

## Becoming a Homeowner and Tightening the Belts in South Korea\*

Taehee Oh\*\*, Jangyoun Lee\*\*\*

This study examines the impact of household indebtedness on consumption by using two measures of household indebtedness: (i) the debt service ratio and (ii) the debt-to-income ratio. Based on South Korean household-level panel data from 2007 to 2021, our estimation results show that South Koreans struggle to climb the property ladder as house prices explode; however, as house-poor families easily fall into the trap of using more credit loans, it becomes harder to afford their daily expenses while repaying their mortgages.

Keywords : debt service ratio; debt-to-income ratio; consumption; household indebtedness  
JEL classification : G51, D12, C23

### I . Introduction

South Korea experienced a rapid increase of household debt after the Global Financial Crisis of 2008. Household debt in South Korea increased from 138% of its net disposal income in 2008 to 198% in 2020 - the highest increase among the 33 OECD countries. Most South Koreans struggle to climb the property ladder as house prices explode; however, house-poor families may easily fall into the trap of using more credit loans with higher interest rates as it becomes harder to afford their daily expenses while repaying their mortgages.

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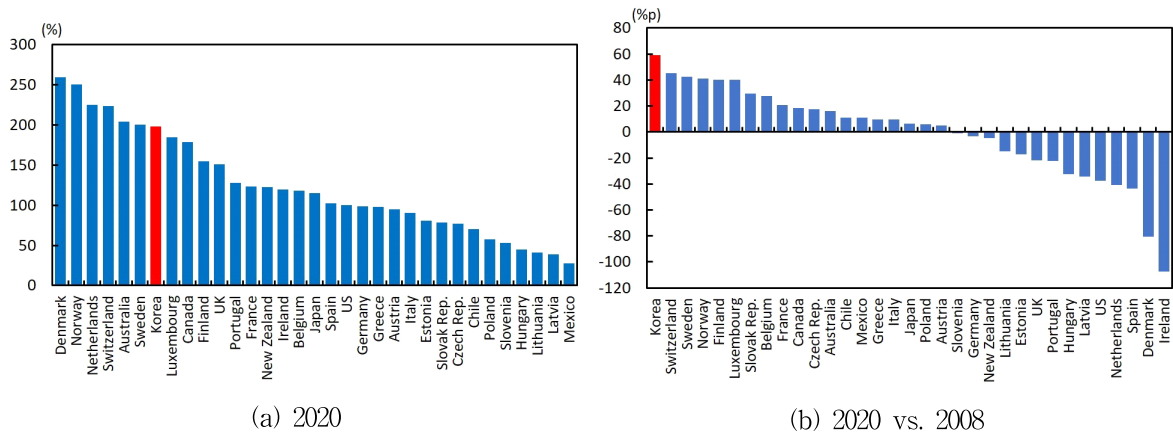
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\*\* Department of Economics, Incheon National University, 119, Academy-ro, Incheon, 22012, South Korea, Email: toh23@inu.ac.kr

\*\*\* Department of Economics, Incheon National University, 119, Academy-ro, Incheon, 22012, South Korea, Email: jylee22@inu.ac.kr

[Figure 1] Household Debt to Net Disposal Income Across OECD Countries



There is close relation between household indebtedness and consumption behaviour (e.g. Andersen et al., 2014; Bunn and Rostom, 2014; Du Caju et al., 2023; Dynan and Edelberg, 2013; Kukk, 2016; Nakajima, 2020; Zhang and Guo, 2020). This paper contributes to the extant literature by exploring potential differential consumption responses of indebted households according to homeownership status. To do this, we decompose household net wealth into assets and liabilities, particularly focusing on the link between household consumption and indebtedness. Also, we use micro data from the Korean Labor and Income Panel Survey (KLIPS) during the period of 2007–2021, focusing on the impact of debt on households with heterogeneous characteristics. The use of the KLIPS allows us to disentangle some of the potential channels generating the relation between household indebtedness and heterogeneous consumption responses of different households. The use of South Korean panel data is particularly suitable for analysing the impact of household indebtedness on consumption because household debt in the country has significantly increased since the 2008 Global Financial Crisis compared to other developed countries.

There is still little consensus on what is the fundamental contributing factor to the Financial Crisis of 2008, however, researchers seem to largely agree on the importance of dramatic expansion of mortgage lending and housing bubble (e.g. Acharya and Richardson, 2009; Mayer et al., 2009). This leads many researchers to study the possible relationship between household indebtedness and their consumption choice. As in Dynan (2012), Andersen et al. (2014), and Kukk (2016), we decompose household net-wealth into assets and liabilities and particularly focus on the link between household consumption and their indebtedness. We first explore potential differential consumption response of indebted households according to homeownership status. After then, we investigate more about heterogeneity across households categorized by age, level of debt, and homeownership status.

Our approach contributes to the literature in several ways. First, we use two different debt variables, debt-to-income ratio (DTI) and debt-to-service ratio (DSR) to investigate the relationship between household consumption and their indebtedness, while controlling the change in earnings and wealth shocks. As the DTI represents households' overall debt sustainability which can potentially restrain consumption through increasing the borrowing constraints or the probability to be constrained, and the DSR relates to the day-to-day sustainability of debt, which limit consumption by directly reducing disposable income (Du Caju et al., 2023; Kukk, 2016).

Second, to the best of our knowledge, this paper is the first seriously looking at potential differential consumption responses between homeowners and non-homeowners.<sup>1)</sup> Similar debt burdens can lead to differential consumption responses, which would rely on homeownership status. For example, non-homeowners would use their debt to smooth consumption over time, however, homeowners would feel difficulties in smoothing their consumption if their indebtedness is closely associated with purchasing a house or have fear of potential credit constraints in the future. Also, consumption of homeowners can potentially respond more or less to the same amount of debt repayment burdens if their demographic and economic characteristics are different from those of non-homeowners. To accommodate potential heterogeneity stemming from homeownership status, we introduce interaction terms between the homeownership dummy and two debt variables.

Third, we investigate the implication of household indebtedness, in line with a wide literature on the relationship between asset values and household spending (e.g. Browning et al., 2013; Campbell and Cocco, 2007). As the literature has pointed out that an increase in housing wealth may lead to a rise in consumption because of wealth and collateral effects, the overlooking of such channels would result in bias. Furthermore, housing assets are a particularly noticeable form of assets in most countries as they generally makes-up the largest proportion of gross assets held. Thus, housing assets have an important implication for the household's balance sheets, and homeownership along side the DSR and DTI is related to heterogeneous consumption responses.

Finally, this study further examines differential consumption responses across households facing different constraints and having different characteristics. For example, if the negative relation between household indebtedness and consumption is mainly caused by credit constraints, the cut in consumption of highly indebted households would be greater. Thus, to reflect such heterogeneities across households, we categorize households into three subgroups in terms of

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1) Although Brown et al. (2012) shows that households with a mortgage can reduce consumption more in a particular environment, they focus on whether consumption responses of households to income shock can differ depending on the homeownership status of households.

homeownership status, household head's age, and the amount of debt, and check whether consumption of households in a particular group responds more or less than others. These additional experiments allow us to identify the underlying mechanism generating the relationship between households' indebtedness and consumption.

Our estimation results yield four insights. First, the burden of debt servicing is associated with the reduction in consumption, and homeowners' consumption response to DSR is not different from that of non-homeowners. We find that for the households making required principal and interest repayment (i.e.  $DSR > 0$ ), the DSR is associated with a reduction in yearly consumption of 1.15%p on average. Second, homeowners face a significant trade-off between housing and consumption. The DTI reduces the consumption growth of indebted homeowners by 0.68%p on average. It is highly likely to be related to buying their home, so there is little room for them to smooth consumption through debt. However, non-homeowners can use their debt to smooth consumption, and thus the relative level of debt is neutral to their consumption. These indicate that to have a better understanding of consumption dynamics, it would not be sufficient to just consider assets or net assets and need to consider the liabilities accompanying the acquisition of assets as well. Third, differential consumption responses between homeowners and non-homeowners are not only caused by over-indebtedness captured by high DSR or DTI but also caused by households' characteristics. Thus, to get consistent estimates, heterogeneities across households are needed to be taken into account. Lastly, the subgroup analysis indicates that the relationship between household indebtedness and consumption is stronger for households who are closer to the end of their lives and do not have too little or too much debt.

**Related literature** There are two strands of different theories explaining the relation between households' indebtedness and their consumption. One strand uses models of household behaviours, especially life-cycle permanent income hypothesis and regards household indebtedness as neutral to consumption choices (e.g. Ando and Modigliani, 1963; Friedman, 1957; Modigliani and Brumberg, 1954). That is, forward-looking rational agents have sufficient information to know their expected life-time income and smooth their consumption over life time. Thus, household debt plays a role in reducing consumption volatility as individuals borrow when their income is low and save when their income is high. Other strand suggests diverse potential channels such as the traditional wealth effect, the fear of potential credit constraints, and the changes in household's debt servicing obligations, which household indebtedness affects their consumption. For instance, Johnson and Li (2007) find that consumption of households with low liquid assets and high DSR is likely to respond more to income changes than the consumption of households with high liquid assets. Brown et al. (2012) show that households with mortgages are more likely to reduce their consumption than those without mortgages.

Dynan and Edelberg (2013) provide that highly indebted households fear of potential future credit constraints as credit providers take into account of households' indebtedness. Thus, the possible refusal to credit causes indebted household to reduce consumption. Kukk (2016) suggests that the rising DSR can hamper consumption.

In particular, as housing prices and debts have risen simultaneously in most countries since the 2000s, studies on the relationship between homeownership, household debt linked to buying a house, and consumption have continued. They find that comparing it with other forms of household debts, the debt held by homeowners (particularly mortgage) and housing asset have several distinguished characteristics. First, mortgages take the highest proportion of household debt in many countries. As many homeowners take mortgage to buy a house, it cannot be directly used to smooth consumption. Second, homeowners treat mortgage repayments as committed expenditure (Chetty and Szeidl, 2007). Thus, in order to meet their current or future repayment burdens, homeowners have incentives to adjust their behaviours, especially by adjusting consumption.<sup>2)</sup> Third, relatively large transaction costs are incurred in the selling of illiquid assets such as house, so highly leveraged households with a large mortgage are more likely to be borrowing constrained and cut in consumption (Landvoigt, 2017). Fourth, some studies identify positive close relation between housing price and household consumption for homeowners. They suggest that the rise in housing price affects consumption via various channels such as conventional wealth effect and improving household balance sheets (Browning et al., 2013; Campbell and Cocco, 2007).

Most studies investigating the effect of household indebtedness on consumption have been analyzing the effect at the macro level, and only some articles have recently taken a microeconomic approach to this issue (e.g. Andersen et al., 2014; Brown et al., 2012; Du Caju et al., 2023; Dynan, 2012; Johnson and Li, 2007; Jord'a et al., 2013; Kukk, 2016; Mian et al., 2013). Our study locates this relatively limited literature as we use micro data from the KLIPS focusing on the impact of debt on households with heterogeneous characteristics.<sup>3)</sup> The use of KLIPS allows us to disentangle some of the potential channels generating the relation between

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2) A household with a large debt hangover would be highly likely to take out the debt to buy a primary residence or a second home for a rental property. In Korea, this channel is particularly important as around 80% of rental properties are owned by households (Zabai, 2017).

3) The use of household-level data is particularly desirable for investigating the impact of debt on households with different characteristics. This is because macro data average out a large degree of heterogeneity across households, however, the use of cross-sectional variation captured by micro survey provides better identification of the link between household credit and consumption and allows researchers to control household characteristics. Micro-data allow researchers to identify heterogeneous responses across households with different features such as level of debt, interest payments, assets, and liabilities. Moreover, the use of micro survey allows for analysing households, which owe the same amount of principals and pay different amounts of interest payments as debts with a higher interest rate cost more than that with a lower rate.

consumption and household indebtedness and causing heterogeneous consumption responses of different households in depth. In particular, considering that, unlike other countries, household debt has continuously increased since the 2008 Global Financial crisis in South Korea, the use of Korean panel data is particularly suitable for analysing the impact of household indebtedness on consumption.

The rest of the paper proceeds as follows. Section 2 explains our empirical model and the data. Section 3 provides estimation results of consumption response to indebtedness of households. Section 5 concludes.

## II. Methodology and Data

### 1. Methodology

Our research approach contributes to the literature in two ways. First, we employ two different debt variables, the DSR and the DTI. Second, to the best of our knowledge, this paper is the first to thoroughly examine potential differential consumption responses between homeowners and non-homeowners.<sup>4)</sup>

The two debt indicators are distinct as follows. First, DTI is the relative size of debt capturing the debt sustainability, whereas DSR depends on principal as well as regular interest payments and measures the financial obligations arising for the debtor and captures the day-to-day sustainability of debt (Du Caju et al., 2023; Kukk, 2016). In addition, as DSR is determined by the principal and interest payments on debt, the required monthly payment depends on various factors such as credit ratings, maturity of debt, and types of interest schedules (i.e. fixed or adjustable rates). This implies that the monthly payment on the same level of debt can differ across households, and these cross-sectional variations provide the identification of related parameters. Thus, our model specification takes into account that different kinds of debt variables can have a differential impact on consumption.

Furthermore, the underlying reason for having debt may also affect debt's influence on consumption. It is possible that non-homeowners can use their debt to smooth consumption over time; however, the consumption of homeowners does not respond, or may even decrease, if they took on debt to purchase a house. Also, homeowners' consumption can potentially

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4) Although Brown et al. (2012) show that households with a mortgage can reduce consumption more in certain environments, they focus on whether consumption responses of households to income shock can differ depending on homeownership status.

respond more or less to the same amount of debt service burdens if their demographic and economic conditions are different from those of non-homeowners. To put it differently, the ownership decision interplays with observable and unobservable household characteristics, which results in behavioural heterogeneities among households facing the same amount of debt and repayment burdens. In this regard, our model introduces interaction terms between homeownership dummy and debt-related variables and accommodates the potential heterogeneity in consumption responses between homeowners and non-homeowners. Thus, our empirical model allows for the differential consumption response of homeowner and non-homeowner households to equal increases of DSR and DTI.<sup>5)</sup>

We use the following empirical specification of the consumption model:

$$\begin{aligned} \Delta c_{it} = & \alpha + \beta \Delta y_{it} + \theta_1 DSR_{it-1} + \theta_2 DSR_{it-1} \times H_{it-1} + \gamma_1 DTI_{it-1} + \\ & \gamma_2 DTI_{it-1} \times H_{it-1} + \phi g_t^H \times HtoI_{it-1} \times H_{it-1} + \theta X_{it} + u_i + \tau_t + \epsilon_{it} \end{aligned} \quad (1)$$

where  $c_{it}$  denotes the log of real consumption of household  $i$  at time  $t$ , and  $y_{it}$  is the log of household disposable income. The two debt indicators,  $DSR_{it-1}$  and  $DTI_{it-1}$ , denote the debt service and debt-to-income ratios of the previous period, respectively. The lagged debt variables are used to avoid endogeneity.  $H_{it-1}$  is a dummy variable that takes the value 1 if a household owned a house in the previous period, and 0 otherwise.  $g_t^H$  is the growth in the house price index.<sup>6)</sup>  $X_{it}$  is a vector containing the exhaustive economic and demographic control variables that likely affect households' consumption choice, including lagged financial assets-to-income ratio,  $FtoI_{it-1}$ , and lagged housing assets-to-income ratio,  $HtoI_{it-1}$ , to control for the link between other household balance components and consumption. Demographic controls include the level of education, marital status, age (including square term), work status (employed or not), gender of the household head, the total number of household members and the number of minor children.  $u_i$  represents the individual fixed effects, which capture time-invariant omitted variables such as preference.<sup>7)</sup>  $\tau_t$  is a time dummy that controls for temporal variation driven by common macro factors.

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5) Our sample shows that the average DTI and DSR of homeowners are 107.1%, and 5.7%, respectively, which is substantially higher than those of non-homeowners (55.1% and 3.7%, respectively).

6)  $g_t^H \times HtoI_{it-1} \times H_{it-1}$  is introduced to capture the realized or unrealized capital gains due to changes in house price. We use the Nationwide House Price Index to capture the nationwide price change.  $g_t^H$  is not multiplied by 100 considering the size of other estimated coefficients

7) As 50.6% of households do not own any debt, the coefficients of  $\gamma_0$ ,  $\gamma_1$ ,  $\theta_0$ , and  $\theta_1$  are estimated just based on indebted households. Thus, following Kukk (2016), we assume that there are unobserved characteristics that affect both household indebtedness and consumption growth and introduce  $u_i$ . The exclusion of individual fixed effects would cause the correlation between error term and explanatory variables.

Our empirical specification also aligns with a vast body of literature on the relationship between asset values and household spending (e.g. Browning et al., 2013; Campbell and Cocco, 2007; Lehnert, 2004). As the literature has pointed out that an increase in housing wealth may lead to a rise in consumption because of the wealth and collateral effects, the overlooking of such channels would result in bias. However, observable wealth changes are not solely caused by house price changes but by a household's endogenous portfolio selection. To handle this endogeneity issue, we exploit exogenous house price index changes,  $g_t^H$ , and compare the consumption response of households with a large amount of housing wealth to those with a relatively small amount of this asset. We also control for the lagged wealth variables in the form of housing and financial assets to capture demographic and economic factors which would normally be omitted from the model.<sup>8)</sup>

## 2. Data

This study uses the data from 2007 to 2021 of the Korean Labor and Income Panel Study (KLIPS). The KLIPS collects data from more than 15,000 households. A key feature of the dataset is that it has finely categorized household-level asset and debt information. Also, as the dataset provides information about the amount of principal and interest payments, we can construct two debt-related variables capturing different aspects of a household's indebtedness: the DTI and the DSR. The former relates to the overall debt sustainability capturing the effect of potential household credit constraints, and the latter relates to the financial burdens associated with debt capturing the day-to-day sustainability of debt. Thus, our dataset is particularly suitable to analyse the effect of an increase in indebtedness on consumption behaviour at the household level.

For this study, we first eliminate households whose head is a student (below age 30) or an old person displaced from a career job (over age 65). Second, we leave 8,844 households who answer two consecutive surveys at least once during the period under this study. We drop households with incomplete data and observations with exceptionally high or low values. We eliminate the top and bottom 1% of the distribution of consumption growth, income growth, DSR, and DTI. We finally use 8,712 households and their 57,647 observations. Table 1 shows the number of observations dropped at each stage of sample selection.

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8) As shown in Table 4, the homeownership is positively associated with household income, assets and debt. This implies that asset holdings can be related to heterogeneity in consumption responses.



&lt;Table 1&gt; Sample Selection

	Household		Observations	
Raw	15,173		114,622	
1. HH head aged below 30 or over 65	10,748	(4,425)	74,484	(40,138)
2. Did not answer two consecutive years at least once	8,844	(1,904)	71,772	(2,712)
3. Outliers and missing observations	8,689	(155)	57,275	(14,497)

*Note:* The parentheses show the numbers of households and their observations excluded at each step

The main goal of this study is to identify the effect of household indebtedness on consumption response. To estimate the related parameters, our primary interest is focused on the relationship between household consumption and two different types of debt variables: the DSR and the DTI. To obtain consistent estimators, we control for a series of covariates such as household assets, debts, income, and demographics. Table 2 provides summary statistics of the main variables that we employ in this study. All of the variables expressed in growth rate and ratio are multiplied by 100 except for the Nationwide House Price Index growth rate, and all monetary variables are converted to 2020 values using the consumer price index. We describe some of these variables as follows.

&lt;Table 2&gt; Demographics of the Entire Sample

	Mean	Std.		Mean	Std.
$\log c_{it}$	7.9	(0.52)	$University_{it}$	28.8	(45.3)
$\log y_{it}$	8.3	(0.66)	$Unemployment_{it}$	13.2	(33.9)
$DSR_{it}$	4.9	(9.3)	$Couple_{it}$	76.8	(42.2)
$DSR_{it} > 0$	12.1	(11.3)	$Num - HH_{it}$	3.1	(1.2)
$DTI_{it}$	87.8	(164.2)	$Num - Immature_{it}$	0.8	(1.0)
$DTI_{it} > 0$	178.5	(196.5)	$SE_{it}$	24.3	(42.9)
$FtoI_{it}$	51.3	(78.2)	$Female_i$	16.3	(37.0)
$RtoI_{it}$	390.0	(581.6)	$Age_{it}$	48.7	(9.5)

*Notes:*  $University_{it}$  takes the value of 1 if the household head's educational attainment is equal to or higher than four-year university, and 0 otherwise.  $Unemployment_{it}$  includes people who are unemployed.  $SE_{it}$  takes the value of 1 if the household head is self-employed, and 0 otherwise.

**Assets and Debts** Our dataset contains finely categorized household assets and debts. Thus, we need to clarify how we calculate household-level debt and assets. On the liability side, household debt is calculated by the summation of financial debt, non-financial debt, personal debt, housing deposits owed to renters, and other loans. As the dataset also provides information about the amount of principal and interest repayments, we can construct not only

DTI but also DSR (household income is defined below). On the asset side of a household balance sheet, we divide a household's assets into two groups: real estate and financial assets<sup>9)</sup>. The summation of housing assets and non-housing assets is defined as household real estate assets.<sup>10)</sup> As housing assets held by South Korean households comprise the majority of overall real estate assets, we refer to real estate assets as housing assets henceforth. Assets relatively easily converted into cash categorized as financial assets.<sup>11)</sup>

**Consumption and Income** Consumption is the level of household consumption expenditure excluding social contributions. After-tax (disposable) income is the sum of comprehensive inflows including labour income, financial income, asset income, income from social security benefits, transfers, and other income excluding principal and interest payments. The main limitation of our dataset is that it does not allow us to differentiate whether debt is secured or unsecured, as it does not provide information on whether the loan is a credit loan or a loan secured by a specific asset. Thus, we cannot directly know whether the cause of over-indebtedness is linked to mortgage loans or any other purpose. However, examining the changes in the amount of debt and principal and interest payments before and after becoming a homeowner confirms that there is a close correlation between household indebtedness and homeownership status. Table 3 shows the amount of debt and principal and interest repayments for the year of purchasing a house and the two years immediately preceding it. Compared to the two years prior to the purchase of a house, the amount of debt and principal and interest repayments in the previous year increased only by 22.2% (from 27.5 to 33.6 million KRW) and 10.2% (from 1.7 to 1.9 million KRW), respectively. However, after purchasing a house, these amounts increase by 238.4% (from 33.6 to 93.1 million KRW) and 217.4% (from 1.9 to 5.4 million KRW), respectively. This implies that most of the homeowners' debt is composed of mortgages and thus supports treating most of the homeowners' debts as mortgage debt.<sup>12)</sup>

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9) South Korean households' assets can be divided into three groups: real estate, financial assets, and housing deposits. Housing deposits comprise a large proportion of household assets in South Korea. Instead of buying a house or paying monthly rent, South Korea has a third option, the so-called 'Jeonse'. A Jeonse renter gives a lump-sum deposit to the homeowner at the beginning of their occupancy (two-year contracts are common), and the owner has to return the same amount upon the end of the lease period. The deposit typically ranges between 50% and 80% of the market value of the housing unit. In the sample, the shares of housing assets, financial assets, and housing deposits on average are 78.2%, 11.4%, and 10.4%, respectively. However, the deposit cannot be easily converted into cash and does not yield any return. Thus, this study does not pay much attention to housing deposits.

10) In South Korea, most real estate assets are in the form of houses: Of the households that responded that they owned real estate in KLIPS, 96.8% owned houses, 2.9% owned buildings, and 0.3% owned forests and land.

11) Financial assets include checking accounts, stocks, bonds, mutual funds, savings insurance plans, uncollected loans and other financial assets.

&lt;Table 3&gt; Changes in Debt and Debt Service Before Buying a House

	-2 year	-1 year	0 year
Debt(mil. KRW)	27.5	33.6	93.1
Debt Service(mil. KRW)	1.7	1.9	5.4

Before we conduct regression analysis, we divide the sample into subgroups according to three dimensions: homeownership status, age, and amount of debt. For homeownership status, our sample is divided into two groups based on homeownership status of the previous period: homeowners and non-homeowners. For age, our sample is divided into two categories based on the household head's age: below 50 and 50 or older. For the amount of debt, we categorize our sample into three groups: 'low', 'medium' and 'high'. A household is categorized into the low-, medium-, or high-debt group if its average amount of debt is in the bottom 25%, 25-75% range, or top 25% of the average debt distribution, respectively.

Table 4 provides the mean value of households' characteristics for the entire sample and the three different subgroups. Columns (2)-(3) show some clues for understanding why richer homeowners are more likely to reduce consumption than non-homeowners. Compared with non-homeowners, homeowners consume more, earn more and hold more financial and housing assets on average. However, their consumption growth rate is approximately 1% lower than non-homeowners. The difference in the income growth rate may account for this; however, the numbers in the Table 4 also suggest the following possible alternative explanations.

First, as a high amount of debt raises concerns about being borrowing constrained in the future, highly indebted households are more likely to hold back consumption (Dynan and Edelberg, 2013). In our sample, homeowners hold more debt in both absolute and relative terms.<sup>13)</sup> Thus, homeowners are credit constrained at a higher probability and reduce their consumption more. Second, as homeowners are highly indebted on average, they spend a large fraction of their income on servicing debt. This implies that homeowners have less money to consume and thus are more conservative on spending (debt distress effect).<sup>14)</sup> Third, highly indebted homeowners have incentives to create sufficient savings buffers to secure their service burdens. Although indebted non-homeowners also can experience similar debt repayment difficulties, they can adjust their housing costs more flexibly. Thus, the consideration of the need for securing

12) Du Caju et al. (2023), using the Belgium Household Finance and Consumption Survey, show that highly indebted households are more likely to have collateralized loans, and these loans are highly likely to be used for housing-related expenditures.

13) The average household income of homeowners is 1.4 times greater than that of non-homeowners; however, homeowners take on 3.1 times more debt and a large share of their assets is in the form of housing assets.

14) Kukk (2016) points out that households with a high DSR are more likely to spend prudently, referred to as the debt distress effect.

&lt;Table 4&gt; Summary Statistics of Major Variables by Subgroup

(million KRW, %)

	Entire	Homeownership		Age		Debt		
		(None)	(Owner)	(Young)	(Old)	(Low)	(Medium)	(High)
Consumption	29.6	25.0	32.5	30.7	28.4	23.6	29.2	36.9
Consumption growth	0.7	1.3	0.4	2.8	-1.6	0.2	0.8	1.2
Income	49.4	39.7	55.1	50.1	48.7	40.4	48.2	61.4
Income growth	2.1	2.7	1.7	3.1	0.9	1.9	2.4	1.4
Homeownership	63.2	0.0	100.0	56.4	70.7	52.3	60.8	79.6
Debt	46.0	19.5	61.4	50.5	41.0	0.4	24.7	138.2
Debt payment	2.6	1.5	3.3	3.1	2.2	0.1	2.0	6.6
Real estate	209.5	10.7	325.4	178.7	243.8	116.3	165.6	399.2
Financial assets	30.7	20.6	36.5	27.7	33.9	31.4	28.5	34.7
Age	48.7	46.4	50.1	41.0	57.3	50.9	48.5	47.1
DSR	4.9	3.7	5.7	5.6	4.2	0.3	4.6	10.4
DSR>0	12.1	11.0	12.6	12.2	12.0	7.1	10.1	15.4
DTI	87.8	55.1	107.1	91.9	83.3	2.2	63.4	230.8
DTI>0	178.5	140.5	194.4	176.3	181.4	33.7	115.1	284.2
# of Observation	57,275	21,881	35,394	38,884	18,391	14,115	29,411	13,749

*Notes:* A household is defined as young (old) if the head of household's age is below 50 (50 or older). A household is categorized into the low-, medium-, or high-debt group if its average amount of debt is in the bottom 25%, 25-75% range, or top 25% of the average debt distribution, respectively

risk related to owning a house causes qualitative and quantitative differences in the consumption behaviour of homeowners (Percoco, 2015). Finally, a home can be used as collateral to take out additional loans and to smooth consumption; however, this is not an option for those who are already heavily indebted.

Columns (4)-(8) suggest that households' consumption response to debt depends on household characteristics. For example, columns (4)-(5) show that there are considerable heterogeneities across households in different age groups. Although households in the older group earn similar incomes and hold far more assets, their consumption growth rate is negative. Columns (6)-(8) also provide some clues as to why various household characteristics must be considered when analysing the relationship between indebtedness and consumption. Households with more debt have more housing assets, earn more, are younger, and are more likely to own a house. These would be positively associated with rapid consumption growth. However, households in the medium-debt group tend to experience more rapid income growth and hold the least amount of financial assets. As there is no unidirectional relationship among factors, the additional

consideration of household characteristics sheds light on the underlying mechanism of the propagation channel between household indebtedness and consumption.

Figure 2 shows the relationship between household indebtedness and consumption level across the subgroups of households. First, it confirms that for households in the homeowner, young, and medium-debt subgroups, an increase in debt leads to a decrease in consumption, by and large. For example, panel 2a (2b) shows that consumption of homeowners with a DSR (DTI) of greater than 40% (400%) is 13.1% (6.2%) lower than homeowners whose DSR ranged from 0% to 10% (from 0% to 100%). This tendency is observed for households belonging to the young or medium-debt groups. Second, a linear rather than non-linear relationship is observed between household indebtedness measured by either DSR or DTI and consumption. Last, Figure 2 suggests that there are considerable differences between households with no debt and households with positive debt.<sup>15)</sup> These relationships are common regardless of homeownership status, age or level of debt.

### III. Estimation Results

#### 1. Household indebtedness and consumption

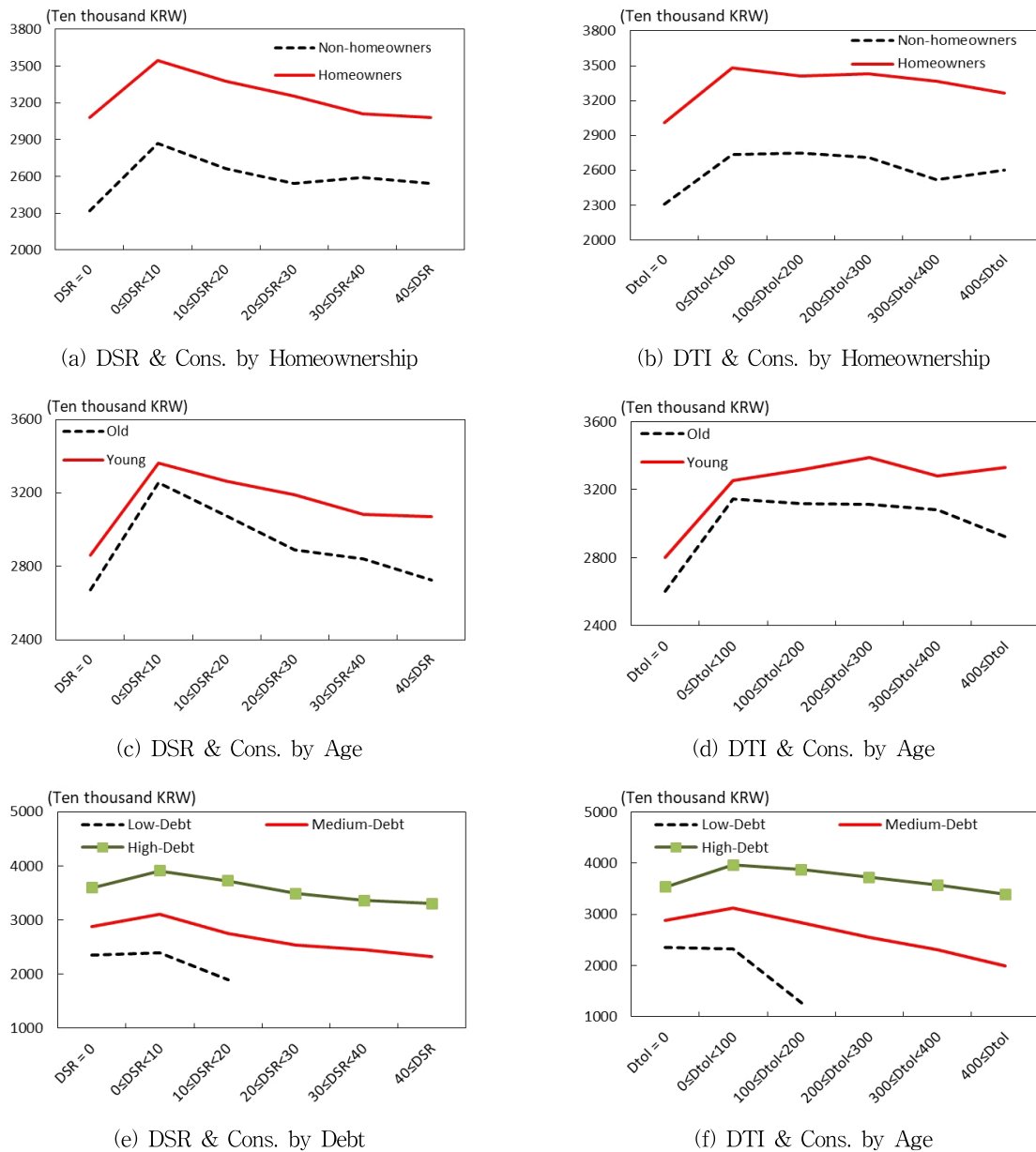
The main objective of this study is to investigate the link between household indebtedness and consumption growth. We use two debt variables, DSR and DTI, and estimate the related coefficients  $\gamma_0$ ,  $\gamma_1$ ,  $\theta_0$ , and  $\theta_1$  to capture the effect of relative size of debt and its day-to-day sustainability on the growth of consumption across homeowner and non-homeowners. Column (1) of Table 5 reports estimates from the baseline regression specified in equation (1).

The estimated coefficient of  $DSR_{it-1}$  reveals that the burden of debt servicing is associated with a reduction in consumption. Households consider debt servicing to be necessary expenses that must be paid, and households facing high service burdens become more cautious on consumption. The estimated coefficient of the lagged DSR,  $\theta_0$ , implies that all else being equal, having a 1%p increase in DSR results in a 0.095%p decrease in consumption growth relative to a household with no debt change. When taking into account the average DSR of households with a DSR greater than 0% (i.e.  $DSR > 0$ , 12.1%), the DSR is associated with a reduction in yearly consumption of 1.15%p. With regard to the estimated coefficient of the lagged DSR

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15) Jappelli (1990) shows that the demographic and economic characteristics of households with no debt are different from those of households with positive debt payments. He finds that indebted households's heads have a high school degree, earn less, and are less likely to be married.

[Figure 2] Household Indebtedness and Level of Consumption by Subgroup



interaction with the homeownership dummy,  $\theta_1$ , the sign of the estimated coefficient is positive, yet statistically insignificant.

Consumption of more indebted homeowners is no more sensitive to DSR than that of households with less debt is probably due to the fact that homeowners' day-to-day debt sustainability does not seem particularly different (or even better) than that of non-homeowners. This is because homeowners earn more and have more assets on average, as described in Table 4. This implies that as the creditworthiness of homeowners is better, the interest rate on loans applied by financial institutions to homeowners is relatively low, and thus

the average DSR of homeowner households is 13.7% which is just 1.2%p higher than that of non-homeowners. As a result, relative debt service burdens of homeowners and concerns about day-to-day debt sustainability are not significantly different from those of non-homeowners.

Looking at the relationship between the relative level of debt and consumption, spending responses of indebted households differ depending on whether a household owns its home or not. We find that the DTI is neutral to consumption growth of non-homeowners; however, there is a trade-off between homeowners' DTI and consumption. The estimated coefficient of the lagged DTI,  $\gamma_0$ , implies that non-homeowners use debt to smooth consumption, and thus the level of debt does not affect the growth of consumption, in line with the prediction of the life-cycle-permanent income hypothesis (Ando and Modigliani, 1963; Friedman, 1957; Modigliani and Brumberg, 1954).

However, the life-cycle-permanent income hypothesis does not seem to sufficiently describe the behaviours of homeowners holding relatively high debt in our sample. The estimated  $\gamma_0$  and  $\gamma_1$  indicate that the average indebted homeowners' DTI of 194.4% in the sample is associated with a drop of the yearly consumption growth rate by 0.68%p(=  $(0.0017 - 0.0052) \times 194.4$ ). This implies that the consumption of homeowners with a large amount of debt respond more because of current liquidity constraints or concerns about future ones, in line with the findings of Dynan (2012), Kukk (2016), Bunn and Rostom (2014) and Baker (2018). They find that households having relatively higher debt reduce their consumption more than others. In the context of this study, as homeowners with relatively high debt overhang are more likely to have taken on debt to buy a house, there is relatively little room for homeowners to smooth consumption through debt, thus making it difficult for highly indebted homeowners to smooth their consumption over time. Although homeowners hold not only housing but also more financial assets on average, they take on a large amount of debt relative to their financial assets. In addition, as housing assets are relatively illiquid and their transactions involve high cost, concerns about becoming constrained in the future cause homeowners to reduce consumption in the present (Kaplan et al., 2014).

Columns (2)–(6) of Table 5 report the results of a robustness check of our findings. Columns (2)–(4) present the estimations for different combinations of the controls by excluding one control variable at a time: column (2) excludes DSR; column (3) excludes DTI, and column (4) excludes the interaction between homeownership dummy and the two debt variables. Column (5) shows the estimation with additional job characteristics.<sup>16)</sup> Column (6) provides the ordinary least squares estimates.

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16) The model specification additionally controls for occupation, industry, irregular worker, large firm and government job dummies.

&lt;Table 5&gt; Estimation Results

	(1) Baseline	(2)	(3)	(4)	(5)	(6)
$\Delta y_{it}$	0.147*** (0.0039)	0.145*** (0.0039)	0.147*** (0.0039)	0.147*** (0.0039)	0.147*** (0.0039)	0.151*** (0.0037)
$DSR_{it-1}$	-0.0950** (0.0292)	-	-0.0830*** (0.0242)	-0.0824*** (0.0182)	-0.0950** (0.0294)	-0.0760*** (0.0212)
$DSR_{it-1} * H_{it-1}$	0.0193 (0.0360)	-	-0.0245 (0.0288)	-	0.0190 (0.0362)	0.0176 (0.0259)
$DTI_{it-1}$	0.0017 (0.0025)	-0.0019 (0.0021)	-	-0.0023# (0.0013)	0.0017 (0.0025)	0.0035# (0.0018)
$DTI_{it-1} * H_{it-1}$	-0.0052# (0.0028)	-0.0043# (0.0022)	-	-	-0.0053# (0.0028)	-0.0048* (0.0020)
$g_t^H * HtoI_{it-1} * H_{it-1}$	0.0140* (0.0070)	0.0138* (0.0070)	0.0136# (0.0070)	0.0134# (0.0070)	0.0135# (0.0070)	0.0146* (0.0061)
$HtoI_{it-1}$	0.0007 (0.0005)	0.0006 (0.0005)	0.0003 (0.0005)	0.0004 (0.0005)	0.0007 (0.0005)	-0.0003 (0.0003)
$FtoI_{it-1}$	-0.0006 (0.0023)	-0.0004 (0.0023)	-0.0005 (0.0023)	-0.0006 (0.0023)	-0.0006 (0.0023)	-0.0017 (0.0014)
R-squared	0.060	0.059	0.059	0.059	0.062	0.068
Fixed Effect	O	O	O	O	O	X
# of Obs.	57,275	57,275	57,275	57,275	57,275	57,275

Notes: Standard errors in parentheses are clustered at the household level: \*\*\* p<0.001, \*\* p<0.01, \* p<0.05, # p<0.10. All regressions include the following additional controls: age, age-squared, dummies for marital status and educational attainment, and a full set of year dummies. Column (6) also includes control dummies for occupation, industry and job characteristics (irregular work, government officer and large firm).

Columns (2)–(4) demonstrate that the exclusion of some important variables results in bias, particularly on the estimates of variables related to household indebtedness. When the DSR is excluded from the model (column [2]), the estimated coefficient for DTI is biased to the downside as the DSR is positively correlated with DTI and negatively correlated with consumption. As a result, the coefficient on DTI not only reflects its own negative relation but also includes the negative relationship between DSR and consumption growth.<sup>17)</sup> Column (3) confirms a similar potential bias caused by the omission of DTI. Column (4) shows that the estimated coefficients of DSR and DTI are biased to the downside as the model fails to capture the heterogeneity between homeowners and non-homeowners. In particular, if we take the

17) As DSR is omitted from the model, the DTI of homeowners (non-homeowners) is associated with a yearly consumption decline of 0.83%p (decrease of 0.27%p), which is 0.14%p (0.51%p) lower than the response in the baseline estimation.



results under specification (4) at face value, we would wrongly conclude that between the two debt variables, the amount of debt is not important, and only DSR is important for explaining consumption growth. Column (5) shows that additional controlling for job characteristics only causes marginal changes in the estimated coefficients.

Column (6) shows that the DTI of non-homeowners is positively associated with consumption growth when individual fixed effects are excluded from the model. The result implies that there are heterogeneous consumption responses between homeowners and non-homeowners to DTI. The rise in the relative amount of debt leads homeowners to decrease consumption; however, consumption of non-homeowners positively responds to a rise in debt, in line with Du Caju et al. (2023). The exclusion of individual fixed effects causes some unobserved factors, such as preference for consumption, and attitude toward debt and savings, to be included in the error term. These unobserved factors might be correlated with other explanatory variables, demonstrating the threat of an endogeneity problem and selection bias.

## 2. Subgroup analysis

We carry out robustness check to further investigate the underlying mechanism of the effect of household indebtedness on consumption growth by using the categories of households for the three dimensions: age, level of debt, and homeownership status. Table 6 summarizes the estimation results of equation (1) on the subgroups of our sample.<sup>18)</sup> The baseline results presented in the first column of Table 5 are copied into column (1) of Table 6. Columns (2) and (3) report the results for the age subgroup. Columns (4)–(6) and (7)–(8) show estimates for the subgroup categorized by the amount of debt and homeownership status, respectively.

The estimates for the subgroup categorized by age (columns [2]–[3]) suggest that the relationship between household indebtedness and consumption observed under the baseline specification still holds by and large. However, regardless of homeownership status, the consumption of households with young heads does not respond to DTI. This implies that the negative association largely stems from households who are closer to the end of their lives, as elderly people, who may have an incentive not to leave debt for their children, reduce debt by cutting expenditure with age.<sup>19)</sup>

Columns (4)–(6) present the estimates for the subgroup categorized by the level of debt.

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18) The full estimation results of Table 6 can be provided by the researchers upon request.

19) The negative consumption response to DTI is more pronounced for household heads aged 50–59. As a large share of South Korean workers retire from their careers in their 50s, they have greater incentives to deleverage while they are still working. Thus, when compared with the overall sample of elderly homeowners aged 50–65, homeowners aged 50–59 reduce their consumption growth rate by 1.37 times more.

These indicate that our baseline result is not mainly driven by households with too little or too much debt. The estimated coefficients show that the negative effect of DSR and DTI on consumption growth is particularly strong for households categorized by medium-debt group.

The extent of the consumption response of households of high-debt groups is equivalent to that of medium-debt group; however, the coefficient on  $DTI_{it-1} \times H_{it-1}$  of high-debt group is not statistically significant. In addition, the estimated coefficients show that households in the

low-debt group seem to have sufficient capacity to sustain their debt and repayment burdens; thus, their consumption does not appear to be constrained and does not respond to DTI and DSR. This is caused by the fact that low-debt households earn 87% of medium-debt households; however, low-debt households not only hold a greater amount of financial assets but also take on far less debt (see Table 4). As a result, their average DSR and DTI are only 0.3% and 2.2%, respectively, which is far less than those of medium-debt households (4.6% and 60.8%). Also, comparing medium-debt group with households in the high-debt group, high-debt households take on 8.5 times more debt, and their DTI and DSR are 4.0 times and 2.5 times greater, respectively. However, households in the high-debt group earn more and hold a greater

<Table 6> Subsample Analysis: Regression of Consumption Growth and Household Indebtedness

	Baseline	Age Group		Level of Debt			Homeownership	
		Young	Old	Low	Medium	High	Non-owner	Owner
$\Delta y_{it}$	0.147*** (0.0039)	0.152*** (0.0058)	0.140*** (0.0055)	0.142*** (0.0079)	0.146*** (0.0057)	0.153*** (0.0075)	0.1464*** (0.0064)	0.147*** (0.0052)
$DSR_{it-1}$	-0.095** (0.0292)	-0.109** (0.0377)	-0.084# (0.0509)	-0.042 (0.1020)	-0.103** (0.0355)	-0.102# (0.0603)	-0.102** (0.0315)	-0.076** (0.0251)
$DSR_{it-1} * H_{it-1}$	0.0194 (0.0360)	0.0281 (0.0467)	0.0110 (0.0616)	0.0552 (0.2150)	0.0424 (0.0497)	0.0201 (0.0650)	- -	- -
$DTI_{it-1}$	0.0017 (0.0025)	-0.0006 (0.0033)	0.0038 (0.0040)	0.0149 (0.0313)	0.0042 (0.0038)	0.0003 (0.0036)	0.0019 (0.0028)	-0.0043** (0.0015)
$DTI_{it-1} \times H_{it-1}$	-0.0052# (0.0028)	-0.0033 (0.0037)	-0.0075# (0.0045)	-0.0775 (0.0488)	-0.0100* (0.0046)	-0.0031 (0.0039)	- -	- -
R-squared	0.068	0.058	0.064	0.062	0.059	0.064	0.059	0.062
# of Obs.	57,275	38,884	18,391	14,115	29,411	13,749	21,881	35,394

Notes: Standard errors in parentheses are clustered at the household level: \*\*\* p<0.001, \*\* p<0.01, \* p<0.05, # p<0.10. All regressions include the following additional controls: age, age-squared, dummies for marital status and educational attainment, and a full set of year dummies. A household is defined as young (old) if the head of household's age is below 50 (50 or older). A household is categorized as the low-, medium-, or high-debt group if its average amount of debt is in the bottom 25%, 25-75% range, or top 25% of the average debt distribution, respectively. A household is categorized as owner (non-owner) if it owns a house at time  $t - 1$ .

amount of housing and financial assets. Households with substantial amount of debt also have a better economic standing measured by various characteristics such as income, assets, and credit ratings; thus, they are not more constrained.

Columns (7) and (8) of Table 6 provide estimates for households grouped by homeownership status. The estimated coefficients on DSR and DTI are both quantitatively and qualitatively similar to those in the baseline specification. We can draw the same conclusion that highly leveraged homeowners decrease in their consumption more than less leveraged non-homeowners. This suggests that there are significant differences between homeowners and non-homeowners, and that our baseline specification, which reflects the observed and unobserved characteristics of these households, is appropriate for analysing the relationship between household indebtedness and consumption growth.

### 3. Robustness check

By using threshold analysis, we further conduct an experiment to verify the validity of our assumption that homeownership rather than over-indebtedness is significant causing the nonlinear consumption response across households.<sup>20)</sup> To do this, we substitute the homeownership variable with a DTI or DSR-related dummy and test whether there is non-linearity in the effect of over-indebtedness on consumption response. The underlying assumption of this experiment is that the non-linearity in the effect of household indebtedness on consumption growth is not actually caused by the differential behaviours between homeowners and non-homeowners but by the extent of household indebtedness.<sup>21)</sup> Thus, we introduce a dummy variable for households with a DTI or DSR higher than a certain threshold as follows:

$$\Delta c_{it} = \alpha + \beta \Delta y_{it} + \theta_1 DSR_{it-1} + \theta_2 DSR_{it-1} * I_{\{DTI_{it-1} \geq K\}} + \gamma_1 DTI_{it-1} + \gamma_2 DTI_{it-1} * I_{\{DTI_{it-1} \geq K\}} + \phi g_t^H \times HtoI_{it-1} \times H_{it-1} + \theta X_{it} + u_i + \tau_t + \epsilon_{it} \quad (2)$$

$$\Delta c_{it} = \alpha + \beta \Delta y_{it} + \theta_1 DSR_{it-1} + \theta_2 DSR_{it-1} * I_{\{DSR_{it-1} \geq K\}} + \gamma_1 DTI_{it-1} + \gamma_2 DTI_{it-1} * I_{\{DSR_{it-1} \geq K\}} + \phi g_t^H \times HtoI_{it-1} \times H_{it-1} + \theta X_{it} + u_i + \tau_t + \epsilon_{it} \quad (3)$$

20) Choi and Son (2016) suggest that households with a DSR or DTI greater than a certain threshold level reduce consumption. They find that if a household's DSR is lower than 27% or its DTI is lower than 210%, household indebtedness is positively associated with consumption.

21) In other words, we cannot completely rule out the possibility that differential consumption responses between homeowners and non-homeowners to the same level of indebtedness expressed by DSR and DTI would actually be the cause of non-linear consumption responses according to DTI or DSR rather than homeownership.

where  $I_{\{DTI_{it-1} \geq K\}}$   $I_{\{DSR_{it-1} \geq K\}}$  is a dummy variable that takes the value 1 if a household is indebted with DTI (DSR) in the previous period higher than the given threshold  $K$ , and 0 otherwise. This implies that a household is categorized as an over-indebted household if its DTI or DSR is over a certain threshold  $K$ .

These regressions are performed separately for different thresholds. The threshold of DTI can have values 150%, 200%, 300%, 400%, or 500%, and the threshold of DSR can vary from 10% to 40% by increments of 10%.<sup>22)</sup> As homeowners and non-homeowners respond differently to the same level of DTI under the baseline specification, we focus this analysis on the effect of DTI on consumption growth. Table 7 summarizes the results.<sup>23)</sup> Panels (A) and (B) show that, regardless of the use of a DTI or DSR dummy for capturing non-linearity in consumption response, none of the coefficients on  $DTI$  and  $DTI_{it-1} * I_{\{\cdot\}}$  are statistically significant except for the coefficient on the  $DTI_{it-1} * I_{\{DTI_{it-1} \geq 150\}}$  in panel (A). Overall, we cannot find nonlinearity of consumption growth at a certain level of DTI and DSR. These results also

<Table 7> Threshold Analysis on DTI and DSR

Panel (A)	K=150	K=200	K=300	K=400	K=500
$DTI$	-0.0078 <sup>#</sup> -(0.0046)	-0.0031 -(0.0035)	-0.0041 -(0.0025)	-0.0032 -(0.0021)	-0.0024 -(0.0019)
$DTI_{it-1} * I_{\{DTI_{it-1} \geq K\}}$	0.0053 -(0.0045)	0.0004 -(0.0035)	0.0017 -(0.0026)	0.0005 -(0.0023)	-0.0003 -(0.0022)
Panel (B)	K=10	K=20	K=30	K=40	-
$DTI$	-0.0011 (0.0017)	-0.0013 (0.0015)	-0.0012 (0.0014)	-0.0012 (0.0013)	- -
$DTI_{it-1} * I_{\{DSR_{it-1} \geq K\}}$	-0.0017 (0.0021)	-0.0012 (0.0022)	-0.0023 (0.0024)	-0.0030 (0.0028)	- -

Notes: Standard errors in parentheses are clustered at the household level: <sup>#</sup> p<0.10. All regressions include the following additional controls:  $\Delta y_{it}$ ,  $DSR_{it-1}$ ,  $DSR_{it-1} * I_{\{DTI_{it-1} \geq K\}}$  (or  $DSR_{it-1} * I_{\{DSR_{it-1} \geq K\}}$ ),  $g^H * HtoI_{it-1} * H_{it-1}$ ,  $HtoI_{it-1}$ ,  $FtoI_{it-1}$ , age, age-squared, dummies for marital status and educational attainment, and a full set of year dummies. Each column of panel (A) shows the DTI threshold varying from 150% to 500%. Each column of panel (B) shows the DSR threshold varying from 10% to 40%.

22) In our sample, the average of indebted non-homeowners' DTI, which is lower than that of homeowners, is slightly below 150%. Thus, we set the threshold point from 150% which is in the top 65% of the indebted households' DTI distribution of indebted households. Threshold points of 200%, 300%, 400%, and 500% of DTI are in the top 31%, 18%, 11%, and 7% of the distribution, respectively. In addition, 10%, 20%, 30%, and 40% of DSR are in the top 45%, 19%, 9%, and 3% of the principal and interest repaying households' DSR distribution, respectively.

23) The full estimation results of Table 7 can be provided by the researchers upon request.

illustrate that heterogeneous consumption responses between homeowners and non-homeowners to DTI are not caused by relatively high level of indebtedness of homeowners but by their distinguishing characteristics. Thus, the estimated coefficients are biased, and we wrongly concluded that the household consumption growth is neutral to the relative amount of debt.

#### IV. Conclusion

South Koreans struggle to climb the property ladder as house prices explode. However, as house-poor families easily fall into the trap of using more credit loans, it becomes harder to afford their daily expenses while repaying their mortgages. In this regard, this paper investigates the effect of household indebtedness on consumption by using two measures of household indebtedness: the DSR and the DTI. Based on South Korean household-level panel data from 2007 to 2021, the estimation results suggest that, regardless of homeownership status, more servicing of the debt results in more conservative spending behaviours. In contrast, the homeownership status leads to heterogeneous consumption responses to the relative level of debt. The consumption of non-homeowners is neutral to DTI as they can use their debt to smooth consumption, whereas the fear of potential credit constraints leads homeowners with relatively high debt to consume less. This indicates that house-poor South Koreans tighten their belts to pay back mortgages.

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