DOI: 10.6277/TER.2017.451.3

Housing Collateral Scarcity and Recessions: An Empirical Perspective

Yu-Hsi Chou*

In this paper, we investigate the dynamic link between the scarcity of housing collateral and economic recessions in the US. First, we use vector error-correction models to identify negative transitory shocks to collateralizable housing wealth, which are used as proxies of housing collateral scarcity. We then use probit models and time-varying transition-probability Markov-switching autoregressive models to investigate how the housing collateral scarcity affects the probability of recession. Using several measures of housing wealth, we find that the probability of economic downturns increases when the housing collateral is scarce, and that an increase in housing collateral scarcity may push the economy from expansion to recession.

Keywords: housing collateral, recession, probit model
JEL classification: E32, E44, G01

1 Introduction

Over the past decade, the dramatic fluctuations in housing markets have received a considerable amount of attention from policymakers and economists alike, and led to greater concerns about the impact of housing markets on real economic activity. In particular, when US house prices started to fall in early 2006, the subprime mortgages associated with some residential loans began to default, causing huge losses in the financial sector and subsequently,

*Department of Civic Education and Leadership, National Taiwan Normal University. I would like to thank two anonymous referees for valuable comments and suggestions. This research was supported by a grant from the National Science Council (NSC 102-2410-H-030-003-).

經濟論文叢刊 (*Taiwan Economic Review*), 45:1 (2017), 125–161。
國立台灣大學經濟學系出版

臺灣大學學術期刊資料庫

from December 2007 onwards, triggering the worst economic contraction in the US since World War II.

A sharp decline in housing wealth may reflect that an asset bubble has burst, and could therefore actually account for a downturn in economic activity by adversely affecting the net worth, balance sheets, and confidence of households and firms (see Case, Quigley, and Shiller, 2013; Carroll, Otsuka, and Slacalek, 2011; Christelis, Georgarakos, and Jappelli, 2015; Ng, 2012, and the references therein). In turn, these negative wealth effects lead to lower spending and increase the risk of recession. Furthermore, the decline in housing wealth may also weaken bank balance sheets when mortgage loans default, and this leads to lower bank lending and investment, and can result in an even larger contraction in economic activity (Case, Shiller, and Weiss, 1995).

Fluctuations in housing markets also matter because housing collateral plays an important role in the transmission mechanism of exogenous shocks to economic activity. Theoretical studies have demonstrated the importance of this mechanism, which operates through the interaction of credit constraints and the value of collateral (Kiyotaki and Moore, 1997; Iacoviello, 2005; Liu, Wang, and Zha, 2013). In brief, when firms are credit constrained by the value of their collateralizable assets, an adverse shock may reduce the value of the collateral and generate large fluctuations in asset prices and persistent effects on economic activity. This potentially explains the weakness of financial institutions, large boom–bust cycles in asset prices, and prolonged contractions in real economic activity.

Recently, several studies have provided support for this view in which the collateral channel transmits shocks from the housing market to the economy, but suggest that this transmission mechanism operates differently when the collateral constraints are only occasionally binding. For instance, Lustig and Nieuwerburgh (2005) used a model with collateralized borrowing and lending to identify a novel collateral channel. In their model, the tightness of the collateral constraints is determined by the housing collateral ratio, defined as the ratio of housing wealth to human wealth. When a decrease in house prices reduces the collateral value of housing, and thereby lowers the housing collateral ratio, the likelihood of households facing binding collateral constraints increases. This adversely affects the risk-sharing mechanism among households that serves to insulate consumption risk from labor income shocks, and thus increases the macroeconomic risk and volatility of the

臺灣大學學術期刊資料庫

aggregate economy.[1] Guerrieri and Iacoviello (2013) also showed that during the housing market boom, the collateral constraints slackened and the changes in housing wealth were then less relevant to consumption growth. By contrast, the collapse of the housing market that followed the more binding collateral constraints during the 1990–91 and 2007–09 recessions exacerbated the decline in consumption in the US.

Motivated by Lustig and Nieuwerburgh (2005) and Guerrieri and Iacoviello (2013), we empirically investigate whether the probability of recession increases when housing collateral is scarce. Although it is generally believed that a reduction in housing collateral may push an economy into recession, there is no supporting evidence for this occurring in any rigorous systematic analysis to date.

To examine whether a decline in housing collateral leads to recession, we first require a proxy of housing collateral scarcity. One measure proposed by Lustig and Nieuwerburgh (2005) is the housing collateral ratio, which is measured as the deviation from the cointegrating relationship between the value of the aggregate housing stock and aggregate labor income. However, if we wish to examine the effect of a contemporaneous exogenous shock to housing collateral on the probability of recession, a simple housing collateral ratio may be subject to an endogeneity problem because it may be affected by the state of the economy (expansion or recession). In this paper, we account for the endogeneity of the housing collateral measure by using a vector error-correction model (VECM) to identify the shocks to housing collateral.[2] In particular, we apply the permanent–transitory decomposition method developed by Gonzalo and Ng (2001) to identify shocks as distinguished by their degree of persistence.[3] We find that the transitory shocks are able to explain most housing wealth movements, and that an adverse transitory shock has a negative impact on the housing collateral ratio. We then use negative versions of these shocks as proxies for contemporary housing collateral scarcity and probit models and time-varying transition-probability

[1] The volatility of aggregate consumption can be interpreted as aggregate economic fluctuations because in an endowment model, aggregate consumption equals output Lustig and Nieuwerburgh (2005). In addition, consumption is a fundamental determinant of the business cycle in the US because it represents some 70% of the gross domestic product (GDP).

[2] This is the approach used by Chen (2011) and Chen and Chou (2016).

[3] Note that the permanent and transitory shocks we identify correspond to a variety of shocks to the economy. As in Lustig and Nieuwerburgh (2005)'s model, those affecting the housing collateral ratio include the liquidity preference and collateral supply shocks, etc.

臺灣大學學術期刊資料庫

Markov-switching autoregressive models to examine the link between housing collateral scarcity and the probability of recession.

We use quarterly data from 1952Q1 to 2011Q4, and consider three alternative measures of the aggregate stock of housing collateral, including the value of residential fixed assets, the value of outstanding mortgages, and the value of residential real estate. The empirical results suggest that a negative transitory shock to residential real estate leads to a greater probability of economic downturn, and will this push the economy from an expansion state to a recession state. We show that the empirical results are robust to different specifications of the probit and Markov-switching models, as well as to different approaches to decomposing the shocks.

We conclude that a reduction in housing collateral indeed pushes the economy into a downturn, and this result complements the literature on the interaction between economic activity and collateral constraints from an empirical perspective. Moreover, we find that a negative transitory shock to housing wealth leads to recession, which supports the findings of recent studies that have quantified the importance of financial shocks in exacerbating the Great Recession using a general equilibrium framework (Del Negro, Eggertsson, and Kiyotaki, 2011; Jermann and Quadrini, 2012; Christiano, Motto, and Rostagno, 2013).

The rest of the paper is structured as follows. Section 2 presents the empirical framework, while Section 3 describes the data and presents some preliminary test results. Section 4 reports the key empirical results, and Section 5 provides the robustness checks. Finally, we offer some concluding remarks in Section 6.

2 Econometric Framework

In this section, we first show how we measure housing collateral scarcity. We then present the empirical framework used to examine the link between the housing collateral scarcity and the probability of recession.

2.1 Measuring Housing Collateral Scarcity

We follow Lustig and Nieuwerburgh (2005) to construct a bivariate VECM with the log of real per capita housing wealth (hv_t) and log of labor income

臺灣大學學術期刊資料庫

(y_t)[4] to measure the shock to housing collateral as follows:

$$\Delta Y_t = \alpha \cdot my_{t-1} + A_1 \Delta Y_{t-1} + \cdots + A_{p-1} \Delta Y_{t-p+1} + e_t, \qquad (1)$$

where $Y_t \equiv [hv_t, y_t]'$, α are the coefficients reflecting the adjustment to the long-run equilibrium and e_t represents a vector of innovations with a variance–covariance matrix $\Sigma_e \equiv E(e_t e_t')$. The housing collateral ratio (error-correction term) my_t is defined as the deviation from the cointegration relationship between housing wealth and labor income:

$$my_t \equiv hv_t + \varpi y_t + \theta t + \chi, \qquad (2)$$

where t represents the deterministic trends. In equation (2), hv_t and y_t are cointegrated, and the cointegrating vector $[1, \varpi, \theta, \chi]'$ eliminates both deterministic and stochastic trends so that my_t is stationary.

Moreover, the existence of the cointegration relationship between housing wealth and labor income enables us to decompose Y_t into its permanent and transitory components, and we thus follow Gonzalo and Ng (2001) by identifying the permanent and transitory shocks in the VECM framework for equation (1). In Section 4.1, the forecast error variance decomposition shows that the transitory shocks account for the vast majority of fluctuations in hv_t, but have a negligible impact on y_t, both contemporaneously and at all future horizons. As the housing collateral ratio my_t is stationary and does not contain a permanent component, most of the variation in my_t can be attributed to transitory shocks. Thus, it is straightforward to use the transitory shocks as a measure of the shocks to collateralizable housing wealth and the housing collateral ratio. According to the Granger representation theorem, under the maintained hypothesis that the growth rates in Y_t are covariance stationary around some deterministic terms, there exists a multivariate Wold representation of equation (1) such that:

$$\Delta Y_t = \delta D_t + C(L) e_t, \qquad (3)$$

where e_t is a 2×1 vector of innovations, $C(L)$ is a distributed lag operator, D_t denotes all deterministic variables (including constant and trend), and δ

[4] In Lustig and Nieuwerburgh (2005), they follow Lettau and Ludvigson (2001) to proxy human wealth using labor income. In particular, the nonstationary component of human wealth can be well approximated by the nonstationary component of labor income if the expected return on human capital is stationary (see Campbell, 1996; Jagannathan and Wang, 1996).

臺灣大學學術期刊資料庫

are the estimated coefficients of these variables. In accordance with Gonzalo and Granger (1995), we define u_t^P as a permanent shock if $\lim_{k\to\infty} \partial E_t Y_{t+k}/\partial u_t^P \neq 0$, and u_t^T as a transitory shock if $\lim_{k\to\infty} \partial E_t Y_{t+k}/\partial u_t^T = 0$.

Note that given the Granger representation theorem in Engle and Granger (1987), the parameters α and ϖ satisfy $\varpi' C(1) = 0$ and $C(1)\alpha = 0$. We let

$$G = \begin{bmatrix} \alpha_\perp' \\ \varpi' \end{bmatrix},$$

where $\alpha_\perp'$ is the orthogonal complementary matrix of α and $\alpha_\perp'\alpha = 0$. The permanent and transitory shocks are then given by:

$$Ge_t = u_t \equiv \begin{bmatrix} u_t^P \\ u_t^T \end{bmatrix}. \tag{4}$$

In equation (4), if there exists one cointegration relationship, the dimension of $\alpha_\perp'$ is 1×2 and the dimension of u_t^P is 1×1. In addition, the dimension of u_t^T is also 1×1. Given the construction of the matrix G, the permanent shock is the first element of the vector u_t.

Under the assumption of nonsingularity of matrix G, we can express (3) as:

$$\begin{aligned} \Delta Y_t &= \delta D_t + C(L)G^{-1}Ge_t \\ &= \delta D_t + F(L)u_t. \end{aligned} \tag{5}$$

The polynomial matrix $F(L) = F_0 + F_1 L + F_2 L^2 + \cdots$ in equation (5) has the property that the last column of $F(1) = C(1)G^{-1}$ is full of zeroes because they refer to the long-run impact of the transitory shocks. However, u_t^P and u_t^T are not mutually orthogonal, and thus computing the impulse response functions and making causal statements about the permanent and transitory shocks at this stage is inappropriate. Thus we follow Gonzalo and Ng (2001) in orthogonalizing the permanent and transitory shocks. Let $\eta_t = [\eta_t^P, \eta_t^T]'$ be the respective vectors of permanent and transitory shocks, which are mutually orthogonal to each other with a unitary variance–covariance matrix. By setting $\Sigma_u \equiv E(u_t u_t')$, we obtain the following relationship between u_t and η_t:

$$u_t = H\eta_t, \tag{6}$$

$$\Sigma_u = HH', \tag{7}$$

臺灣大學學術期刊資料庫

where H is a 2×2 nonsingular matrix. Using (6) and (7), we can rewrite (5) as

$$\Delta Y_t = \delta D_t + F(L)HH^{-1}u_t = M(L)\eta_t,$$

where $M(L) = M_0 + M_1 L + M_2 L^2 + \cdots$.

The relationship between Σ_e and Σ_u is as follows:

$$\Sigma_e = M_0 M_0' = F_0 \Sigma_u F_0'. \tag{8}$$

According to (8), Σ_e includes three unknown parameters, which is less than the number of parameters in M_0. The difference is $4 - 3 = 1$. To identify M_0, Gonzalo and Ng (2001) use the Cholesky decomposition method to decompose $\Sigma_u = G\Sigma_e G'$, where H is a lower block diagonal matrix. The orthogonalized shocks are then obtained by $\eta_t = H^{-1}Ge_t$. It is worth noting that the numbers in the last column of the matrix $M(1) = F(1)H$ are all zero, which implies the long-run impact of η_t^T on Y_t is zero.

Finally, we proxy housing collateral scarcity using the negative transitory shock to my_t as follows:

$$v_t = -\hat{\eta}_t^T. \tag{9}$$

Hence, the higher value of v_t implies greater housing collateral scarcity.

2.2 Housing Collateral Scarcity and Business Cycle Dynamics

We utilize a probit model to evaluate the explanatory power of the housing collateral scarcity on recessions. The probit model has been employed by a number of studies, including Estrella and Mishkin (1998), Filardo (1999), and Chauvet and Potter (2005). In particular, Del Negro (2001) has shown the predictive superiority of probit models compared with the usual econometric models or leading indicators.

We consider the following probit model:

$$P(d_t = 1) = \Phi\left(\xi + \beta' V_t + \gamma' X_{t-1}\right), \tag{10}$$

where $\Phi(\cdot)$ is the cumulative standard normal distribution function, d_t is the recession indicator, $V_t = \{v_t, v_{t-1}, \cdots, v_{t-k}\}$ is the proxy of housing collateral scarcity, and $\beta' = [\beta_0, \beta_1, \beta_2, \cdots, \beta_k]'$, and X_{t-1} contains other (lagged) control variables that may affect the recession probabilities, including the term spread (the difference between the long-term bond yield and the

臺灣大學學術期刊資料庫

three-month treasury bill rate, Term_t), the credit spread (the difference between the Moody Baa corporate bond yield and the Aaa bond yield, Cred_t), and the stock market returns, Sret_t.

We define a recession indicator d_t that characterizes the state of the economy as follows:

$$d_t = \begin{cases} 1 \text{ if the economy is in recession,} \\ 0 \text{ otherwise.} \end{cases}$$

Using equation (10), we will examine how housing collateral scarcity affects the probability of recession.

Furthermore, Markov-switching models have been widely applied to business cycle analysis since the seminal work by Hamilton (1989) as an alternative business cycle dating method. As shown in previous studies, a two-state Markov-switching model characterizes well the switching of economic fluctuations between expansions and contractions (for instance, see Hamilton and Perez-Quiros, 1996; Filardo and Gordon, 1998; McConnell and Perez-Quiros, 2000; Lam, 2004, and the references therein). Moreover, Chen and Leung (2008) use a three period general equilibrium model with collateral constraint, and they find that if the feedback effect between the residential and commercial property markets is triggered, the model exhibits a regime-switching relationship between economic aggregates and the real estate market. To further examine the relationship between housing collateral scarcity and recessions, we estimate a time-varying transition-probability Markov-switching autoregressive (TVTP-MS-AR(q)) model, which allows the transition probability to vary over time as a function of housing collateral scarcity.

Following Filardo (1994) and Durland and McCurdy (1994), we consider the following two-state TVTP-MS-AR(q) model of real GDP growth g_t to characterize the states of the economy:

$$\phi(L)g_t = \mu_{S_t} + \epsilon_t, \quad \epsilon_t \sim N\left(0, \sigma^2_{S_t}\right), \tag{11}$$

where g_t denotes the quarterly growth rate of real GDP, $\phi(L) = 1 - \phi_1 L - \phi_2 L^2 - \cdots - \phi_q L^q$ is a polynomial in the lag operator, L, μ_{S_t} is the state-dependent intercept, and σ_{S_t} is the state-dependent variance of ϵ_t. The unobserved state variable S_t is a latent dummy variable equal to either 0 or 1, indicating recessions or expansions, respectively. The state variable S_t is

臺灣大學學術期刊資料庫

assumed to follow a Markov process with a TVTP matrix as follows:

$$P(t) = \begin{bmatrix} p_t^{00}(Z_t) & 1 - p_t^{11}(Z_t) \\ 1 - p_t^{00}(Z_t) & p_t^{11}(Z_t), \end{bmatrix} \tag{12}$$

where $p_t^{ij}(Z_t) = P(s_t = i|s_{t-1} = j, Z_t)$, Z_t are the variables that may affect the transition probabilities. The TVTP matrix in equation (12) guides the switch between the two different regimes over time, and is assumed to vary with the evolution of housing collateral scarcity and other control variables:

$$p_t^{00}(Z_t) = \frac{\exp\left(\xi_{00} + \Sigma_{k=0}^{K}\beta_{00}^{k} v_{t-k} + \gamma_{00}' X_{t-1}\right)}{1 + \exp\left(\xi_{00} + \Sigma_{k=0}^{K}\beta_{00}^{k} v_{t-k} + \gamma_{00}' X_{t-1}\right)},$$

$$p_t^{11}(Z_t) = \frac{\exp\left(\xi_{11} + \Sigma_{k=0}^{K}\beta_{11}^{k} v_{t-k} + \gamma_{11}' X_{t-1}\right)}{1 + \exp\left(\xi_{11} + \Sigma_{k=0}^{K}\beta_{11}^{k} v_{t-k} + \gamma_{11}' X_{t-1}\right)}.$$

Notice that $p_t^{10}(Z_t) = 1 - p_t^{11}(Z_t)$ is the probability of switching from an expansion to a recession. If the housing collateral scarcity pushes the economy into recession, we expect to obtain $\hat{\beta}_{11}^{k} < 0$. On the other hand, $\hat{\beta}_{00}^{k} > 0$ suggests that an increase in housing collateral scarcity raises the probability of remaining in recession.

3 Data and Preliminary Tests

We follow Lustig and Nieuwerburgh (2005) to consider three alternative measures of housing wealth, including fixed assets hv_t^{fa}, value of outstanding home mortgages hv_t^{mo}, and residential real estate wealth hv_t^{rw}. The data are from 1952Q1 to 2011Q4. hv_t^{fa} is constructed using the current cost of the net stock of owner-occupied and tenant-occupied residential fixed assets for non-farm persons from the fixed asset tables of the Bureau of Economic Analysis. hv_t^{mo} is obtained using non-farm home mortgages (FL153165105) from the Flow of Funds, Balance Sheet of Households and Nonprofit Organizations, available from the US Federal Reserve Board. Finally, hv_t^{rw} is taken from the same source and is given by the market value of household real estate (FL155035015). Aggregate labor income y_t is the sum of aggregate labor income and transfers. Aggregate labor income is the sum of wage and salary disbursements, other labor income, and proprietors' income with inventory valuation and capital consumption adjustments, where transfers

臺灣大學學術期刊資料庫

Table 1: Unit Root Tests

Series	ADF	PP
hv_t^{fa}	−2.428	−2.190
Δhv_t^{fa}	−3.880*	−7.915*
hv_t^{mo}	−2.423	−2.612
Δhv_t^{mo}	−4.284*	−7.257*
hv_t^{rw}	−2.066	−1.670
Δhv_t^{rw}	−4.597*	−9.623*
y_t	−1.110	−0.997
Δy_t	−5.189*	−11.774*
Term_t	−4.037*	−4.427*
Cred_t	−3.643*	−3.822*
Sret_t	−14.287*	−14.255*
g_t	−8.194*	−10.600*

Note: ADF and PP are augmented Dickey-Fuller and Phillips-Perron test statistics, respectively. An intercept and a time trend are included in the testing equation, the lag length of ADF test are chosen by modified Akaike information criterion. * indicates significance at 10% or above.

are defined as transfer payments to persons minus personal contributions for social insurance. We then use total personal consumption expenditure to deflate hv_t^{fa}, hv_t^{mo}, hv_t^{rw}, and y_t and rescale in per household terms using data on the number of households from the US Census Bureau. All variables are in logarithms.

Table 1 presents the results of the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests on hv_t^{fa}, hv_t^{mo}, hv_t^{rw}, and y_t. We find the null hypothesis of a unit root cannot be rejected at the 10% level. We then use Johansen (1991)'s trace test to examine whether a cointegration relationship exists between housing collateral and labor income. To implement the trace test, the lag length of the VECM in equation (1) is chosen by the Akaike information criterion. The test results are shown in Table 2, where we find that the null hypothesis of no cointegration relationship can be rejected, whereas the null hypothesis of one cointegration relationship cannot. This is evidence of the presence of one cointegration relationship

臺灣大學學術期刊資料庫

Table 2: Cointegration Test

	Trace Test		
	hv_t^{fa} and y_t	hv_t^{mo} and y_t	hv_t^{rw} and y_t
$r = 0$	34.11*	25.59*	27.71*
	(0.002)	(0.052)	(0.027)
$r = 1$	4.38	2.14	7.70
	(0.689)	(0.945)	(0.286)
	Hansen (1992)'s Test		
L_c	0.003	0.002	0.004

Note: "Trace" indicates the test statistics described in Johansen (1991), L_c represents the residual-based cointegration test proposed by Hansen (1992), with the cointegration regression is estimated by dynamic ordinary least square method which includes the four-period lead and lag of the first differences of y_t for the independent variables. r represents the number of cointegrating relations in null hypothesis, the entries in parentheses are p-values and * denotes significance at the 10% level or above.

between housing collateral and labor income. Furthermore, because the trace tests take no cointegration as the null hypothesis and cointegration as the alternative hypothesis, we also consider an additional residual-based cointegration test proposed by Hansen (1992) to test the null hypothesis of cointegration against the alternative of no cointegration.[5] The results are reported in Table 2, and the test statistic indicates the existence of a cointegration relationship at conventional significance levels for all measures of housing wealth.

We denote the estimated housing collateral ratio based on hv_t^{fa}, hv_t^{mo}, and hv_t^{rw} as my_t^{fa}, my_t^{mo}, and my_t^{rw}, respectively, and we plot these three series in Figure 1, with the shaded areas representing the NBER recession periods. We observe that my_t^{fa} and my_t^{rw} tend to fall prior to the recession periods. As for my_t^{mo}, it drops dramatically during the 2007–2009 recession,

[5]To implement Hansen (1992)'s test, we estimate the cointegration relationship between hv_t and y_t using the dynamic ordinary least squares method á la Stock and Watson (1993), which includes the four-period lead and lag of the first difference of y_t.

臺灣大學學術期刊資料庫

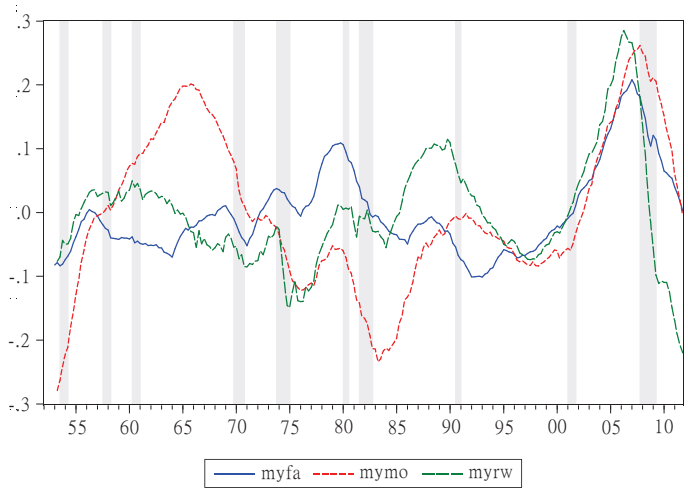


Figure 1: Plots of Estimated Housing Collateral Ratio. Shaded areas represent NBER recession dates

but its relationship with other recession periods is less clear.[6]

Lastly, the NBER recession dates are used to construct the recession variable d_t. The term spread term_t is constructed as the difference between the long-term bond yield and the three-month Treasury bill rate, which are obtained from the Ibbotson's *Stocks, Bonds, Bills, and Inflation Yearbook* and the Federal Reserve Economic Data (FRED) database provided by the Federal Reserve Bank of St. Louis, respectively.[7] We then use Moody's Baa- and Aaa-rated corporate bond rates from the FRED database to construct the Baa minus Aaa spread, Cred_t. Finally, we use the value-weighted returns in the Center for Research in Security Prices database to proxy the aggregate stock market returns, Sret_t. We also report the ADF and PP unit root test results for Term_t, Cred_t, and Sret_t in Table 1. Clearly, the null hypothesis of a unit root process can be rejected for these series.

[6]The variable my_t^{mo} constructed by Lustig and Nieuwerburgh (2005) with the last observation being from 2005 exhibits similar properties.

[7]They are available on Amit Goyal's homepage: http://www.hec.unil.ch/agoyal/. Our estimation results are qualitatively unchanged by constructing the term spread as the difference between the 10-year Treasury constant maturity rate and the 3-month Treasury bill rate as in Estrella and Mishkin (1998).

臺灣大學學術期刊資料庫

Table 3: Estimates from VECMs

	χ	θ	ϖ	α_1	α_2
$Y_t = [hv_t^{fa}, y_t]'$	−4.857*	0.002*	0.398*	−0.030*	−0.044*
	(−5.555)	(3.285)	(8.874)	(−3.848)	(−3.953)
$Y_t = [hv_t^{mo}, y_t]'$	−6.255*	0.007*	0.405*	−0.015*	−0.000
	(−3.362)	(11.120)	(1.828)	(−3.383)	(−0.082)
$Y_t = [hv_t^{rw}, y_t]'$	−4.857*	0.002*	0.398*	−0.027*	−0.005
	(−6.643)	(10.594)	(4.572)	(−2.495)	(−0.630)

Note: t-statistics are given in parentheses, * denotes significance at the 10% level or above.

4 Empirical Results

4.1 Measures of Housing Collateral Scarcity

In this subsection, we apply the permanent–transitory decomposition discussed in Section 2.1 to identify transitory shocks to housing wealth as a proxy of shocks to the housing collateral ratio using the VECM framework. Table 3 reports the coefficient estimates from the VECM based on three measures of housing wealth. We find that the estimate of α_1 in (1) is statistically significant, while the estimate of α_2 in (1) is small and insignificant with the exception of hv_t^{fa}, which implies that labor income is likely to be weakly exogenous. That is, it is primarily housing wealth, not labor income, that adjusts to restore the long-run equilibrium.

The variance decompositions in Table 4 show the fraction of forecast errors in hv_t and y_t attributable to the orthogonalized permanent shock and the transitory shock for the h-th step ahead, respectively. We consider $h = 1, 4, 8, 16$, and 32. In particular, we follow Fisher and Huh (2007) by placing y_t first in the ordering in the VECM when applying the orthogonalization of the permanent and transitory innovations. This is because the innovations to the weakly exogenous variable accumulate to form the common trend in the cointegrated system. In other words, the orthogonalized shock to housing wealth obtained from the standard Cholesky decomposition method is identical to the transitory shock identified by using Gonzalo and Ng (2001)'s decomposition.[8]

[8] For details, see Fisher and Huh (2007).

臺灣大學學術期刊資料庫

Table 4: Forecast Error Variance Decomposition Results: Orthogonalized Shocks

		Forecast Error Variance Decomposition of hv_t				
		$h=1$	$h=4$	$h=8$	$h=16$	$h=32$
$Y_t=[hv_t^{fa}, y_t]'$	P	0.006	0.003	0.007	0.019	0.049
	T	0.994	0.997	0.993	0.981	0.951
$Y_t=[hv_t^{mo}, y_t]'$	P	0.201	0.196	0.181	0.171	0.193
	T	0.799	0.804	0.819	0.829	0.807
$Y_t=[hv_t^{rw}, y_t]'$	P	0.010	0.020	0.049	0.110	0.204
	T	0.990	0.980	0.951	0.890	0.796
		Forecast Error Variance Decomposition of y_t				
		$h=1$	$h=4$	$h=8$	$h=16$	$h=32$
$Y_t=[hv_t^{fa}, y_t]'$	P	0.723	0.673	0.664	0.653	0.648
	T	0.277	0.327	0.336	0.347	0.352
$Y_t=[hv_t^{mo}, y_t]'$	P	0.990	0.968	0.962	0.962	0.977
	T	0.010	0.032	0.038	0.038	0.023
$Y_t=[hv_t^{rw}, y_t]'$	P	0.875	0.818	0.841	0.902	0.952
	T	0.125	0.182	0.159	0.098	0.048

Note: The table reports the fraction of the variance in the h-step-ahead forecast error of the variable listed at the top of the table that is attributable to the permanent shock P and the transitory shock T.

The results suggest that for three measures of housing wealth, the transitory shocks dominate in explaining the changes in housing wealth because they account for around 80% to 90% of the variation in housing wealth for all horizons we investigate. Conversely, the permanent shocks account for less than 20% of housing wealth at horizons between one and sixteen quarters. At horizons longer than sixteen quarters, we observe that the permanent shocks account for 4.9%, 19.3%, and 20.4% of the housing wealth variation for hv_t^{fa}, hv_t^{mo}, and hv_t^{rw}, respectively. On the other hand, over 70% of the variation in labor income arises from permanent shocks, while the transitory shocks are not associated with most of the variability in labor income. This is consistent with the findings in Lettau and Ludvigson (2004) and Corsetti and Konstantinou (2012) that the permanent shocks explain most of the

臺灣大學學術期刊資料庫

variation in labor income in the US, whereas the transitory shocks are less relevant.

Figure 2 depicts the impulse response functions of hv_t, y_t and my_t to a one-standard-deviation negative transitory shock for the three measures of housing wealth. As shown, a decrease in transitory shocks leads to a persistent hump-shaped response in housing wealth, as well as to responses in the error-correction term my_t. In all cases, the adjustment patterns of hv_t and my_t are very similar, which confirms our VECM estimation results that the housing wealth adjustment is the primary driving force in restoring the long-run equilibrium. Moreover, the magnitudes of the responses in y_t are smaller than the responses in hv_t and my_t, which indicates that the transitory shocks are a relatively unimportant source of variation in labor income.

In sum, we find that transitory shocks to housing wealth explain most of the variation in hv_t, while y_t is dominated by permanent shocks. Moreover, as the housing collateral ratio my_t does not contain any permanent component, it seems reasonable to use transitory shocks to housing wealth to proxy the shocks to the housing collateral ratio as well. Figure 3 provides a plot of the measure of housing collateral scarcity constructed in equation (9).

4.2 Results from Probit Model

We have shown in the previous section that transitory shocks account for most of the variation in the collateralizable housing wealth. Now, we focus on the main issue of whether greater housing collateral scarcity (which is proxied by negative transitory shocks to housing wealth) generates a higher probability of recession using probit models. To measure the model's fit, we follow Estrella and Mishkin (1998) in computing the pseudo-R^2 developed by Estrella (1998):

$$\text{Pseudo-}R^2 = 1 - \left(\frac{\log L_u}{\log L_c}\right)^{-(2/T)\log L_c},$$

where L_u denotes the value of the maximized probit likelihood and L_c denotes the value of the maximized likelihood under the constraint that all coefficients are zero except for the constant. A low value of the pseudo-R^2 suggests a "poor fit," while pseudo-$R^2 = 1$ represents a "perfect fit."

We report the coefficient estimates, Newey–West corrected t-statistics, and the pseudo-R^2 of the probit model in equation (10) with different spec-

臺灣大學學術期刊資料庫

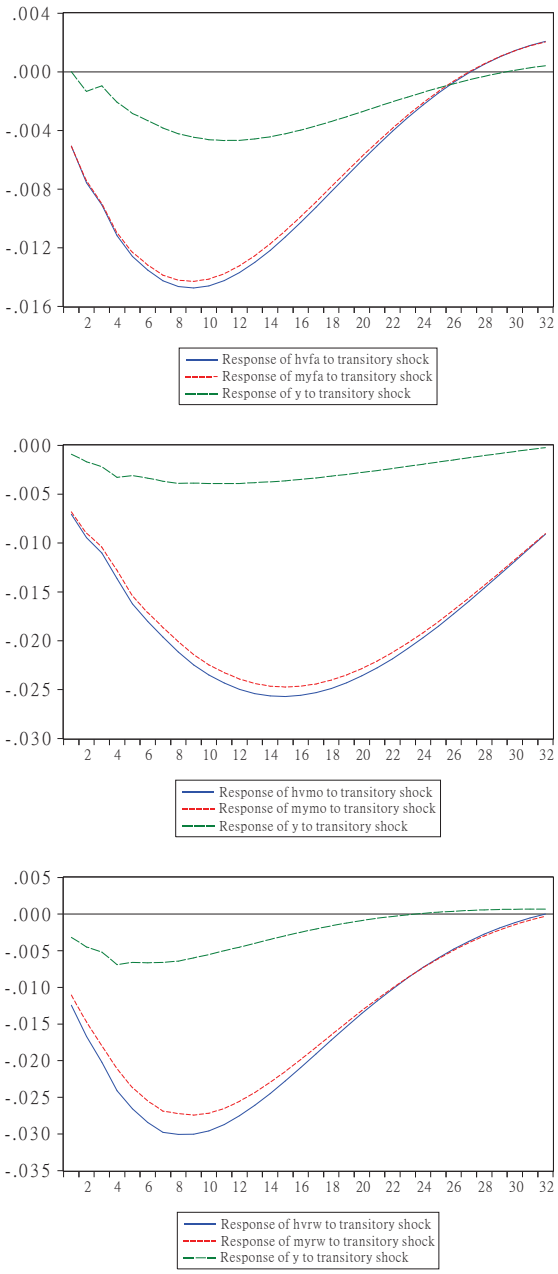


Figure 2: Impulse Response Functions of Housing Wealth (hv_t), Labor Income (y_t) and Housing Collateral Ratio (my_t) to a Negative Transitory Shock

臺灣大學學術期刊資料庫

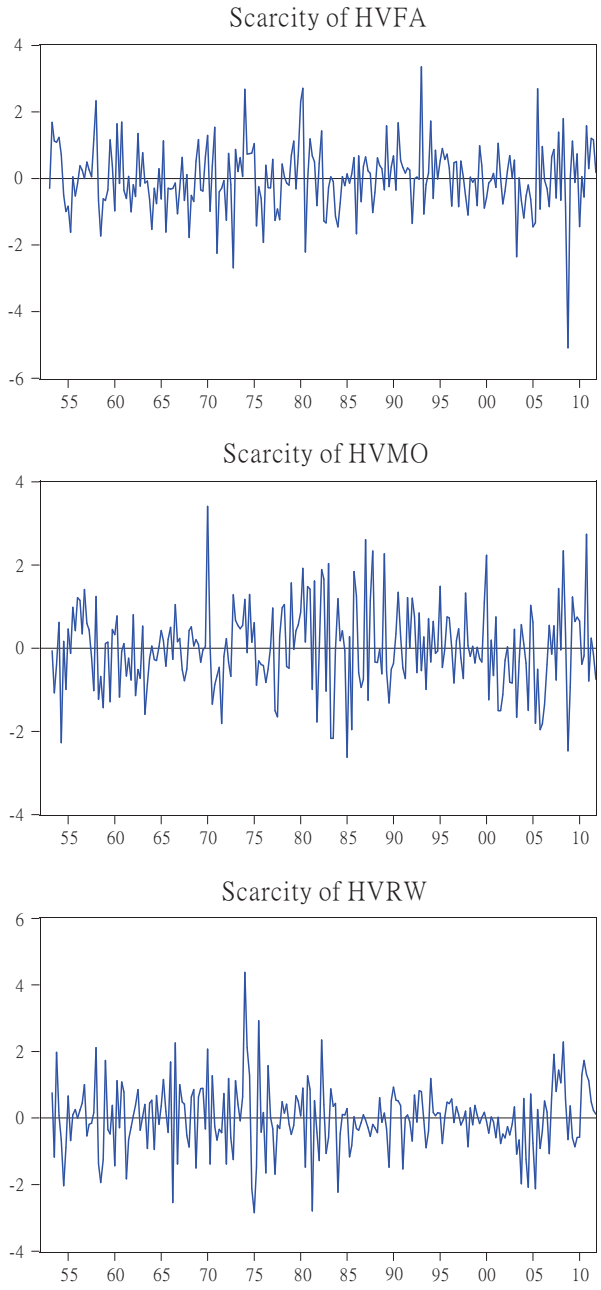


Figure 3: Measure of the Housing Collateral Scarcity

臺灣大學學術期刊資料庫

ifications, including $\{v_t\}$, $\{v_t, v_{t-1}\}$, and $\{v_t, X_{t-1}\}$ as the explanatory variables.[9] Columns (1)–(3) in Table 5 report the results using hv_t^{fa} as a measure of housing wealth. First, the estimates of $\hat{\beta}_0$ are significant for all specifications we consider. That is, a scarcity of housing collateral induces a higher probability of recession. In addition, the average marginal effect of v_t equals 0.028,[10] which implies that the likelihood of recession increases by 2.8% in response to a one-unit negative transitory shock to collateralizable housing wealth. The result regarding the effect of housing collateral scarcity on the probability of economic downturns is unchanged when including v_{t-1} or $X_{t-1} = \{\text{Term}_{t-1}, \text{Cred}_{t-1}, \text{Sret}_{t-1}\}$ as additional control variables. This result remains intact when using hv_t^{rw} as the measure of housing wealth, as shown in columns (7)–(9).[11] As for the estimation results using hv_t^{mo} as the measure of housing wealth, the impact of v_t on the recession probabilities becomes insignificant, which may be attributable to the fact, illustrated in Figure 1, that my_t^{mo} does not decline preceding the 1990–1991 recession, the dot-com crisis, and recession periods prior to the 1970s.

It is worth noting that according to Table 5, the sign of the estimates generally accord with economic intuition. For instance, Cred_t is positively associated with future recessions, implying that an increase in default risk raises the likelihood of future recessions. On the other hand, Term_t is negatively correlated with future recessions, which suggests that when the supply of long-term bonds increases because of an expected economic expansion in the future, long-term bond yields will rise with a lower probability of future recessions. Finally, higher stock market returns are negatively associated with the probability of recession because the stock market usually begins to decline before the economy declines and improves before the economy begins to pull out of a recession.

4.3 Results from Markov-switching Model

The evidence from the probit model suggests that an increase in housing

[9] A Bartlett kernel with a bandwidth of $4(T/100)^{2/9}$ is used for the Newey–West estimator.

[10] This is computed as $\phi(\hat{\beta}_0 \times \overline{v_t}) \times \hat{\beta}_0$, where $\overline{v_t}$ denotes the sample mean of v_t and $\phi(\cdot)$ represents the standard normal density function.

[11] These results are unchanged when using the Schwarz Bayesian information criterion to select the optimal lag length of the VECM. For brevity, these results are not reported, but are available upon request.

臺灣大學學術期刊資料庫

Table 5: Estimates from Probit Model

	hv_t^{fa}			hv_t^{mo}			hv_t^{rw}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_0	0.320*	0.315*	0.330*	0.069	0.069	−0.033	0.208*	0.210*	0.189*
	(1.867)	(1.805)	(1.797)	(0.720)	(0.694)	(−0.314)	(2.024)	(1.866)	(1.755)
β_1		0.258	0.438*		0.111	0.057		0.219*	0.204*
		(1.617)	(3.675)		(1.147)	(0.507)		(2.264)	(1.867)
γ^{Term}			−0.224*			−0.337*			−0.315*
			(−2.075)			(−3.297)			(−3.262)
γ^{Cred}			1.292*			1.092*			1.191*
			(3.570)			(3.354)			(3.474)
γ^{Sret}			−0.189*			−0.169*			−0.154*
			(−4.806)			(−4.650)			(−4.310)
ξ	−1.023*	−1.048*	−2.072*	−0.984*	−0.991*	−1.567*	−1.001*	−1.020*	−1.753*
	(−5.655)	(−5.334)	(−5.897)	(−6.051)	(−6.092)	(−4.165)	(−6.082)	(−6.141)	(−4.341)
pseudo-R^2	0.052	0.083	0.315	0.002	0.008	0.232	0.021	0.044	0.259

Note: Newey-West corrected t-statistics are given in parentheses, * denote the significance at the 10% level or above. The probit model is $P(d_t = 1) = \Phi(\xi + \beta' V_t + \gamma' X_{t-1})$, where $\Phi(\cdot)$ represents the cumulative standard normal distribution function, d_t denotes the recession indicator identified by the NBER, $V_t = [v_t, v_{t-1}, \cdots v_{t-k}]'$ is the measure of housing collateral scarcity. The vector $X_{t-1} = [\text{Term}_{t-1}, \text{Cred}_{t-1}, \text{Sret}_{t-1}]'$, where Term_t is the term spread, Cred_t is the credit spread, and Sret_t is the stock market return.

臺灣大學學術期刊資料庫

collateral scarcity leads to a higher probability of recession. In this section, we further use the TVTP-MS-AR(q) model discussed in Section 2.2 to examine whether an increase in housing collateral scarcity increases the probability of switching from an expansion to a recession. Furthermore, we examine whether greater housing collateral scarcity also increases the probability of becoming trapped in a recession regime.

Table 6 reports the estimation results of the TVTP-MS-AR(q) model represented by equations (11) and (12). The lag length q is set to four by the Akaike information criterion. Clearly, the TVTP-MS-AR(4) model of real GDP growth identifies a regime with a high mean (μ_1) and low volatility (σ_1), and a regime with a low mean (μ_0) and high volatility (σ_0). We label the high-mean stable and low-mean volatile states in real GDP as expansions and recessions, respectively. That is, the TVTP-MS-AR(4) model identifies well the fluctuations in the economy, as in the previous literature.

We consider different specifications of the TVTP-MS-AR(4) model with $Z_t = \{v_t\}$, $Z_t = \{v_t, v_{t-1}\}$, and $Z_t = \{v_t, \text{Term}_{t-1}\}$.[12] Columns (1)–(6) present the results using hv_t^{fa} and hv_t^{mo} as measures of housing wealth, and we find some evidence that $\hat{\beta}_{11}^0$ is significant when $Z_t = \{v_t\}$. However, these results are not robust to different specifications. On the other hand, the results obtained using hv_t^{rw} as the measure of housing wealth in columns (7)–(9) show that $\hat{\beta}_{11}^0$ is negative and statistically significant for all specifications, and its impact on absolute value is larger than in the cases of hv_t^{fa} and hv_t^{mo}. This provides evidence that an increase in housing collateral scarcity raises the probability of switching from an expansion to a recession. However, the evidence that an increase in housing collateral scarcity increases the probability of being trapped in recession is rather weak, because most estimates of β_{00}^0 and β_{00}^1 are statistically insignificant and have incorrect signs for all measures of housing wealth.

We plot the filtered probabilities of the recession states in Figure 4 with $Z_t = \{v_t\}$ using hv_t^{rw} as the measure of housing wealth. When greater than 0.5, the predicted probability shows strong evidence that the economy was in the recession regime. As a comparison, Figure 4 also contains shaded areas that represent the recession periods identified by the NBER. Clearly, the TVTP-MS-AR(4) model provides a fairly good fit to the NBER recession data.

[12] We do not report the cases with Cred_{t-1} and Sret_{t-1} as explanatory variables because they are insignificant in explaining P_t^{00} and P_t^{11} for all specifications we considered.

臺灣大學學術期刊資料庫

Table 6: Estimates from TVTP-MS-AR(4) Model

	hv_t^{fa}			hv_t^{mo}			hv_t^{rw}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ξ_{00}	5.736*	5.322*	16.403*	5.194*	6.995*	5.224*	2.489*	5.842*	13.650*
	(3.531)	(1.407)	(1.025)	(2.334)	(3.786)	(2.624)	(2.925)	(1.793)	(2.433)
ξ_{11}	4.714*	2.221*	5.143*	4.832*	4.414*	4.005	5.175*	4.839*	2.246*
	(3.568)	(1.966)	(2.860)	(3.972)	(7.172)	(1.654)	(2.639)	(4.065)	(1.888)
ϕ_1	0.268*	0.272*	0.278*	0.272*	0.254*	0.275*	0.252*	0.277*	0.267*
	(3.891)	(2.965)	(4.185)	(4.077)	(3.884)	(3.916)	(2.780)	(4.090)	(4.516)
ϕ_2	0.214*	0.235*	0.225*	0.217*	0.229*	0.235*	0.209*	0.217*	0.258*
	(3.052)	(3.2603)	(3.255)	(3.134)	(3.506)	(3.624)	(3.281)	(3.131)	(4.057)
ϕ_3	−0.095	−0.128*	−0.093*	−0.121*	−0.112*	−0.124*	−0.066	−0.115*	−0.094*
	(−1.446)	(−1.909)	(−1.408)	(−1.806)	(−1.687)	(−1.911)	(−0.914)	(−1.678)	(−1.656)
ϕ_4	0.025	0.016	0.018	0.047	0.013	0.028	−0.020	0.036	−0.085
	(0.406)	(0.270)	(0.290)	(0.723)	(0.224)	(0.460)	(−0.325)	(0.525)	(−1.590)
σ_0	1.070*	1.255*	1.074*	1.221*	1.263*	1.270*	1.169*	1.230*	1.225*
	(14.911)	(10.346)	(15.097)	(11.534)	(11.043)	(10.853)	(11.231)	(11.413)	(11.327)
σ_1	0.458*	0.522*	0.458*	0.525*	0.531*	0.527*	0.453*	0.531*	0.498*
	(13.650)	(14.373)	(14.193)	(15.323)	(16.025)	(16.131)	(8.675)	(14.586)	(13.672)
μ_0	0.431*	0.268*	0.414*	0.289*	0.261*	0.234*	0.441*	0.288*	0.430*
	(3.580)	(1.975)	(3.052)	(12.126)	(1.939)	(1.660)	(4.057)	(2.111)	(3.608)
μ_1	0.457*	0.529*	0.449*	0.496*	0.531*	0.504*	0.496*	0.500*	0.536*
	(5.797)	(4.694)	(5.737)	(5.628)	(5.933)	(5.601)	(5.175)	(5.558)	(6.817)

臺灣大學學術期刊資料庫

Table 6: Estimates from TVTP-MS-AR(4) Model (Cont.)

	hv_t^{fa}			hv_t^{mo}			hv_t^{rw}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_{00}^0	1.560*	−1.273	5.284	2.342*	−1.344	−1.243	−0.825	2.581	−7.332
	(2.073)	(−0.559)	(0.909)	(1.692)	(−1.184)	(−1.464)	(−1.083)	(1.372)	(−1.569)
β_{11}^0	−0.821*	−1.814	−0.943	−1.482*	−1.363*	−3.731	−5.300*	−1.577*	−4.463*
	(−0.789)	(−1.414)	(−0.826)	(−2.132)	(−3.490)	(−1.296)	(−1.952)	(−2.082)	(−2.870)
β_{00}^1		−1.364			4.073*			−0.984	
		(−1.103)			(3.433)			(−0.734)	
β_{11}^1		3.157*			−0.414			−0.282	
		(1.739)			(−0.691)			(0.270)	
γ_{00}^{Term}			−5.908			−1.235			−7.236*
			(−0.891)			(−1.555)			(−2.248)
γ_{11}^{Term}			0.937			3.543			0.796*
			(0.470)			(1.389)			(1.715)
log-lik	−254.965	−250.146	−253.517	−255.064	−254.062	−249.030	−251.931	−254.765	−252.441

Note: t-statistics are given in parentheses, * denote the significance at the 10% level or above. The Markov-switching autoregressive model is $\phi(L)g_t = \mu_{S_t} + \epsilon_t$, $\epsilon_t \sim N(0, \sigma_{S_t}^2)$, $S_t = \{0, 1\}$. The transition probabilities for TVTP are specified as

$$p_t^{00}(Z_t) = \frac{\exp\left(\xi_{00} + \Sigma_{k=0}^{K}\beta_{00}^k v_{t-k} + \gamma_{00}' X_{t-1}\right)}{1 + \exp\left(\xi_{00} + \Sigma_{k=0}^{K}\beta_{00}^k v_{t-k} + \gamma_{00}' X_{t-1}\right)}, \; p_t^{11}(Z_t) = \frac{\exp\left(\xi_{11} + \Sigma_{k=0}^{K}\beta_{11}^k v_{t-k} + \gamma_{11}' X_{t-1}\right)}{1 + \exp\left(\xi_{11} + \Sigma_{k=0}^{K}\beta_{11}^k v_{t-k} + \gamma_{11}' X_{t-1}\right)}.$$

log-lik represents the value of log-likelihood function.

臺灣大學學術期刊資料庫

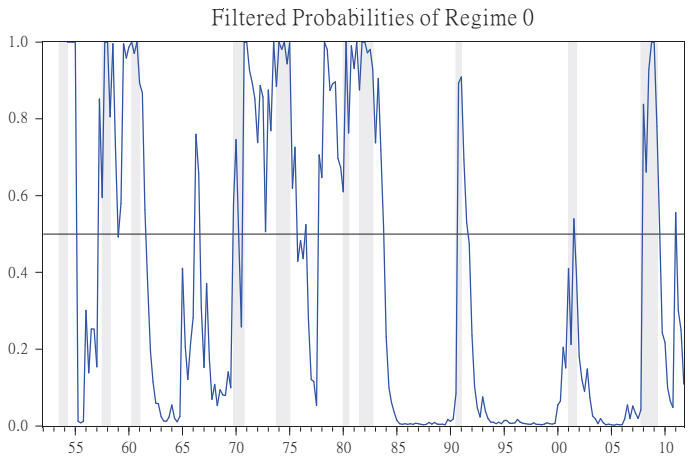


Figure 4: Filtered Probabilities in State 0 (Recession), TVTP-MS-AR(4) Model with the Negative Transitory Shock to hv_t^{rw}. Shaded areas represent NBER recession dates

To sum up, the TVTP-MS-AR(4) model indicates that a scarcity of housing collateral pushes the economy into a downturn. This result echoes the recent findings of Agnello, Castro, and Sousa (2015) that housing busts are likely to turn into chronic slumps and ultimately lead to severe recessions. On the other hand, there is little evidence that housing collateral scarcity affects the probability of becoming trapped in the recession state.

5 Robustness Issues

To check the robustness of the empirical results, we consider the following modifications. First, we investigate whether the empirical results are robust to the inclusion of a lagged recession indicator using a dynamic probit model. We also consider a different specification of the Markov-switching model. Finally, we use different measures of transitory shocks to housing wealth to complete our empirical analysis.

5.1 Dynamic Probit Model

We follow Dueker (1997), Kauppi and Saikkonen (2008), and Nyberg (2010) to consider a natural extension to the probit model in equation (10) by

臺灣大學學術期刊資料庫

adding a lagged value of the recession indicators d_{t-l} to form a dynamic probit model as follows:

$$P\left(d_t = 1\right) = \Phi\left(\xi + \beta' V_t + \gamma' X_{t-1} + \zeta d_{t-l}\right).$$

It is worth noting that the measure of housing collateral scarcity and other recession predictors are available in real time; however, the NBER recession dates are announced with substantial time delays. Thus, we need to take this practical issue into consideration and make our assumptions based on what information is available at the time when the shock to housing collateral occurs. As shown by Kauppi and Saikkonen (2008) and Ng (2012), the average publication lag is about nine months. Thus, we follow Kauppi and Saikkonen (2008) by assuming a three-quarter publication lag in the recession indicator, i.e., $l = 3$.

Table 7 presents the results. Based on the pseudo-R^2, it is obvious that the statistical improvement over the static models is substantial, which is consistent with the findings in Kauppi and Saikkonen (2008). The housing collateral scarcity measures based on hv_t^{fa} and hv_t^{rw} continue to be strongly significant and their economic impact is very close to Table 5.

5.2 Alternative Markov-switching Model

As shown in Clements and Krolzig (2003), the TVTP-MS-AR(4) model of equation (11) is characterized by switching in the intercept μ_{S_t}, which implies a smooth transition, rather than a once-and-for-all jump, in the level of the process after a shift in regime. In this section, we consider a conventional specification of an MS-AR(q) model á la Hamilton (1989) with time-varying transition probabilities as follows:

$$\phi(L)\left(g_t - \mu_{S_t}\right) = \epsilon_t, \epsilon_t \sim N\left(0, \sigma_{S_t}^2\right).$$

The estimation results reported in Table 8 suggest that our main findings remain unchanged, that is, the negative transitory shock to hv_t^{rw} still significantly increases the probability of switching from an expansion to a recession.

5.3 Unorthogonalized Transitory Shock to Housing Collateral

Up to this point, we have obtained our results by assuming the transitory shock to be orthogonal to the permanent shock. However, this assumption

臺灣大學學術期刊資料庫

Table 7: Estimates from Dynamic Probit Model

	hv_t^{fa}			hv_t^{mo}			hv_t^{rw}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_0	0.366*	0.373*	0.352*	0.100	0.101	0.004	0.238*	0.238*	0.169*
	(2.221)	(2.206)	(2.014)	(1.011)	(0.990)	(0.038)	(2.134)	(2.076)	(1.899)
β_1		0.299*	0.458*		0.146	0.089		0.269*	0.233*
		(2.108)	(3.892)		(1.464)	(0.695)		(2.342)	(1.827)
γ^{Term}			−0.259*			−0.358*			−0.344*
			(−2.327)			(−3.387)			(−3.388)
γ^{Cred}			1.047*			0.903*			0.994*
			(2.916)			(2.740)			(2.830)
γ^{Sret}			−0.208*			−0.183*			−0.167*
			(−4.708)			(−5.250)			(−5.025)
ξ	−1.194*	−1.251*	−1.961*	−1.115*	−1.132*	−1.496*	−1.151*	−1.194*	−1.668*
	(−6.351)	(−6.308)	(−5.769)	(−6.429)	(−6.461)	(−4.136)	(−6.552)	(−6.445)	(−4.260)
ζ	0.720*	0.845*	0.865*	0.559*	0.590*	0.665*	0.653*	0.753*	0.704*
	(2.805)	(3.275)	(2.392)	(2.172)	(2.231)	(2.069)	(2.349)	(2.436)	(1.935)
pseudo-R^2	0.082	0.121	0.336	0.025	0.039	0.253	0.045	0.079	0.281

Note: Newey-West corrected t-statistics are given in parentheses, * denote the significance at the 10% level or above. The probit model is $P(d_t = 1) = \Phi(\xi + \beta' V_t + \gamma' X_{t-1} + \zeta d_{t-3})$, where $\Phi(\cdot)$ represents the cumulative standard normal distribution function, d_t denotes the recession indicator identified by the NBER, $V_t = [v_t, v_{t-1}, \cdots v_{t-k}]'$ is the measure of housing collateral scarcity. The vector $X_{t-1} = [\text{Term}_{t-1}, \text{Cred}_{t-1}, \text{Sret}_{t-1}]'$, where Term_t is the term spread, Cred_t is the credit spread, and Sret_t is the stock market return.

臺灣大學學術期刊資料庫

Table 8: Estimates from an Alternative TVTP-MS-AR(4) Model

	hv_t^{fa}			hv_t^{mo}			hv_t^{rw}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ξ_{00}	5.734*	16.403	5.790*	5.277*	7.279*	5.476	2.548*	5.538*	13.884*
	(3.518)	(1.018)	(1.882)	(2.408)	(2.676)	(2.081)	(2.632)	(2.254)	(2.021)
ξ_{11}	4.715*	5.145*	2.357*	4.993*	4.579*	4.329*	5.196*	4.952*	2.319*
	(3.625)	(2.860)	(2.240)	(4.019)	(4.750)	(2.099)	(2.649)	(4.054)	(1.978)
ϕ_1	0.267*	0.278*	0.286*	0.267*	0.242*	0.281*	0.259*	0.272*	0.267*
	(3.886)	(4.164)	(3.894)	(4.029)	(3.767)	(4.111)	(2.717)	(4.052)	(4.612)
ϕ_2	0.213*	0.224*	0.237*	0.221*	0.234*	0.247*	0.208*	0.221*	0.252*
	(3.049)	(3.244)	(3.629)	(3.213)	(3.693)	(3.773)	(3.215)	(3.204)	(3.990)
ϕ_3	−0.096	−0.093	−0.134*	−0.125*	−1.104	−0.122*	−0.068	−0.122*	−0.094*
	(−1.452)	(−1.390)	(−2.035)	(−1.852)	(−1.649)	(−1.867)	(−0.920)	(−1.801)	(−1.680)
ϕ_4	0.025	0.018	0.031	0.068	0.023	0.049	−0.018	0.062	−0.086
	(0.415)	(0.278)	(0.481)	(1.029)	(0.371)	(0.791)	(−0.248)	(0.890)	(−1.590)
σ_0	1.070*	1.073*	1.266*	1.231*	1.298*	1.267*	1.170*	1.236*	1.248*
	(14.889)	(15.091)	(10.844)	(11.736)	(10.857)	(11.064)	(11.048)	(11.648)	(10.096)
σ_1	0.458*	0.458*	0.522*	0.519*	0.527*	0.520*	0.456*	0.522*	0.503*
	(13.642)	(14.179)	(15.585)	(15.812)	(16.209)	(16.414)	(8.319)	(15.303)	(12.602)
μ_0	0.744*	0.756*	0.435*	0.451*	0.381*	0.329*	0.747*	0.456*	0.776*
	(4.629)	(4.591)	(2.274)	(2.333)	(2.168)	(1.678)	(5.938)	(2.336)	(9.566)
μ_1	0.772*	0.778*	0.872*	0.854*	0.870*	0.870*	0.779*	0.859*	0.787*
	(9.673)	(9.704)	(10.886)	(10.605)	(11.734)	(10.550)	(9.674)	(10.597)	(4.816)

臺灣大學學術期刊資料庫

Table 8: Estimates from an Alternative TVTP-MS-AR(4) Model (Cont.)

	hv_t^{fa}			hv_t^{mo}			hv_t^{rw}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_{00}^0	1.558*	5.284	−1.532	2.383*	−1.881*	−1.457	−0.884	2.399	−7.648
	(2.062)	(0.902)	(−0.964)	(1.753)	(−1.973)	(−1.642)	(−1.069)	(1.642)	(−1.545)
β_{11}^0	−0.823	−0.951	−1.841	−1.588*	−1.333*	−4.085*	−5.230*	−1.636*	−4.371*
	(−0.817)	(−0.838)	(−1.467)	(−2.280)	(−2.260)	(−1.871)	(−1.986)	(−2.204)	(−2.738)
β_{00}^1		5.905			4.320*			−0.780	
		(0.884)			(2.472)			(0.726)	
β_{11}^1		−0.932			−1.089*			−0.289	
		(−0.465)			(−4.284)			(−0.288)	
γ_{00}^{Term}			−1.511			−1.303			−7.544*
			(−1.469)			(−1.233)			(−1.914)
γ_{11}^{Term}			3.198*			3.680*			0.764*
			(1.728)			(1.779)			(1.730)
log-lik	−254.982	−253.652	−249.635	−254.495	−253.463	−247.688	−252.403	−254.285	−252.846

Note: t-statistics are given in parentheses, * denote the significance at the 10% level or above. The Markov-switching autoregressive model is $\phi(L)(g_t - \mu_{S_t}) = \epsilon_t$, $\epsilon_t \sim N(0, \sigma_{S_t}^2)$, $S_t = \{0, 1\}$. The transition probabilities for TVTP are specified as

$$p_t^{00}(Z_t) = \frac{\exp\left(\xi_{00} + \Sigma_{k=0}^{K}\beta_{00}^k v_{t-k} + \gamma_{00}' X_{t-1}\right)}{1 + \exp\left(\xi_{00} + \Sigma_{k=0}^{K}\beta_{00}^k v_{t-k} + \gamma_{00}' X_{t-1}\right)}, \; p_t^{11}(Z_t) = \frac{\exp\left(\xi_{11} + \Sigma_{k=0}^{K}\beta_{11}^k v_{t-k} + \gamma_{11}' X_{t-1}\right)}{1 + \exp\left(\xi_{11} + \Sigma_{k=0}^{K}\beta_{11}^k v_{t-k} + \gamma_{11}' X_{t-1}\right)}.$$

log-lik represents the value of log-likelihood function.

臺灣大學學術期刊資料庫

may not be warranted in the data (Corsetti and Konstantinou, 2012; Lettau and Ludvigson, 2004). To address this possibility, we consider a permanent–transitory decomposition that does not require the shocks to be orthogonal.

At first, we present the fraction of the h-step ahead forecast error of hv_t and y_t that is attributable to the variance of the permanent and transitory shocks, and two times the covariance between the permanent and transitory shocks in Table 9. The transitory component in housing wealth and labor income is correlated with the permanent shocks, especially when housing wealth is measured by hv_t^{fa} and hv_t^{rw}. However, the main results remain qualitatively unchanged compared with Table 4: that is, transitory shocks continue to dominate the housing wealth fluctuations, while permanent shocks dominate the variation in labor income.

We then use the negative, unorthogonalized transitory shock to measure housing collateral scarcity, i.e., $v_t = -\hat{u}_t^T$. The empirical results of the probit model are reported in Table 10. The only exception is that the shock to housing collateral based on hv_t^{fa} becomes insignificant. Nevertheless, the unorthogonalized transitory shock to hv_t^{rw} still has a positive and significant impact on the probability of recession, which is consistent with the results using orthogonalized transitory shocks presented in Tables 5 and 7.

5.4 Transitory Shocks to House Prices

As shown by Leung (2007), house prices may have an important influence on macroeconomic fluctuations. In this section, we use house prices instead of housing wealth to construct the measure of housing collateral scarcity. The reason is threefold. First, house price fluctuations are the main source of short-run housing wealth changes (Slacalek, 2006). Second, Nitschka (2010) has shown that the comovements between the housing collateral ratio and the house price to GDP ratio has been positive since the late 1960s. Third, Leung (2014) constructs a dynamic stochastic general equilibrium model that generates reduced form dynamics between house prices and income that are consistent with error-correction models, and argues that the dynamics of equilibrium house prices are tied to the dynamics of the house price to income ratio. Overall, these suggest the house price to income ratio is a suitable potential measure of collateral scarcity.

We obtain the data on house prices from 1975Q1 to 2011Q4 from the Office of Federal Housing Enterprise Oversight. We then follow Leung (2014) to estimate a bivariate VECM with real house prices and labor in-

臺灣大學學術期刊資料庫

Table 9: Unorthogonalized Forecast Error Variance Decomposition

		Forecast Error Variance Decomposition of hv_t				
		$h=1$	$h=4$	$h=8$	$h=16$	$h=32$
$Y_t=[hv_t^{fa}, y_t]'$	$\tilde{P}$	0.034	0.004	0.005	0.008	0.008
	$\tilde{T}$	1.275	1.032	0.933	0.887	0.898
	$\tilde{P},\tilde{T}$	−0.309	−0.036	0.062	0.105	0.093
$Y_t=[hv_t^{mo}, y_t]'$	$\tilde{P}$	0.090	0.087	0.076	0.069	0.086
	$\tilde{T}$	0.821	0.826	0.841	0.852	0.829
	$\tilde{P},\tilde{T}$	0.089	0.087	0.082	0.079	0.085
$Y_t=[hv_t^{rw}, y_t]'$	$\tilde{P}$	0.101	0.123	0.185	0.282	0.384
	$\tilde{T}$	1.038	1.027	0.997	0.933	0.835
	$\tilde{P},\tilde{T}$	−0.139	−0.150	−0.182	−0.215	−0.219
		Forecast Error Variance Decomposition of y_t				
		$h=1$	$h=4$	$h=8$	$h=16$	$h=32$
$Y_t=[hv_t^{fa}, y_t]'$	$\tilde{P}$	1.737	1.623	1.616	1.826	1.469
	$\tilde{T}$	2.045	2.102	2.106	1.820	0.668
	$\tilde{P},\tilde{T}$	−2.782	−2.725	−2.722	−2.645	−1.137
$Y_t=[hv_t^{mo}, y_t]'$	$\tilde{P}$	0.957	0.912	0.900	0.900	0.932
	$\tilde{T}$	0.010	0.033	0.039	0.039	0.024
	$\tilde{P},\tilde{T}$	0.033	0.055	0.061	0.061	0.044
$Y_t=[hv_t^{rw}, y_t]'$	$\tilde{P}$	1.027	0.996	1.009	1.030	1.015
	$\tilde{T}$	0.132	0.190	0.169	0.103	0.051
	$\tilde{P},\tilde{T}$	−0.158	−0.186	−0.176	−0.133	−0.066

Note: The table reports the fraction of the variance in the h-step-ahead forecast error of the variable listed at the top of the table that is attributable to the permanent shock $\tilde{P}$ and the transitory shock $\tilde{T}$, and two times the covariance between $\tilde{P}$ and $\tilde{T}$.

come, and use the negative, orthogonalized transitory shock to house prices to measure housing collateral scarcity.[13]

[13]The results of the cointegration tests and the VECM estimates are available upon request.

臺灣大學學術期刊資料庫

Table 10: Estimates from Probit Model: Unorthogonalized Transitory Shocks

	hv_t^{fa}			hv_t^{mo}			hv_t^{rw}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_0	0.148	0.148	−0.044	0.169	0.169	0.016	0.130*	0.129*	0.125*
	(0.844)	(0.830)	(−0.307)	(1.191)	(1.167)	(0.013)	(1.862)	(1.689)	(1.655)
β_1		0.137	0.124		0.226	0.166		0.144*	0.125*
		(0.753)	(0.723)		(1.540)	(1.007)		(1.793)	(1.706)
γ^{Term}			−0.336*			−0.319*			−0.331*
			(−3.313)			(−3.168)			(−3.430)
γ^{Cred}			1.101*			1.066*			1.176*
			(3.228)			(3.268)			(3.391)
γ^{Sret}			−0.169*			−0.169*			−0.157*
			(−4.569)			(−4.614)			(−4.447)
ξ	−0.985*	−0.987*	−1.581*	−0.988*	−1.000*	−1.572*	−0.992*	−1.002*	−1.691*
	(−6.007)	(−6.002)	(−4.145)	(−6.045)	(−6.079)	(−4.158)	(−7.652)	(−7.599)	(−4.185)
pseudo-R^2	0.004	0.007	0.232	0.007	0.018	0.235	0.011	0.023	0.246

Note: Newey-West corrected t-statistics are given in parentheses, * denote the significance at the 10% level or above. The probit model is $P(d_t = 1) = \Phi(\xi + \beta' V_t + \gamma' X_{t-1})$, where $\Phi(\cdot)$ represents the cumulative standard normal distribution function, d_t denotes the recession indicator identified by the NBER, $V_t = [v_t, v_{t-1}, \cdots v_{t-k}]'$ is the measure of housing collateral scarcity. The vector $X_{t-1} = [\text{Term}_{t-1}, \text{Cred}_{t-1}, \text{Sret}_{t-1}]'$, where Term_t is the term spread, Cred_t is the credit spread, and Sret_t is the stock market return.

臺灣大學學術期刊資料庫

Table 11: Estimates from Static and Dynamic Probit Models: Negative Transitory Shocks to House Prices

	Standard Probit Models			Dynamic Probit Models		
	(1)	(2)	(3)	(4)	(5)	(6)
β_0	0.151*	0.145*	0.107	0.179*	0.175*	0.096
	(1.968)	(1.853)	(0.789)	(1.900)	(1.806)	(0.679)
β_1		0.102	0.241		0.133	0.246
		(1.269)	(1.189)		(1.430)	(1.173)
γ^{Term}			−0.249*			−0.244*
			(−2.060)			(−1.948)
γ^{Cred}			1.356*			1.437*
			(3.931)			(3.026)
γ^{Sret}			−0.216*			−0.217*
			(−3.769)			(−3.775)
ξ	−1.101*	−1.107*	−2.308*	−1.239*	−1.259*	−2.392*
	(−4.929)	(−8.428)	(−4.398)	(−7.808)	(−7.544)	(−3.706)
ζ				0.700*	0.747*	−0.178
				(2.062)	(2.146)	(−0.267)
pseudo-R^2	0.011	0.016	0.319	0.040	0.050	0.319

Note: Newey-West corrected t-statistics are given in parentheses, * denote the significance at the 10% level or above. The probit model is $P(d_t = 1) = \Phi(\xi + \beta' V_t + \gamma' X_{t-1} + \zeta d_{t-3})$, where $\Phi(\cdot)$ represents the cumulative standard normal distribution function, d_t denotes the recession indicator identified by the NBER, $V_t = [v_t, v_{t-1}, \cdots v_{t-k}]'$ is the measure of housing collateral scarcity. The vector $X_{t-1} = [\text{Term}_{t-1}, \text{Cred}_{t-1}, \text{Sret}_{t-1}]'$, where Term_t is the term spread, Cred_t is the credit spread, and Sret_t is the stock market return.

Table 11 reports the empirical results for the static and dynamic probit models. As shown, housing collateral scarcity v_t has a significantly positive effect on the recession probabilities when including $\{v_t\}$ and $\{v_t, v_{t-1}\}$ as explanatory variables. However, the impact of v_t on the recession probabilities becomes insignificant when including $X_{t-1} = \{\text{Term}_{t-1}, \text{Cred}_{t-1}, \text{Sret}_{t-1}\}$ as additional control variables, which suggests that the negative transitory shocks to house prices may not provide any additional explanatory power for future recessions beyond these classic recession predictors. Nevertheless, our results indicate that the contemporaneous, negative orthogonalized transitory shocks to house prices still exert a positive impact on the probability

臺灣大學學術期刊資料庫

of recession, which is consistent with the results reported in Tables 5 and 7 based on the housing collateral ratio proposed by Lustig and Nieuwerburgh (2005).

6 Conclusion

The collapse of the US housing market after early 2006 has been seen as a key catalyst for the Great Recession in 2007–09. In this paper, we take a fresh look at the relationship between housing collateral scarcity and recession. Rather than investigating the impact on macroeconomic variables, we investigate whether a reduction in housing collateral leads to a recession.

We first used a VECM model to identify the effects of negative shocks to housing wealth as a measure of housing collateral scarcity. We then used probit models to examine whether the probability of a recession increases as a result of housing collateral scarcity in the US. Finally, we employed time-varying transition-probability Markov-switching models to investigate how housing collateral scarcity affects the probability of switching between economic recession and expansion.

Using quarterly data from 1952Q1 to 2011Q4 and the value of residential real estate as a measure of aggregate housing wealth, the empirical results suggested that housing collateral scarcity indeed increases the probability of economic downturns. Further, we found evidence that an increase in housing collateral scarcity pushes the economy into a downturn. We showed that the empirical results are robust to different specifications of the probit and Markov-switching models, and to different measures of housing collateral scarcity.

While our study contributes to our understanding of the relationship between housing collateral and recessions, several interesting extensions remain open. For instance, it would be interesting to consider the qualitative vector autoregressive model proposed by Dueker (2005) to incorporate the recession dates and housing collateral ratio into the vector autoregressive structure. This would facilitate exploration of the predictability of recession. Moreover, it would be of interest to investigate the relationship between the housing collateral ratio and other macroeconomic variables related to the business cycle, such as consumption expenditure and unemployment, using a Markov-switching vector autoregressive model a lá Chang, Chen, and Leung (2011) and Chang, Chen, and Leung (2012). In this way, we could also consider the interactions between housing collateral and the macroecon-

臺灣大學學術期刊資料庫

omy under different economic conditions. We defer these issues to future research.

References

Agnello, L., V. Castro, and R. Sousa (2015), "Boom, Busts, and Normal Times in the Housing Market," *Journal of Business and Economic Statistics*, 33, 25–45.

Campbell, J. (1996), "Understanding risk and Return," *Journal of Political Economy*, 104, 298–345.

Carroll, C., M. Otsuka, and J. Slacalek (2011), "How Large are Housing and Financial Wealth Effects? A new Approach," *Journal of Money, Credit and Banking*, 43, 55–79.

Case, K., J. Quigley, and R. Shiller (2013), "Wealth Effect Revisited: 1975–2012," NBER Working Paper, No. 18667.

Case, K., J. Shiller, and A. Weiss (1995), "Mortgage Default Risk and Real Estate Prices: The Use of Index-Based Futures and Options in Real Estate," NBER Working Paper, No. 5078.

Chang, K. L., N. K. Chen, and C. K. Y. Leung (2011), "Monetary Policy, Term Structure and Asset Return: Comparing REIT, Housing and Stock," *Journal of Real Estate Finance and Economics*, 43, 221–257.

——— (2012), "The Dynamics of Housing Returns in Singapore: How Important are the International Transmission Mechanisms?" *Regional Science and Urban Economics*, 42, 516–530.

Chauvet, M. and S. Potter (2005), "Forecasting Recessions Using the Yield Curve," *Journal of Forecasting*, 24, 77–103.

Chen, N. K. and C. K. Y. Leung (2008), "Asset Price Spillover, Collateral and Crises: With an Application to Property Market Policy," *Journal of Real Estate Finance and Economics*, 37, 351–385.

Chen, S.-S. (2011), "Lack of Consumer Confidence and Stock Returns," *Journal of Empirical Finance*, 18, 225–236.

Chen, S.-S. and Y.-H. Chou (2016), "Does fear Lead to Recession?" *Macroeconomic Dynamics*, 20, 1247–1263.

Christelis, D., D. Georgarakos, and T. Jappelli (2015), "Wealth Shocks, Unemployment Shocks, and Consumption in the wake of the Great Recession," *Journal of Monetary Economics*, forthcoming.

Christiano, L., R. Motto, and M. Rostagno (2013), *Risk Shocks*, NBER Working Papers, No. 18682.

臺灣大學學術期刊資料庫

Clements, M. and H.-M. Krolzig (2003), "Business Cycle Asymmetries: Characterization and Testing Based on MMarkov-Switching Autoregression," *Journal of Business and Economic Statistics*, 21, 196–211.

Corsetti, G. and P. Konstantinou (2012), "What Drives US Foreign Borrowing? Evidence on the External Adjustment to Transitory and Permanent Shocks," *American Economic Review*, 102, 1062–1092.

Del Negro, M. (2001), "Turn, Turn, Turn: Predicting Turning Points in Economic Activity," *Economic Review, Federal Reserve Bank of Atlanta*, Q2, 1–12.

Del Negro, M., G. Eggertsson, and N. Kiyotaki (2011), "The Great Escape? A Quantitative Evaluation of the Fed's Liquidity Facilities," Manuscript, Federal Reserve Bank of New York.

Dueker, M. (1997), "Strengthening the Case for the Yield Curve As a Predictor of U.S. Recessions," *Federal Reserve Bank of St. Louis Review*, 79, 41–51.

——— (2005), "Dynamic Forecasts of Qualitative Variables: A qual VAR Model of U.S. Recessions," *Journal of Business and Economic Statistics*, 23, 96–104.

Durland, J. and T. McCurdy (1994), "Duration-Dependent Transitions in a Markov model of U.S. GNP Growth," *Journal of Business and Economic Statistics*, 12, 279–288.

Engle, R. and C. Granger (1987), "Co-Integration and Error Correction: Representation, Estimation, and Testing," *Econometrica*, 55, 251–276.

Estrella, A. (1998), "A New Measure of Fit for Equations with Dichotomous Dependent Variables," *Journal of Business and Economic Statistics*, 16, 198–205.

Estrella, A. and F. Mishkin (1998), "Predicting U.S. Recessions: Financial Variables as Leading Indicators," *Review of Economic and Statistics*, 80, 45–61.

Filardo, A. (1994), "Business-Cycle Phases and Their Transitional Dynamics," *Journal of Business and Economic Statistics*, 12, 299–308.

——— (1999), "How Reliable are Recession Prediction Models?" *Economic Review, Federal Reserve Bank of Kansas City*, Q2, 35–55.

Filardo, A. and S. Gordon (1998), "Business Cycles Durations," *Journal of Econometrics*, 85, 99–123.

Fisher, L. and H.-S. Huh (2007), "Permanent-Transitory Decompositions under weak Exogeneity," *Econometric Theory*, 1, 183–189.

臺灣大學學術期刊資料庫

Gonzalo, J. and C. Granger (1995), "Estimation of Common Long-Memory Components in Cointegrated System," *Journal of Business and Economic Statistics*, 13, 27–35.

Gonzalo, J. and S. Ng (2001), "A Systematic Framework for Analyzing the Dynamic Effects of Permanent and Transitory Shocks," *Journal of Economic Dynamics and Control*, 25, 1527–1546.

Guerrieri, L. and M. Iacoviello (2013), *Collateral Constraints and Macroeconomic Asymmetries*, International Finance Discussion Papers, Board of Governors of the Federal Reserve System.

Hamilton, J. (1989), "A New Approach to the Economic Analysis of Non Stationary time Series and the Business Cycle," *Econometrica*, 57, 357–384.

Hamilton, J. and G. Perez-Quiros (1996), "What do the Leading Indicators Lead?" *Journal of Business*, 69, 27–39.

Hansen, B. (1992), "Tests for Parameter Instability in Regression with I(1) Processes," *Journal of Business and Economic Statistics*, 10, 321–335.

Iacoviello, Matteo (2005), "House Prices, Borrowing Constraints and Monetary Policy in the Business Cycle," *American Economic Review*, 95, 739–764.

Jagannathan, R. and Z. Wang (1996), "The Conditional CAPM and the Cross-Section of Expected Returns," *Journal of Finance*, 51, 3–53.

Jermann, U. and V. Quadrini (2012), "Macroeconomic Effects of Financial Shocks," *American Economic Review*, 102, 238–271.

Johansen, S. (1991), "Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models," *Econometrica*, 59, 1551–1580.

Kauppi, H. and P. Saikkonen (2008), "Predicting U.S. Recessions with Dynamic Binary Response Models," *Review of Economics and Statistics*, 90, 777–791.

Kiyotaki, N. and J. Moore (1997), "Credit Cycles," *Journal of Political Economy*, 105, 211–248.

Lam, P.-S. (2004), "A Markov-Switching model of GNP Growth with Duration Dependence," *International Economic Review*, 45, 175–204.

Lettau, M. and S. Ludvigson (2001), "Consumption, Aggregate Wealth and Expected Stock Returns," *Journal of Finance*, 56, 815–849.

——— (2004), "Understanding Trend and Cycle in Asset Values: Reevaluating the Wealth Effect on Consumption," *American Economic Review*, 94, 276–296.

臺灣大學學術期刊資料庫

Leung, C. K. Y. (2007), "Equilibrium Correlations of Asset Price and Return," *Journal of Real Estate Finance and Economics*, 34, 233–256.

——— (2014), "Error Correction Dynamics of House Prices: An Equilibrium Benchmark," *Journal of Housing Economics*, 25, 75–95.

Liu, Z., P. Wang, and T. Zha (2013), "Land-Price Dynamics and Macroeconomic Fluctuations," *Econometrica*, 81, 1147–1184.

Lustig, H. and S. Van Nieuwerburgh (2005), "Housing Collateral, Consumption Insurance, and Risk Premia: An Empirical Perspective," *Journal of Finance*, 60, 1167–1219.

McConnell, M. and G. Perez-Quiros (2000), "Output Fluctuations in the United States: What has Changed Since the Early 1980's?" *American Economic Review*, 90, 1464–1476.

Ng, E. (2012), "Forecasting U.S. Recessions with Various risk Factors and Dynamic Probit Models," *Journal of Macroeconomics*, 34, 112–125.

Nitschka, T. (2010), "Securitization, Collateral Constraints and Consumption risk Sharing in the Euro Area," *Economics Letters*, 106, 197–199.

Nyberg, H. (2010), "Dynamic Probit Models and Financial Variables in Recession Forecasting," *Journal of Forecasting*, 29, 215–230.

Slacalek, J. (2006), "What Drives Personal Consumption? The role of Housing and Financial Wealth," DIW discussion paper 647.

Stock, J. and M. Watson (1993), "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems," *Econometrica*, 61, 783–820.

投稿日期: 2015年3月3日, 接受日期: 2015年5月14日

臺灣大學學術期刊資料庫

房屋擔保品缺乏與景氣衰退: 一個實證的分析

周有熙
國立台灣師範大學公民教育與活動領導系

本文以實證的方式研究美國時間序列資料中房屋擔保品缺乏度和景氣衰退的動態關係。我們先以向量誤差修正模型萃取對房屋財富的負向暫時性衝擊作爲對房屋擔保品缺乏度的近似指標, 再以累積常態機率函數模型和具有因時變動遞移機率的馬可夫轉換自我迴歸模型檢驗房屋擔保品缺乏度和景氣衰退機率之間的關聯性。以數種房地產財富資料的實證結果顯示, 房屋擔保品缺乏度增加會提高經濟進入景氣衰退的機率, 且可能將經濟體系由景氣擴張階段推入景氣衰退階段。

關鍵詞: 房屋擔保品, 景氣衰退, 累積常態機率函數模型
JEL 分類代號: E32, E44, G01

臺灣大學學術期刊資料庫

臺灣大學學術期刊資料庫