Discussion Paper ERU/2014 – 08
August, 2014

Asymmetry in the Extracted Housing Wealth Effects on Consumption

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Abstract:

This paper investigates the asymmetric effect of extracted housing wealth on consumption under the consumption-smoothing and financial motivation of households for two most developed economies viz., the USA and UK. By applying the methodology of two-regime threshold cointegration in vector error correction model developed by Hansen and Seo (2002), the paper finds that the motivation behind withdrawing equity depends on the threshold variable of return differential between mortgage and saving. The findings clearly establish that a very strong asymmetric effect of housing wealth on consumption exists for both the countries.

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Introduction

The household's desire to access home equity during times of falling mortgage interest rate provides a net economic stimulus. This act of refinancing has been increasing since early 1990s in the developed countries. This period was not merely a period of low mortgage rate, it was also a period when mortgage markets were undergoing structural changes. In their paper Bennett et al. (1998) have shown that accessing home equity was much easier in the 1990s relative to the 1980s. There are very few theoretical and empirical works that highlight the reasons as to why households may choose to refinance. There are basically two motivations. The first one is called the financial motivation, it states that in periods of relatively low mortgage returns, households would refinance to make a lower stream of mortgage payments and consequently receive an increase in life time wealth. The other motivation is that households may refinance in order to be able to access accumulated home equity, and this is referred to as the consumption smoothing motivation. Households receiving negative income shocks and having very limited liquid assets to buffer the shocks are more likely to refinance and access home equity. This consumption smoothing motivation can also explain the fact that some households will refinance even in a world of stable or rising mortgage returns. Hurst and Stafford (2004) have shown that in periods of negative income shocks, household can sustain their consumptions by either drawing down their liquid assets or extracting housing equity. Hence it can be argued that the decision to withdraw equity is driven by consumption-smoothing motivation.

On the other hand, much of the work on mortgage refinancing has focused on purely financial motivation (see, for instance, Curley and Guttentag (1974), Green and Shoven (1986), and Quigley (1987) and Angelini and Simmons (2005)). When mortgage returns are relatively higher than returns on bond or other equity, households do not want to withdraw equity for financial gain. In case they still do so, then it is due to consumption smoothing motivation alone. It suggests that when difference between mortgage returns and returns on savings exceeds a particular value, the housing equity withdrawal may significantly affect consumption. This returns differential can serve as a threshold variable to identify different motivations. It is, therefore, important to consider this aspect of differential returns for these two motivations in studying the relationship between extracted housing wealth and consumption. It may be noted that this fact of differential returns is the cause of asymmetry in this relationship.

Some studies in the past have noted that there exists co-movement between consumption and house price, and thus have found long-run relations involving them. One possible explanation advocated for this finding is that house price is an asset price and that it largely reflects macroeconomic conditions with no special effect of its own, and hence much of the co-movement of house price and consumption is driven by common movement prevalent in other variables. But there is likely to have causal effect of house price on consumption, which results from the collateral channel. This explains the fact that after a rise in house price, homeowners enjoy capital gains through refinancing process i.e., through housing equity withdrawal. The primary focus of this paper is to empirically examine this relationship between housing wealth and consumption with due consideration to the possible existence of this collateral channel. This is done in a framework which considers the asymmetric effects through a threshold variable. To be more specific, the two-regime threshold vector error correction model (Hansen and Seo (2002)) is applied for this study. It may be worth mentioning that the rationale behind threshold cointegration which was first introduced by Balke and Fomby (1997) is that this generalizes the cointegration – VECM methodology by introducing non-linearity due to regime consideration. As pointed out by them, such an analysis would consider the long-run equilibrium relationship by the cointegration methodology while assuming the feature of asymmetric adjustment. Hence this modeling framework is appropriate for our analysis. To the best of our knowledge, this methodology has not yet been applied to study the asymmetric wealth effect on consumption. Unlike Hansen and Seo (2002), where the ECM has been taken to be the threshold variable, in this paper we have used a predetermined stationary variable as the threshold variable. To be specific, this variable is the difference between mortgage returns and saving returns as mentioned earlier. Since extracted housing wealth data could not be accessed for countries other than the USA and the UK, this study has been carried out only for these two countries, and the empirical results are found to support the view that extracted housing wealth has asymmetric effect on consumption.

The remainder of the paper is organized as follows: Section 2 describes the methodology. The details about the data along with the estimated models are presented in the next section. The paper ends with some concluding remarks in Section 4.

2. The Methodology

In this section, following Hansen and Seo (2002), we briefly describe the two-regime threshold cointegration model. The model can be treated as a non-linear vector error correction model (VECM) of order $(l+1)$ having the following form:

$$\Delta x_t = \begin{cases} A_1^{/} X_{t-1}(\beta) + U_t & if\ w_{t-1}(\beta) \leq \gamma \\ A_2^{/} X_{t-1}(\beta) + U_t & if\ w_{t-1}(\beta) > \gamma \end{cases} \qquad \text{……………….. (1)}$$

with $$X_{t-1}(\beta) = \begin{pmatrix} 1 \\ w_{t-1}(\beta) \\ \Delta x_{t-1} \\ \Delta x_{t-2} \\ \cdot \\ \cdot \\ \Delta x_{t-l} \end{pmatrix}$$

where x_t is a p-dimensional $I(1)$ time series is cointegrated , β is the $p \times 1$ cointegrating vector, and $w_t(\beta) = \beta^{/} x_t$ is the $I(0)$) error-correction term. The coefficient matrices, A_1 and A_2, describe the dynamics in the first and second regimes, respectively, γ is the threshold parameter, and U_t is an error term assumed to be a vector of martingale difference sequence with finite covariance matrix $\Sigma = E\left(U_t U_t^{/}\right)$.

It is obvious that the model specified in equation (1) involves two regimes, each of which is linear but the combined one is thus nonlinear in nature, and the regime switch-over mechanism depends on the deviations from the equilibrium below or above the threshold parameter. Since it has been assumed that the variables are cointegrated, when $p = 2$, there is only one cointegrating vector, and hence convenient choice then is to set one element of β equal to unity that has no cost in the bivariate system.In case $p > 2$, this imposes the restriction that the corresponding elements of x_t goes into the cointegrating relationship. Hansen and Seo (2002) proposed a heteroskedastic consistent LM test to test if the cointegration is linear. In case of linearity, there is no threshold under the null and hence the model in (1) reduces to a conventional linear VECM. This test statistic is given as

$$Sup\ LM = \underset{\gamma_L \leq \gamma \leq \gamma_U}{\text{Sup}}\ LM\left(\tilde{\beta}, \gamma\right),$$

where $\tilde{\beta}$ is the estimate of β under the null hypothesis. In this test, $[\gamma_L, \gamma_U]$ is the search region for the unknown threshold parameter γ so that γ_L is the π_0 percentile of $\widetilde{w}_{t-1}$, and γ_U is the $(1 - \pi_0)$ percentile. This test statistic has non-standard distribution under the null, and the bootstrap method proposed by Hansen and Seo is used obtain the asymptotic critical values and the p-values based on sufficient number of simulation replications.

3. The Empirical Results

It is to be noted at the outset that while in this analysis, unlike Hansen and Seo who have considered the error correction as the threshold variable, we have taken a predetermined stationary variable as the threshold variable. This is so because, households are motivated toward extracting housing wealth based on whether the returns on bond or other equities, s_t are higher than mortgage returns, m_t, and this leads to asymmetric effect of housing wealth on consumption. Accordingly, the variable which determines this decision making by the household is the difference of these two returns i.e., $m_t - s_t$, and hence this is taken as the threshold variable. Further, the study has been done with two countries only viz., the USA and the UK. The data on housing equity withdrawal is not available in public domain for other developed countries.

3.1. Data

All the data sets used in this study are at quarterly frequency, and cover the period from 1990:2 to 2011:1 for the USA and from 1985:4 to 2007:4 for the UK. In case of the UK, the time series on mortgage rate is not available beyond the last quarter of 2007. It may be noted that in this study the variables of interest are gross home equity extraction and the consumption debt service ratio. The home equity extraction is basically the extraction of home equity as collateral to obtain cash to either pay down the debt or to spend on additional goods, while the consumption debt service ratio means the ratio of consumption debt without any mortgage debt to total disposable income. The data on consumer debt service ratio, 30-year conventional mortgage rate (m_t) and US Treasury bill rate (s_t) have been obtained for the USA from Federal Reserve Economic Data. The last two rates are required for defining the threshold variable$(m_t - s_t)$. Finally, the time series on estimated gross equity extraction (GEE) has been taken from Kennedy (2011). The GEE series is normalized by disposable personal income and identified as gross equity extraction ratio (GEER). The aggregate data on household's debt service ratio is taken as a proxy variable for consumption debt service ratio (CDR). For the UK, we have chosen consumption credit data to be a proxy variable for CDR. All the time series for the UK have been taken from the CEIC data source. All the computations have been done using EViews 7 and the Gauss code written by Hansen (2002) for this methodology.

3.2. The Findings

In this section, we first give the details of the data sets used and then discuss the empirical results obtained by applying the methodology stated in the preceding section. We first present our findings on cointegration allowing for asymmetric adjustments between the gross equity extraction (GEER) and consumption debt service ratio (CDR). To do that we first check for the stationary/nonstationary status of these time series by using the augmented Dicky-Fuller (ADF) (1979) test and the Phillips-Perron (PP) (1988) test.

Table 1 reports the results of these two tests with the level as well as the first difference values. The optimum lag length for the ADF test has been chosen by the Schwarz information criteria (SIC). It is evident from the entries in the table that in case of the USA, at the level values GEER is found to be stationary at 5% level of significance by the ADF test while the CDR and the threshold variable $(m_t - s_t)$ are nonstationary by both the ADF and PP test. Since the conclusion for GEER was found to be different by the ADF and PP tests, the KPSS test was done, and it was found to reject the null hypothesis of stationarity at 5% level of significance. At the level of first difference, all are found to be stationary. So, all the three series are found to be $I(1)$ for the USA. In case of the UK, the threshold variable is seen to be stationary at level values by both the tests. But the PP test suggests stationarity for CDR at level values unlike the ADF test. To resolve this, the KPSS test was done which supported nonstationarity at 5% level of significance. Thus both the tests were done at first difference level for GEER and CDR, and these were found to be stationary.

Table 1: Results of the unit root tests for the USA and the UK

Variable	PP test		ADF test	
	Levels	First difference	Levels	First difference
		The USA		
GEER	-2.023	-12.658**	-3.596*	-10.806**
CDR	-1.001	-5.461**	-1.175	-3.405*
$(m_t - s_t)$	-2.074	-11.178**	-2.479	-5.928**
		The UK		
GEER	-1.393	-11.979**	-1.498	-11.683**
CDR	-7.525**	-20.879**	-2.120	-15.736**
$(m_t - s_t)$	-4.670**	-	-4.664**	-

Note:
i) The optimal lag orders of the variables in ADF regressions are selected by the Schwarz Information Criterion.
ii) '*' and '**' denote significance at 5% and 1% levels, respectively

Based on the finding that both the GEER and CDR are $I(1)$ variables for both the countries, we carried out the computations required for the threshold cointegration with the threshold variable $(m_t - s_t)$ at first difference values in case of the USA and at level values for the UK. The $Sup\ LM$ test statistic value was found to be 17.51 and 21.71 for the USA and the UK respectively. Compared with the critical values, both the test statistic values are found to be significant, and hence it is concluded that the null hypothesis of linear cointegration between GEER and CDR is rejected in favor of asymmetric cointegration involving these two variables for both the USA and the UK. The lag length for the underlying VAR model has been found to be 1and 2 for the USA and the UK respectively, by the SIC. The threshold values have been estimated as 0.003 for the USA and 0.85 for the UK. The Wald test statistic value under the null of equality of the intercept for the two regimes in case of the USA is 0.04 with p-value 0.829, suggesting that the null hypothesis cannot be rejected for the USA while this test statistic value for the UK is 7.25 with p-value 0.007 and hence the null hypothesis is rejected at 1% level of significance.

The estimates of the two-regime threshold VECM models along with the Eicker-White standard errors in parentheses are given below.

$$\Delta CDR_{t,USA} = \begin{cases} \underset{(0.20)}{0.47} - \underset{(0.01)}{0.043}\, w_{t-1} + \underset{(0.12)}{0.33}\, \Delta CDR_{t-1} + \underset{(0.03)}{0.02}\, \Delta GEER_{t-1} + U_{1t}, & \Delta(m-s)_{t-1} \leq 0.003, \\ \underset{(0.24)}{0.54} - \underset{(0.02)}{0.05}\, w_{t-1} + \underset{(0.21)}{0.26}\, \Delta CDR_{t-1} - \underset{(0.06)}{0.12}\, \Delta GEER_{t-1} + U_{2t}, & \Delta(m-s)_{t-1} > 0.003, \end{cases}$$

…………………… (2)

$$\Delta GEER_{t,USA} = \begin{cases} \underset{(0.09)}{-0.67} + \underset{(0.03)}{0.06}\, w_{t-1} + \underset{(0.33)}{0.55}\, \Delta CDR_{t-1} - \underset{(0.12)}{0.24}\, \Delta GEER_{t-1} + U_{1t}, & \Delta(m-s)_{t-1} \leq 0.003, \\ \underset{(0.47)}{-0.44} + \underset{(0.05)}{0.04}\, w_{t-1} + \underset{(0.62)}{1.63}\, \Delta CDR_{t-1} + \underset{(0.19)}{0.11}\, \Delta GEER_{t-1} + U_{2t}, & \Delta(m-s)_{t-1} > 0.003, \end{cases}$$

…………………… (3)

$$\Delta CDR_{t,UK} = \begin{cases} \underset{(78.42)}{-0.232} - \underset{(0.07)}{0.05}\, w_{t-1} - \underset{(0.17)}{0.77}\, \Delta CDR_{t-1} + \underset{(103.4)}{136.58}\, \Delta GEER_{t-1} & \\ - \underset{(0.09)}{0.507}\, \Delta CDR_{t-2} + \underset{(72.63)}{41.09}\, \Delta GEER_{t-2} + U_{1t}, & (m-s)_{t-1} \leq 0.854, \\ \underset{(115.6)}{376.2} - \underset{(0.123)}{0.394}\, w_{t-1} - \underset{(0.133)}{0.553}\, \Delta CDR_{t-1} - \underset{(45.82)}{55.51}\, \Delta GEER_{t-1} & \\ - \underset{0.36}{1.117}\, \Delta CDR_{t-2} + \underset{(64.32)}{143.9}\, \Delta GEER_{t-2} + U_{2t}, & (m-s)_{t-1} > 0.854, \end{cases}$$

…………………… (4)

$$\Delta GEER_{t,UK} = \begin{cases} \underset{(0.154)}{0.314} - \underset{(0.001)}{0.002}\, w_{t-1} + \underset{(0.001)}{0.004}\, \Delta CDR_{t-1} + \underset{(0.142)}{0.189}\, \Delta GEER_{t-1} & \\ + \underset{(0.001)}{0.002}\, \Delta CDR_{t-2} + \underset{(0.140)}{0.369}\, \Delta GEER_{t-2} + U_{1t}, & (m-s)_{t-1} \leq 0.854, \\ \underset{(0.258)}{0.126} - \underset{(0.001)}{0.003}\, w_{t-1} - \underset{(0.001)}{0.001}\, \Delta CDR_{t-1} - \underset{(0.212)}{0.247}\, \Delta GEER_{t-1} & \\ \underset{(0.001)}{0.005}\, \Delta CDR_{t-2} - \underset{(0.098)}{0.199}\, \Delta GEER_{t-2} + U_{2t}, & (m-s)_{t-1} > 0.854, \end{cases}$$

…………………… (5)

It is noted that in case of the USA, the estimate of the intercept in the first regime given in equation (2) is smaller than that in the second regime but the difference is not statistically significant. This implies that the volume of consumption made through equity extraction is more or less same. The returns differential cannot alter the motivation behind extraction. So the equity extraction due to house price appreciation leads to the increased demand in the commodity market. This finding could be explained in terms of a surge in commodity market price being an after-effect of housing market bubble. In case of the UK the Wald test for equality of the two intercepts suggesting that there is significant difference between them in the two regimes. The estimate of the threshold value (γ) is 0.854 which means that even when mortgage returns is substantially higher than the returns on savings, households extract equity for consumption smoothing purpose. When the returns differential is less than the threshold value, households choose to invest the extracted wealth in the other equity market and hence the volume of consumption is less in the first regime than that in the second regime.

4. Conclusions

In this paper we have examined the non-linear long-run equilibrium relationship between gross equity extraction ratio and consumer debt service ratio for the USA and the UK following the threshold cointegration methodology of Hansen and Seo (2002). This is expected to fill in the void in the empirical literature on this issue which, till date, has limited the analysis only to those models which allow that the equity can be withdrawn and then injected making it difficult to relate the findings to the relevant macro variables. In order to overcome this limitation, the threshold variable for this study has been taken to be the difference between the mortgage returns and saving returns. The finding confirms the existence of significant asymmetric dynamic adjustment process between GEER and CDR implying thereby important policy issues. For instance, by reducing mortgage rate, the Central Bank of these two countries can increase the net benefits to accessing home equity. It has also been found that in the lower mortgage rate period households in the UK take the benefit of gain in present value wealth by servicing their existing mortgage balance at this lower mortgage rate. This additional gain can help the households to offset the high cost of accessing home equity for the purpose of consumption smoothing.

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