island of Taiwan and other outlying islands. As SRDA only provides de-identified samples for researchers, this study was reviewed and deemed exempt by the Ethics Committee of Asia University.

Due to the small number of samples and incomplete data in Kinmen, Matsu, and Lianjiang counties, which are located in the offshore islands of Taiwan, we exclude them from the regression sample. Of the total number of observations 16,528, Table 1 shows that only 7,240 are used after data cleanup due to missing and incomplete values. We focus on the fixed assets of the Taiwanese people. The value of housing price is calculated by multiplying the average housing price of the county and city by the number of pings held by the family. Ping, a widely used measure for the unit space of house in Taiwan, is roughly equal to 3.305 square meter. The average house prices of the county and city in Table 1 are collected from Taiwan Economic Journal (TEJ) database. However, it is worth noting that TEJ database only records the housing prices of the municipalities over the years, while registered real prices are used in other counties and cities. Since the house price fluctuations in other counties and cities in Taiwan had been relatively stable from 2014 to 2018, we used the house price of 2018 as the basis year to collect the survey data. The stability of the housing price and interest rate within this period from 2014 to 2018 can also help us to find a more sustainable relationship between housing price and household consumption. Since the place of residence of the respondent is not mentioned in the questionnaire, and most of the working population generally live in the same county or city as the place of work, we adopt the place of work as the place of residence.

Economic factors may change during the year, such as marital status and adult population. These factors are based on data from the last filling date to the end of the year. Dummy variables are set for marital status and the education level of the heads of households (married = 1; university degree or higher = 1). The original survey data provided 24 types of family structures. Due to the excessive subdivision of the family types in the original survey data, we focused on the largest four types of family structure which accounted for more than 60% of the data: nuclear family, couple family, single-person family and three-generation family, which are tabulated in Table 2. The nuclear family is mainly composed of parents and unmarried children. The family burden is lower than that of three-generation family. The main expenses are education, medical insurance, and catering. Couples' families are also known as DINK families, i.e., double income no kids.

[1] DGBAS, an office of the Executive Yuan of Taiwan government, is responsible for the National statistics ranging from public budget to ntional information management. To facilitate widespread use of the website data by various sectors, all information and materials published on the DGBAS website can be provided to the public free of charge and on a non-exclusive basis, allowing further authorization. Users are granted the right to reproduce, adapt, edit, publicly transmit, or utilize them in other ways, including the development of various products or services (referred to as derivative works), without any limitations on time or location. https://eng.dgbas.gov.tw/cp.aspx?n=2011

[2] https://srda.sinica.edu.tw/browsingbydatatype_result.php?category=surveymethod&type=4&csid=45

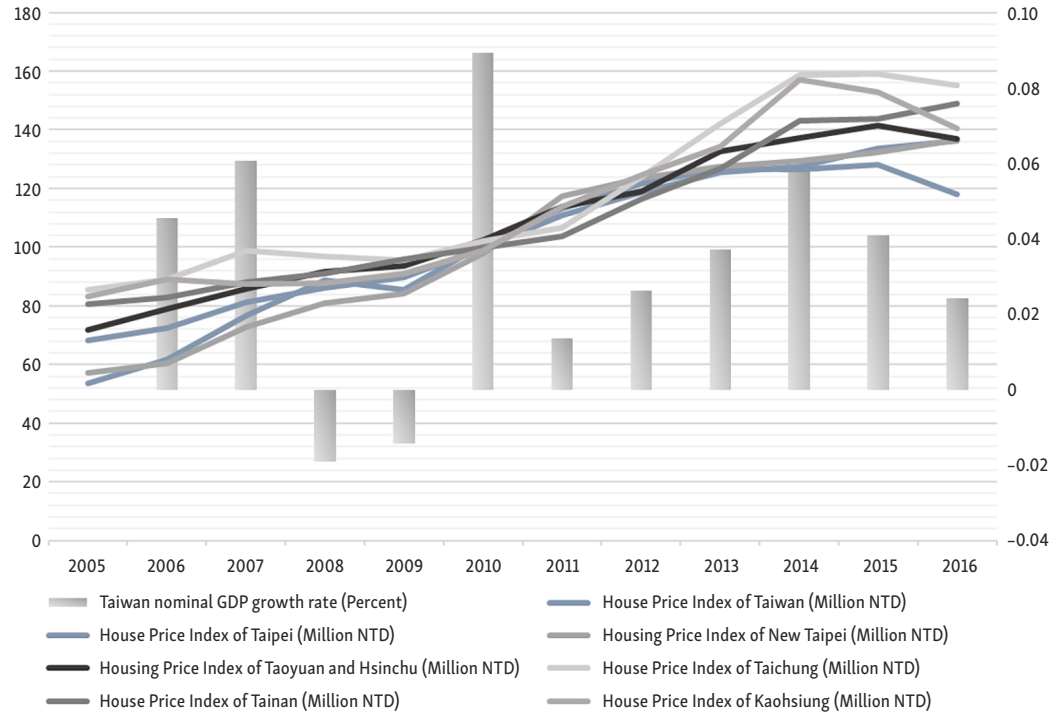

Figure 1. The relationship between house price index and GDP in Taiwan

Table 1. Summary statistics

Variable	Mean	Median	Std. Dev.
Expenditure (NTD)	827,025	755,773	448,030
Housing price (NTD 10,000)	450.21	400.4	402.06
Investment (NTD)	12,406	0.00	120,685
Income (NTD)	1,387,471	1,202,766	1,075,956
Deposits (NTD)	20,265	7,450	43,611
Adults	2.65	2	1.16
Education	0.44	0.00	0.50
Marriage	0.47	0.00	0.50
Observations	7,240	7,240	7,240

Note: Expenditure is the total consumption at the end of 2018. Housing price is the average estimated housing value in the sampled working area in the whole year. Investment is composed of all types of financial assets and only calculates inflow in the whole year. Deposits aredefined as the interest income accrued thoughout the year. Education and marriage aredummy variables. Education is 1 when the head of the household has university degree or higher, and 0 otherwise. Marriage is 1 when the head of family is in marriage condition and 0 otherwise.

They advocate the pursuit of quality of life and are free from the financial burden of raising children and supporting elders. Three-generation family living under one roof is also classified as an extended family in Western countries, and this family structure is more financially burdened than other families. Because Taiwan has entered an aging society, coupled with the development of medical technology, the three-generation family is a very common family structure in Taiwan. However, with the decreasing number of family members, the three-generation family under one roof has gradually changed to the three-generation family with neighbors. The family structures are expected to change to single-person or couples. We will discuss whether the economic and family factors in the total sample have a significant impact on household consumption, and whether the value of real estate will significantly change household consumption due to different types of household organization.

Table 2. Definitions of family structures

Family structures	Definitions
Nuclear family	Only parents and children in the family
Couple family	Only two people in the family
Single-person family	Living alone
Three-generation family	Grandparents, parents and children in the family

2.2. Econometric methodology

We use the regression equation to examine the relationship between household consumption and household wealth. The equation is as follows:

$$\begin{aligned} Expenditure_i &= \beta_{0,i} + \beta_{1,i}\left(HP\right) + \\ &\beta_{2,i}\left(Investment\right) + \beta_{3,i}\left(Deposits\right) + \\ &\beta_{4,i}\left(HI\right) + \beta_{5,i}\left(Adults\right) + \beta_{6,i}D_e + \beta_{7,i}D_m, \end{aligned} \quad (1)$$

where: $Expenditure_i$ is household consumption, which refers to the total consumption for household i in 2018; *HP* is housing price; *Investment* is investment income; *Deposits* is interest of deposits; *HI* is household income; *Adults* is number of adults; D_e and D_m are dummy variables for education level and marital status respectively. Education level

is 1 for those with university degrees or above. The dummy variable for the married is 1. Furthermore, to examine whether the location of house will affect the household consumption in different cities, we select the four largest cities in Taiwan, Taipei, New Taipei, Taichung and Kaohsiung, as the categorical variables, and Taipei city is used as the reference city in the regression model as follows:

$$\begin{aligned} Expenditure_i &= \beta_{0,i} + \beta_{1,i}(HP) + \\ &\beta_{2,i}(Investment) + \beta_{3,i}(Deposits) + \\ &\beta_{4,i}(HI) + \beta_{5,i}(Adults) + \beta_{6,i}D_e + \\ &\beta_{7,i}D_m + \beta_{8,i}NewTaipei + \beta_{9,i}Taichung + \\ &\beta_{10,i}Kaohsiung. \end{aligned} \quad (2)$$

By including the family structure (j) in the model, the equation is as follows:

$$\begin{aligned} Expenditure_{i,j} &= \beta_{0,i,j} + \beta_{1,i,j}(HP) + \\ &\beta_{2,i,j}(Investment) + \beta_{3,i,j}(Deposits) + \\ &\beta_{4,i,j}(HI) + \beta_{5,i,j}(Adults) + \beta_{6,i,j}D_e + \beta_{7,i,j}D_m. \end{aligned} \quad (3)$$

The dependent variable of the Equation (3) is household consumption with subscript j denoting family structure in 2018. We divide the family structures into four categories: nuclear family, couple family, single-person family and three-generation family. The independent variable is similar to the Equation (1), and the difference lies in the classification of the family structures. The regression analysis of the total sample is mainly completed by the Equation (1). Here we emphasize the degree of influence of family wealth on family consumption under different family structures. Similar to Equation (2), we also include the location of house see if it will affect the family consumption across family structures.

$$\begin{aligned} Expenditure_{i,j} &= \beta_{0,i,j} + \beta_{1,i,j}(HP) + \\ &\beta_{2,i,j}(Investment) + \beta_{3,i,j}(Deposits) + \\ &\beta_{4,i,j}(HI) + \beta_{5,i,j}(Adults) + \beta_{6,i,j}D_e + \\ &\beta_{7,i,j}D_m + \beta_{8,i,j}NewTaipei + \\ &\beta_{9,i,j}Taichung + \beta_{10,i,j}Kaohsiung. \end{aligned} \quad (4)$$

In addition, we replace the dependent variable with non-consumption expenditure, including mortgage, social insurance, donations and taxes. The main purpose is to explore whether changes in house prices have a significant impact on non-consumption expenditures:

$$\begin{aligned} Nonconsumption\ expenditure_i &= \\ &\beta_{0,i} + \beta_{1,i}(HP) + \beta_{2,i}(Investment) + \\ &\beta_{3,i}(Deposits) + \beta_{4,i}(HI) + \beta_{5,i}(Adults) + \\ &\beta_{6,i}D_e + \beta_{7,i}D_m. \end{aligned} \quad (5)$$

We will also discuss whether current transfer expenditures, private or government expenditures, will be affected by household wealth.

$$\begin{aligned} Current\ transfer\ expenditure_i &= \\ &\beta_{0,i} + \beta_{1,i}(HP) + \beta_{2,i}(Investment) + \\ &\beta_{3,i}(Deposits) + \beta_{4,i}(HI) + \beta_{5,i}(Adults) + \\ &\beta_{6,i}D_e + \beta_{7,i}D_m. \end{aligned} \quad (6)$$

3. Empirical findings

3.1. The influence of economic factors on consumption

We first classify family wealth into fixed assets, investment income, passive income, and active income, among which fixed assets are mainly represented by real estate. Other factors such as education and marital status are used as dummy factors in the regression equation. By Equation (1), the model 1 in Table 3 shows that the increase in the number of adults will expand household consumption by NTD 195,000. With the addition of dependent variables, however, the increase in household consumption shows a downward trend (NTD 112,544). The level of education also has a significant impact on household consumption. The higher the education level, the stronger the consumption power. Every additional highly educated person in the family (D_e) will increase spending by about NTD 100,000 to 200,000 per year (NTD 96,583 to 197,379). Marital status (D_m) also affects family consumption. In particular, married people must consider the basic needs of the family.

Table 3. Regression of household consumption on household wealth

	Dependent variable: Household consumption		
	Model 1	Model 2	Model 3
HP	53.1334***	45.4119***	49.2960***
Investment	0.9635***	0.8044***	–0.1832***
Deposits		1.7576***	0.4132***
HI			0.2404***
Adults	195,085.83***	184,212.30***	112,543.94***
D_e	197,379.15***	172,789.41***	96,583.47***
D_m	143,719.10***	139,204.23***	76,406.50***
(*Intercept*)	121,684***	133,246***	89,490***
Obs	7,240	7,240	7,240
Adj. *R*-squared	0.429	0.454	0.616

The regression results are based on Equation (1):

$$\begin{aligned} Expenditure_i &= \beta_{0,i} + \beta_{1,i}(HP) + \beta_{2,i}(Investment) + \\ &\beta_{3,i}(Deposits) + \beta_{4,i}(HI) + \beta_{5,i}(Adults) + \beta_{6,i}D_e + \beta_{7,i}D_m. \end{aligned}$$

$Expenditure_i$ is the household consumption, which refers to the total consumption for household i in 2018; *HP* is housing price; *Investment* is investment income; *Deposits* is interest of deposits; *HI* is household income; *Adults* is number of adults; D_e and D_m are dummy variables which indicate education level and marital status respectively. D_e is 1 for those with university degrees or above. D_m is 1 if married. ***: $p < 0.001$.

Therefore, the family expenses of married people are higher than that of unmarried families, although the impact is not as large as the number of adults and education level.

Model 1 in Table 3 includes the housing price and investment income so that we can measure whether housing prices and investment income have a crowding effect on household consumption, and then observe the degree of impact on household consumption. In Model 1, we find that the coefficient of housing price is 53.133 and the coefficient of investment income is 0.964, and both have a significant impact on household consumption (*P*-value is less than 0.001). According to the data, the impact of housing prices on household consumption is greater than investment income. The reason may be that the unit of change in housing prices is NT$10,000, that is, the impact of housing price changes of NT$10,000 on household consumption. In comparison with other assets held by households, the wealth effect created by changes of housing prices on household consumption, is not just positive but also the largest. In addition, the reason why investment income has less impact on household consumption than housing prices is due to the limited sample size. Not all households will invest in financial assets. Of all the sample, 82.38% of households have no investment income from financial assets, so the impact of investment income on household consumption is very limited.

Furthermore, we classify household wealth into active and passive income. Active income is the labor income including employee compensation and proprietor income, whereas passive income is the income from the increase of housing prices, investment income and interest of deposits. By Model 2 in Table 3, the wealth effect of housing prices is slightly subsumed by other factors, and the estimated coefficient drops to 45.412, but still dominant among other factors affecting the household consumption. It is worth noting that the impact of investment income on household consumption (coefficient of 0.804) is smaller than that of interest of deposits on household consumption (coefficient of 1.758). For a given interest rate, the larger the amount of bank deposits, the more the interest earned. It is not difficult to imagine that the larger the amount of deposits, the more wealth the households have and thus higher spending power. Not all households will invest, but generally households will keep a certain level of bank deposits, so that they tend to earn interest of deposits more or less.

Finally, we include all family wealth factors in the regression equation to explore whether there exists crowding effect among factors, and measure the degree to which each factor has a significant effect on household consumption. In Model 3 in Table 3, we find that impact of housing prices on household consumption becomes greater than that in Model 2 (49.296 vs. 45.412), but the impact of investment income on consumption turns to a negative value –0.183. As a result, household income seems to have a crowd out effect on consumption in comparison with the investment income. In general, as household income will be used to maintain the family's minimum standard of living, it definitely has a certain impact on consumption. However, as the household income will not change in the short term, if part of the income is allocated to investment instead of consumption, investment will thus have a negative impact on household consumption. It reveals that it is quite common for households in Taiwan to allocate part of their income to investment. In addition, investment also implies an asset with a potential wealth effect in the future, which may prompt households to curb their consumption now in exchange of gains from assets in the future. When investment income increases, even if the financial assets have not been sold, psychologically, people will think that the asset will increase and consumption will increase, and vice versa. On the other hand, the impact of interest of deposits on household consumption (coefficient 0.413) becomes greater than that of household income on consumption (coefficient 0.240), indicating that, of the total family wealth, the share of interest of deposits is more important for household in determining the level of household consumption. This implies that the passive income such as interest income from deposits tends to increase the household consumption.

The influence of household wealth and the location of house on family consumption

To account for the effect of income disparity on the household consumption across different cities in Taiwan, we selected the largest four cities, Taipei, Newe Taipei, Taichung and Kaoshiung, as the control variables to analyze whether the household wealth still significantly affects the household consumption. Table 4 shows the medium and mean salary income of the four largest cities in Taiwan in 2018. We find that except Taipei, all the other three cities share similar salary income levels.

As the annual salary income in Taipei is the largest among four cities in Taiwan, we use Taipei as the baseline model with which the other three cities are compared to measure the effect of location of city on household consumption. By controlling the location of houses, we find that housing price and investment income have a significant impact on household consumption, which is consistent with results in Table 3. By Table 5, the household consumption expenditures in New Taipei, Taichung and Kaohsiung are significantly less than the house location in Tapei, holding all other variables constant. This is also

Table 4. Annual salary income ranking of the four largest cities in Taiwan in 2018

2018	Annual salary income of the four largest cities in Taiwan (in thousand NTD)	
Location	Medium	Mean
Taipei	766	1,396
New Taipei	640	932
Taichung	624	921
Kaohsiung	644	897

consistent with the results of Table 4 that Taipe city has the highest salary income in four cities. The ANOVA test indicates that all of the models with city locations can explain the household consumption more significantly than the models without locations. In summary, results of the Table 5 are consistent with Table 3, and the household consumption is still significantly affected by household wealth and other income factors after the inclusion of the variables of house location.

Table 5. Regression of household consumption on household wealth and the location of house

	Dependent variable: Household consumption		
	Model 1	Model 2	Model 3
HP	29.487*	22.073+	31.060**
Investment	0.908***	0.757***	–0.096**
Deposits		1.773***	0.468***
HI			0.210***
Adults	194,467.56***	183,804.91***	122,662.82***
D_e	159,001.29***	135,212.23***	87,865.57***
D_m	155,761.82***	151,141.09***	85,208.97***
New Taipei	–125,344***	–117,521***	–83,267***
Taichung	–103,025***	–108,165***	–61,515***
Kaohsiung	–151,694***	–143,777***	–106,464***
(*Intercept*)	288,284***	293,297***	209,017***
Obs	4,016	4,016	4,016
Adj. *R*-squared	0.436	0.463	0.613
ANOVA	0.000***	0.000***	0.000***

The regression results are based on Equation (2):

$$Expenditure_i = \beta_{0,i} + \beta_{1,i}(HP) + \beta_{2,i}(Investment) + \beta_{3,i}(Deposits) + \beta_{4,i}(HI) + \beta_{5,i}(Adults) + \beta_{6,i}D_e + \beta_{7,i}D_m + \beta_{8,i}NewTaipei + \beta_{9,i}Taichung + \beta_{10,i}Kaohsiung.$$

$Expenditure_i$ is the household consumption, which refers to the total consumption for household i in 2018; *HP* is housing price; *Investment* is investment income; *Deposits* is interest of deposits; *HI* is household income; *Adults* is number of adults; D_e and D_m are dummy variables which indicate education level and marital status respectively. D_e is 1 for those with university degrees or above. D_m is 1 if married. *New Taipei*, *Taichung* and *Kaohsiung* are categorical variables for the house location. Taipei is treated as the reference city. ANOVA indicates the model significance level by including additional categorical variables, i.e., city locations, in comparison with the models without locations. ***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.05$; +: $p < 0.1$.

3.2. The influence of household wealth on family consumption across family structures

Here we are interested in whether different family structures will change the degree of influence of house prices on household consumption. Since Eastern cultures tend to have stereotypes about gender, the difference between men and women is greater than that in Western countries. In addition to distinguishing the family structure, we also distinguish the gender of the head of household, and further compared whether the gender of the head of household under the same family structure will change the degree of impact of housing prices on household consumption. The data is presented in Table 6.

We divide the family structures into four categories based on the size of the sample: nuclear family, couple family, three-generation family and single-person family, and the rest are classified as other. It should be noted here that as the couple family is defined as a two-person family, we delete the number of adults in the regression analysis. The marital status should be virtually treated as married. To avoid collinearity, the marital status in the couple family is not included in the regression. We try to measure the impact of household wealth on household consumption under different family structures and whether the degree of influence of the gender of head of household on household consumption is significantly different.

Table 6 shows the regression results of household consumption on household wealth and expenditure across family structures. For nuclear family and three-generation family with male household heads, the effect of housing price on consumption is more significant than families with female heads. For couple family, the effect of housing price on household consumption is significant for male and female head of household (66.12 and 83.27).

An interesting result is that for single-person family with male heads, the impact of housing prices on consumption is substantially less significant than that with female heads (19.845 and –39.766). Furthermore, the effect of housing price on consumption is estimated to be significantly negative, a result different from the couple family with female household heads. We think it is mainly caused by the difference in family structure. Couple family is usually characterized by high education, high income, high spending power, and by sharing family wealth, they can better cope with economic shocks than single-person family. Another possible reason is that women living alone are more conservative, which is consistent with Yuan et al. (2011) and Lim (2020) that rising housing prices can impact single women's consumption behavior due to the financial burden. When housing prices rises, the wealth effect is not fully reflected in women's consumption. According to the survey, the average total current assets held by women are about NTD 2.5 million, only about 60% of the average current assets held by men. This shows that women in Taiwan are relatively short of capital. Therefore, as housing prices rise with economic expansion along with increasing living costs, women living alone tend to face higher uncertainty for the future, which may inhibit them from increasing consumption.

In addition, Table 6 shows that, for households with male heads, the effect of investment income on household consumption is significantly positive for couple family (0.2310). However, it is negative or significantly negative

for the other three types of family with male heads. For households with women heads, the estimated coefficients are mostly positive, especially for nuclear family (1.076) and couple family (0.483), both of which are significant and higher than the estimated coefficients of *Deposits* and *HI*, a result consistent with the impression that financial affordability of the couple family is well above the average family. Additionally, it's not hard to imagine that women in the couple family have more autonomy over investment and spending. According to the Fidelity Internation Investment survey in 2020, up to 80% of women in Taiwan can use their personal income and invest in themselves. To be precise, 84% of professional women in Taiwan have investment, which is much higher than 23.5% in Japan and 48% in Australia. Although the investment attitude is positive, the women heads of households in Taiwan are much more conservative than men. Most of investments women select are savings and insurance, and nearly half of women mostly take retirement savings as their primary goal. Since investment is mostly based on insurance, it is easy to plan when paying investment expenses, it is not easy to affect consumer spending due to the wealth effect caused by investment losses.

For nuclear family and couple family, regardless of the gender of the head, the impact of interest of deposits on consumption is less than that of the household income, and the coefficients of interest of deposits in couple family is not significant. It may be related with their family structures. The quality of the life of DINK family is usually higher than other family structures. Consumption behavior is also different from other types of family structure and has great potential for consumption. In Taiwan, DINK has three obvious characteristics: high age, high education and high income. Therefore, the factors that affect the consumption of couple family are more obvious in terms of income. Single-person family and three-generation family are easily affected by the interest of deposits. According to statistics, the salary of single-person family is not high, and savings are the primary source for their consumption. The family of three generations in the same house is characterized by the elderlyand the young, and the outlays of family are much more than other family structures. Therefore, in single-person families and three-generation families, deposits play a more important role in determining the household consumption.

The influence of household wealth and the location of house on family consumption across family structures

Table 7 shows the regression of household consumption on household wealth and the location of house across family structures. The ANOVA tests show that city location variables in the models of couple and single-person family can significantly explain the household consumption. The possible reason may be due to the fact that for the couple and single family located in different cities, they can have higher flexibility in household consumption than the families with children and elderly to take care of. Besides, the house price of the couple family also shows significant effects on the household consumption (54.708^{+} and 105.164^{+}). The house prices of the other three family structures, however, do not significantly affect the household consumption. The main reason is that the couple family (DINK) can afford higher consumption level with higher price of their houses in the market. More interesting is that the DINK families in Taichung have higher household consumption (93,941, 105,755) than household

Table 6. Regression of household consumption on household wealth across family structures

	Dependent Variable: Household consumption							
	Nuclear family		Couple family		Single-person family		Three-generation family	
Gender of household's head	Male	Female	Male	Female	Male	Female	Male	Female
HP	43.9516*	58.3664	66.1225**	83.2789^{+}	19.8454	–39.7663*	61.2167**	–4.3268
Investment	–0.4611***	1.0760***	0.2310***	0.4826*	–3.5223***	0.1380	–0.1811	1.0022
Deposits	0.1965	–0.4538*	–0.2191	–0.2922	2.5867***	2.9894***	0.5212*	1.8487***
HI	0.2134***	0.2862***	0.1996***	0.2922***	0.2911***	0.2822***	0.3997***	0.3748***
Adults	37,672***	19,063			8,048		36,678**	67,871*
D_e	156,674***	116,970**	94,006***	40185	63,479***	44,620**	52,581*	39,977
D_m	45,469*	21,389	250,678		–27,098	43,919^{+}	32,717	–10,729
(*Intercept*)	425,131***	365,663***	103,304	303,679***	142,962	194,646***	216,560***	146,875
Observations	1,721	304	681	262	526	509	538	90
Adjusted *R*-squared	0.514	0.530	0.516	0.524	0.458	0.544	0.600	0.710

The regression results are based on Equation (3):

$$Expenditure_{i,j} = \beta_{0,i,j} + \beta_{1,i,j}(HP) + \beta_{2,i,j}(Investment) + \beta_{3,i,j}(Deposits) + \beta_{4,i,j}(HI) + \beta_{5,i,j}(Adults) + \beta_{6,i,j}D_e + \beta_{7,i,j}D_m.$$

The dependent variable of the Equation (3) is household consumption with subscript *j* denoting family structure in 2018. The family structure has four categories: nuclear family, couple family, single-person family and three-generation family. The independent variable is similar to the Equation (1), and the difference lies in the classification of the family structures. ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$; $^{+}$: $p < 0.1$.

Table 7. Regression of household consumption on household wealth and the location of house across family structures

	Dependent Variable: Household consumption							
	Nuclear family		Couple family		Single-person family		Three-generation family	
Gender of household's head	Male	Female	Male	Female	Male	Female	Male	Female
HP	36.417	72.894	54.708^{+}	105.164^{+}	10.552	–47.299	32.817	–120.645
Investment	–0.350***	0.916**	0.232***	0.631**	–0.873	0.220^{+}	0.635	1.149
Deposits	–0.234	–0.286	0.287	–0.285	–0.271	3.140**	1.042*	1.292*
HI	0.197***	0.297***	0.181***	0.237***	0.181***	0.229***	0.397***	0.454***
Adults	50,389.85***	–16,889.87			94,068.88		30,572.69^{+}	28,910.89
D_e	195,586.80***	88,551.50^{+}	49,560.14^{+}	55,632.10	67,790.05***	3,238.20	36,073.74	–25,908.94
D_m	24,445.45	58,161.68			–25,318.98	30,900.20	8,083.70	–31,550.72
New Taiepi	–40,261	–121,088^{+}	–73,367*	–97,439*	–35,740	–45,862	–32,148	8,800
Taichung	–28,238	–72,606	93,941**	105,755*	103,150***	–54,534^{+}	78,068	–41,838
Kaohsiung	–69,242*	–66,298	–121,122***	–190,323***	97,294**	–88,515**	21,625	–15,389
(*Intercept*)	507,249***	526,143***	497,354***	461,837***	234,660^{+}	314,424***	274,647**	302,672^{+}
Observations	1,038	191	325	136	239	238	264	47
Adjusted *R*-squared	0.514	0.530	0.516	0.524	0.458	0.544	0.600	0.710
ANOVA	0.124	0.283	0.006**	0.000***	0.000***	0.032*	0.103	0.946

The regression results are based on Equation (4):

$$Expenditure_{i,j} = \beta_{0,i,j} + \beta_{1,i,j}\left(HP\right) + \beta_{2,i,j}\left(Investment\right) + \beta_{3,i,j}\left(Deposits\right) + \beta_{4,i,j}\left(HI\right) + \beta_{5,i,j}\left(Adults\right) + \beta_{6,i,j}D_e + \beta_{7,i,j}D_m + \beta_{8,i,j}NewTaipei + \beta_{9,i,j}Taichung + \beta_{10,i,j}Kaohsiung.$$

The dependent variable of the Equation (4) is household consumption with subscript *j* denoting family structure in 2018. The family structure has four categories: nuclear family, couple family, single-person family and three-generation family. The independent variable is similar to the Equation (2), and the difference lies in the classification of the family structures. New Taipei, Taichung and Kaohsiung are categorical variables for the house location. Taipei is treated as the reference city. ANOVA indicates the model significance level by including additional variables of house location.***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$; $^{+}$: $p < 0.1$.

consumption in Taipei, which is contrary to the DINK families in New Taipei (–73,367, –97,439) and Kaohsiung (–121,122, –190,323). DINK families in Taichung might have slightly different consumption patterns compared to those in Taipei and Kaohsiung. In general, they may spend less on childcare-related expenses such as education, daycare, and children's activities since they do not have children. However, other aspects of their consumption, such as housing, transportation, food, and leisure activities, could be influenced by factors like regional prices, lifestyle preferences, and job market conditions.

3.3. The influence of economic factors on non-consumption and current transfer expenditures

In this section, we mainly want to understand whether the wealth effect has a significant impact on non-consumption expenditure. Here we choose non-consumption expenditure and current transfer expenditure as the dependent variables in Model 4 and Model 5, respectively, and the regression results are shown in Table 8. Disposable income is the income that households can freely use for consumption or savings. It is defined as total income minus non-consumption expenditures. Non-consumption expenditures refer to expenditure items that households are required to pay, such as tax expenditures, interest expenditures, donations, etc., of which the amount must be paid and will directly affect the disposable income. Interest expenses including mortgage are tax deductible in Taiwan. Personal investment is also a form of non-consumption expenditures including but not limited to investment in stocks and bonds, and real estate investment. Current transfer expenditure is a kind of gratuitous expenditure, such as taxes and social insurance. Whether expenditures are for non-consumption or current transfer, they are required expenditures for every family. Therefore, we choose these two expenditures as dependent variables for regression analysis.

From Table 8, we can see that the adjusted *R*-squared of Model 4 and Model 5 are 0.774 and 0.767 respectively, suggesting that dependent variables are highly related with explanatory variables. The results of these two models are very similar. Except household income, other factors including housing prices have negative and significant effects on these two specific expenditures. It can be understood that non-consumption expenditure and current transfer expenditure will increase due to the increase in household income. Non-consumption expenditure includes tax items. The higher the income, the higher the tax. The expenditure on interest of mortgage will also be proportional to the income of the family. The higher the income, the more expensive and higher quality of the house that people can afford, implying higher interest expenses.

Table 8. Regression of non-consumption and current transfer expenditures on household wealth

Dependent variable	Non-consumption	Current transfer
	Model 4	Model 5
HP	–15.1612***	–9.4071*
Investment	–0.0333	–0.0388*
Deposits	–0.5270***	–0.4709***
HI	0.2055***	0.2001***
Adj. *R*-squared	0.7744	0.7669

Note: ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$.

Current transfer expenditures are mainly dependent on personal income, and most of the expenditures are social insurances that are mainly used to ensure the above-average living quality when there is no income. People also hope that they can purchase more insurances when their financial condition permits.

Here we also find some differences from the previous results. Most of the literature mentions that the wealth effect of housing prices has a significant impact on total consumption. However, by Table 8, after we replace consumption expenditure with non-consumption and current transfer expenditure, the housing price has a negative effect on non-consumption and current transfer expenditure. We think that for most risk-averse home buyers in their management of real estate investment in Taiwan, they tend to repay their housing loans earlier when housing price rises due to increased equity and psychological factors. As housing prices rise, homeowners' equity in their property increases. This increased equity may provide them with a greater sense of financial security, making them more comfortable using additional funds to pay off their mortgage earlier. For the psychological factors, the rise in property values can create a perception of increased wealth among homeowners. This "wealth effect" may prompt them to reduce their liabilities by paying off their mortgage sooner, aiming for greater financial freedom and peace of mind. In generally, the effect of increased equity and psychological factors will lead to a decrease in non-consumption expenditure for risk-averse home owners.

Another negative impact of housing price on non-consumption and current transfer expenditures may be related to the reduction in mortgage tax and social insurance expenditures. Sun et al. (2022) also found that rising housing price in China leads to a decrease in non-consumption expenditure and current transfer due to increased precautionary savings. Many people in Taiwan use interest of mortgage for tax deductions. The upper limit of each household's declaration of interest on purchases houses for self-use is NTD 300,000, and the comprehensive income tax rate is 5% to 40%. Housing loans increase due to rising housing prices, which also pushes up non-consumption expenditures, and the tax-saving part will reduce current transfer expenditures. While the tax shield effect of mortgage can reduce current transfer expenditures, the tax shield only accounts for a little part of these two consumptions. In other words, the effect of the mortgage tax shield is limited. The increase in housing price also raise household consumption which in turn squeeze the non-consumpion expenditure such as social insurance expenditures. Compared with personal savings, social insurance has the function of risk diversification, and the goal is to maintain a normal standard of living. The rise in housing prices will increase family wealth. The increase in family wealth means that the more it will buffer against future economic shocks, and the unit of housing prices is 10,000 NTD. One unit increase on housing price will increase the protectioin for the family from potential economic risks in the future and thus decrease their expenditures on social insurance. This is why we find that housing price has negative effect on non-consumption expenditure and current transfer expenditures.

4. Conclusions

The reason why housing prices have the largest impact on household consumption is that housing prices are usually the largest asset in the household wealth and have a significant wealth effect. But the wealth effect will be affected due to other factors of passive income. Investment income also has a significant impact on household consumption, but its impact on household consumption is less pronounced than the impact of housing price on household consumption. The possible reason may be due to the limited number of observations. In addition, by including other economic factors, the empirical results show that investment income has an opposite relationship with household consumption. The impact of interest of deposits on household consumption is higher than the impact of household income on household consumption. Even if the income remains unchanged, the increase in the total deposit amount will also increase consumption expenditure.

Household wealth has different impact on household consumption due to different family structures. The impact of housing prices on household consumption is the largest among household wealth. Each family structure has different degrees of influence, and it will vary in degree due to the gender of the heads of households. The family type that has the greatest positive influence on household consumption is the couple family with the male heads of households, whereas single family with female heads has negative effect on household consumption. The reason here is that we believe that the difference in family structures is related to the increase in housing prices and prices driven by economic expansion. Compared with women in married couples, women living alone are more conservative, and the wealth effect of housing prices is subsumed by the rising prices which will reduce consumption. Investment income in different family structures is significantly different from the results based on aggregated samples. For nuclear and couple family with female household heads, the investment income has a

positive impact on household consumption, which is related to women's investment methods and conservative attitudes. The degree of influence of interest of deposits on household consumption will also change due to different family structures. Based on the aggregated family structures samples, the impact of interest of deposits on household consumption is greater than that of household income. However, the differentiation of family structure reveals that the interest of deposits of couple families have a smaller impact than household income. Couple family has higher family income and are less worried about future economic uncertainty. Therefore, household income will affect household consumption more than savings do. It is believed that different family structures have their own consumption patterns. The wealth effect will also vary in degree according to different family structures and economic conditions. The gender of the household heads also has different effects on the wealth effect of housing prices on household consumption.

Moreover, we changed the dependent variables of the model to non-consumption expenditure and current transfer expenditure, which are found to be negatively affected by the housing prices. We believe that the reason for the negative effect may be related to the tax deduction of mortgage and the reduction of social insurance expenditures. The rise in housing prices along with economic growth will not only increase housing loans, but also increase commodity prices, which in turn will increase necessary expenditures and reduce wealth. Many people in Taiwan will use donations and mortgages for tax deductions. An increase in mortgage will increase non-consumption expenditure, and a decrease in tax due to the effect of tax deductions will decrease current transfer expenditure. Social insurance accounts for the largest proportion of non-consumption expenditures and current transfer expenditures, so changes in social insurance expenditures have a greater impact on these two consumptions. The increase in housing price increases household wealth. The amount of household wealth can affect household consumption and the degree of protection of the future. Rising housing prices will increase the guarantee of the future, thereby reducing the expenditure on social insurance, resulting in a decrease in non-consumption expenditure and current transfer expenditure. In this study, we can clearly understand the relationship between housing price and family structures, and the degree to which the gender of heads of households affects household consumption. We also understand that housing prices not only affect total consumption, but also affect other specific consumption.

Finally, we analyze the impact of income disparity on household consumption across the four largest cities in Taiwan. By accounting for the household wealth and income factors across these cities, the study finds that household consumption is significantly affected by the factors such as housing price, investment income, and location of the house. The results show that household consumption expenditures in New Taipei, Taichung, and Kaohsiung are significantly lower than the consumption expenditures in Taipei, the city with the highest salary income in Taiwan. The regression analysis also indicates that after the inclusion of the variables like education level and marital status, household wealth and income still have a significant impact on consumption. The inclusion of the location of the house in the analysis also provides additional insight into the factors influencing household consumption in different cities in Taiwan.

By controlling different family structures, including nuclear family, couple family, single-person family, and three-generation family, we find that the financial affordability of couple families is well above average, which allows them to have more autonomy over investment and spending. Moreover, the study suggests that DINK families in Taiwan have a higher consumption level than other family structures due to their higher income and education levels, as well as their flexible consumption behavior. It is interesting that, contrary to other cities, the Taichung city of couple and single-person family is found to have a significantly positive effect on household consumption, as they have higher flexibility in household consumption than families with children and elderly to take care of. The findings may have implications for policymakers in shaping consumption policies that cater to the different needs of different family structures in Taiwan.

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