
Chien-Chung Nieh*, Shi-jie Jiang**

Abstract
A kind of conditional ECM, which avoids the problems producing noises within traditional multiple cointegration vectors, has been employed in this paper to explore the dynamics of surrender behavior. The results provide solid evidence supporting emergency fund hypothesis and interest rate hypothesis both in short run and long run. A unique cointegration relationship within the surrender dynamics has been validated. Besides, a new hypothesis test which stresses the competition for the withdrawal of cash values of life insurance policies has also been conducted. Such crowding-out effect between policy loans and policy surrenders might be attributed to the motivation that keeps life policy in force, the existence of surrender charges, and the automatic premium loan provision.

Keywords: Policy surrenders; Policy loans; Autoregressive distributed lags model

1. Introduction

It is always crucial to understand the behavior of existing policyholders in the life insurance business. Voluntary termination of a policy, so called surrender or lapse, normally happens if premium is not paid by a policyholder within grace period. There are several reasons why life insurance business actively seeks to surrender of policies and encourage timely premium payment (Black and Skipper, 2000). First, surrendering policies makes the insurance companies unable to fully recover their initial acquisition expenditures, especially for terminations within the first two policy years. Second, in general, policyholders who have poor health tend to lapse less than the healthy ones. More voluntary termination of healthy policyholders worsens the adverse selection issue. Under such circumstance, insurance companies would receive more claims and incur more losses than expected. Third, insurance companies have to face a liquidity constraint due to early surrender, and therefore forced to adopt a short term investment strategy, which generates lower returns, to meet surrender demands. During the early 1980s, most U.S. life insurance companies suffered from negative

Author for Correspondence: Chien-Chung Nieh. E-mail: niehcc@mail.tku.edu.tw

* Director, Department of Banking and Finance, Tamkang University, Tamsui, Taiwan 251, R.O.C.

** Ph.D. student, Graduate Institute of Banking and Finance, Tamkang University, Tamsui, Taiwan 251, R.O.C.
Besides providing economic protection, many life insurance products also allow policyholders to accumulate savings, whose cash values can be used in time of financial needs. There are two kinds of financial needs which have been proposed as two different hypotheses to explain the surrender behavior. The emergency fund hypothesis, first proposed by the classic research of Linton (1932), says that cash values are utilized by policyholders for emergency at time of a recession or financial crisis. Insurance protection, which requires cash to pay for its premium, is of secondary importance during such periods. Many may not even afford the premium, so one might expect more terminations at time of high unemployment.

The Interest rate hypothesis, which has received most attention, emphasizes on the arbitrage needs of policyholders at time of higher interest rates. (Schott, 1971 Pesando, 1974) Retaining original contracts implies higher opportunity costs when interest rate rises. Interest-rate-induced surrender and prepayment of assets raise the sensitivity of the duration mismatch between assets and liabilities. When interest rate goes down, so does the surrender of liabilities, but the asset prepayment rate stays high. In this case the duration of liability cash flows increases, but that of asset cash flow decreases and causes a mismatch problem. (see Fabozzi 2001). As the market value of liability rises, that of asset goes down due to stronger prepayment. Grosen and Jorgensen (2000) also indicated that the surrender option itself is costly to insurance companies, up to half of the value of the insurance contracts if policyholders exercise such option optimally. Their conclusion suggests that the surrender factor has to be incorporated when pricing or evaluating insurance contracts.

One important characteristic of insurance industry is that each policy typically generates a stream of revenues in the form of premium payment. Once a life insurance company sells a policy, it generally expects the policy to be in force so that the revenue stream associated with policy continues. The surrender, or lapsation problem, is essential in running insurance business hence modeling the surrender behavior properly is a crucial task. Also, higher lapse rate erodes benefits of the remaining policyholders. Carson and Dumm (1999) found that insurance companies with higher surrender rates end up offering products with poor performances. Policyholders who carry participating policies would get lower bonuses when the lapse rate rises dramatically. Despite the importance of policy surrenders, most insurance companies do not have reliable surrender models and have not yet tracked or organized their lapse data in a manner that allows them to accurately predict the surrendering
dynamics (Santomero and Babbel, 1997). Since no theoretical models have been established to specify the causes of surrender behavior, hypothesis testing remains a purely empirical issue. The objective of this paper is to construct an empirical model to explore the dynamics of surrender behavior as well as to examine other relevant hypotheses.

2. Empirical Reviews and Hypotheses

Richardson and Hartwell (1951) is a classic survey which considers macroeconomic effects on surrender behavior. They mentioned that, in very many cases, the termination behavior in later years have more severe economic impact than the first two policy years. Intuitively speaking, as a policy matures, it accumulates more cash values. Outreville (1990) performed OLS analysis with the Cochrane-Orcutt adjustment, covering the period 1955-1979, to find consistent support for the emergency fund hypothesis in both the United States and Canada. The interest rate hypothesis was not significantly supported, possibly due to lack of fluctuation of interest rates as in the 1980s. Furthermore, OLS merely focuses on the short-term dynamics and ignores potential long-term relations. To explore potential long-term relations, Kuo et al (2004) used the Johansen’s cointegrated analysis and VECM to construct an empirical model for the surrender dynamics. Utilizing annual data from 1951-1998, they found that the unemployment rate is statistically significant in explaining voluntary termination behavior both in the short run and the long run, although the explanatory power of interest rate is relatively weak in the short run. By contrast, the impulse response analysis concluded that voluntary termination responded insignificantly to shocks from the unemployment rate but significantly to shocks from the interest rate. In their VECM, the coefficients of lagged interest rate changes and lagged unemployment rate changes are significant, but have negative signs which are consistent with neither the emergency fund hypothesis nor the interest rate hypothesis. These empirical issues are far from inconclusive and therefore merit further investigations.

Multivariate models generally are not suitable for analyzing the surrender behavior. According to Kuo et al (2004), voluntary termination rate does not have feedback impact on the macroeconomic equilibrium therefore a multivariate model may produce noises within Johansen’s multiple cointegration vectors. A single equation, to characterize macroeconomic effects on policy surrenders should be considered in the whole VAR system. Moreover, using VECM for analyzing annual data might not be
suitable because it only incorporates lagged variables, ignoring current period regressors. For instance, Kim (2005) used Korean monthly data from 1997 to 2000 and found that current unemployment rate has positive impact on current surrender rates. He also concluded that policyholders actually factored in the interest rate movements between two to six months before surrendering. The speed to reflect macroeconomic impacts by policyholders is faster than expected. In this context, a conditional ECM\(^1\) which involves the innovation of current macroeconomic information would be more appropriate than VECM.

In order to resolve the above issues, the Autoregressive Distributed Lags (ARDL) model, which could be rearranged as a conditional ECM, is adopted in this paper. Its comprehensive framework helps distinguishing different hypotheses and providing clearer answers about the surrender behavior. In our model, interest rate and unemployment rate are included as weakly exogenous determinants to examine hypotheses we are interested in. The first and the second hypotheses in this paper are described as follows:

**Hypothesis 1**: Emergency fund hypothesis explains the surrender behavior, both in short run and long run.

**Hypothesis 2**: Interest rate hypothesis explains the surrender behavior, both in short run and long run.

We also incorporate a proxy of policy loans as a control variable in our model. Earlier studies did not consider the behaviors of policy surrenders and policy loans simultaneously. Similar to the surrender behavior, policy loans disrupt companies’ cash flow and impose an opportunity cost if market interest rate exceeds the policy loan interest rate. According to Carson and Hoyt (1992), if unemployment results in policy surrenders rather than policy loans, the emergency fund hypothesis for policy loans would not be significantly supported. They found that policy loans are significantly negatively related to unemployment, which is against the emergency fund hypothesis for policy loans. Their explanation is that unemployment might not have contributed to the increase in policy loans but in policy surrenders, which results in outstanding loans being repaid. In sum, by controlling policy loans, we could investigate relevant hypotheses about the surrender behavior in a more transparent way. Since there may be crowding-out effect between policy loans and policy surrenders, we construct a new hypothesis as follows:

\(^1\) See Boswijk, (1994) for more detail interpretations of conditional ECM.
Hypothesis 3: There exists a crowding-out effect between policy loans and policy surrenders

Crowding-out hypothesis stresses the competition for the withdrawal of cash values. If policyholders choose to take loans, it would curtail the potential surrender behavior they originally planned to do. We build this new hypothesis to investigate scenarios where policyholders use the loans as a primary source for financial needs, or where policyholders with outstanding policy loans prefer to increase their loan size rather than terminating their own policy for cash values.

3. Data and Methodology

3.1. Data
We use the annual U.S. industry-wide voluntary termination rates for individual life insurance policies from 1951 to 2004. Rates are reported in *The Life Insurance Fact Book*, published annually by the American Council of Life Insurance (ACLI). The voluntary termination rate equals the ratio of the number of surrendered policies to the mean number of policies in force. We also collect the ratio of policy loans to policy reserves as a proxy for policy loans. Such ratio, also collected from *The Life Insurance Fact Book*, is usually used to represent policy loans behavior (Kraegel and Reiskvrl, 1977). The annualized three-month Treasury bill rates collected from the Federal Reserve Bulletin are used to test the interest rate hypothesis. The unemployment rates are obtained from U.S. Bureau of Labor Statistics to test the emergency fund hypothesis. The time series of the termination rates, policy loans proxy, interest rate, and unemployment rate are depicted in Fig 1.

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2 The data sources of *Life Insurance Fact Book* are derived from the annual statements filed by life insurance companies with the NAIC, ACLIs surveys, and external sources such as government agencies and trade associations.
Observations 1951-2004

Fig. 1. Time series of the voluntary termination rates, policy loan rate, interest rate, and unemployment rate

3.2. Methodology
To examine the relations between the surrender behavior and its determinants, we employ the ARDL model by Pesaran et al. (2001) as a cointegration framework. Unlike other cointegration techniques (e.g., Johansen’s procedure) which require certain pre-testing for unit roots as well as underlying variables to be integrated of order one, the ARDL model provides an alternative test for examining long-run relationship regardless of whether the underlying variables are purely I(0) or I(1), or fractionally integrated. So the unit root testing of variables (e.g. Kuo et al, 2004) is no longer necessary. For the error-correction representation of the corresponding ARDL model, only one error-correction term will be present, which avoids confusion from having multiple cointegration vectors. Note also that the ARDL procedure allows for uneven lag orders, while the Johansen’s VECM (Johansen, 1988) does not.

An equation of dynamics of voluntary termination is given by:

\[ \Delta y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{n-1} \beta_i \Delta y_{t-i} + \gamma_0 \Delta r_t + \sum_{i=1}^{n-1} \gamma_i \Delta r_{t-i} + \delta_0 \Delta u_t + \sum_{i=1}^{n-1} \delta_i \Delta u_{t-i} + \eta_0 \Delta p_t + \sum_{i=1}^{n-1} \eta_i \Delta p_{t-i} \]

\[ + \theta_1 y_{t-1} + \theta_2 r_{t-1} + \theta_3 u_{t-1} + \theta_4 p_{t-1} + \varepsilon_t \]  

(1)

Where \( y_t \), \( r_t \), and \( u_t \) denote voluntary termination rate, short-term interest rate and unemployment rate respectively and the number \( n \) is the maximum lags on the first differenced variables. \( p_t \) is the policy loans proxy during the year \( t \). Notice that \( r_t, u_t, \) and \( p_t \) are treated as weakly exogenous to formulate a single-equation ARDL
model. A linear trend $t$ is also included in Equation (1) as suggested by Fortune (1973) and Outreville (1990). Inclusion of the trend corrects coefficients for the common (linear) trends in the other explanatory variables, thereby leaving only the cyclical relationship to be reflected in the estimated coefficients.

According to Pesaran et al., (2001), to test the absence of any level relationships between $y_t$, $r_t$, $u_t$ and $p_t$ requires the exclusion of the lagged level variables $y_{t-1}$, $r_{t-1}$, $u_{t-1}$ and $p_{t-1}$. Therefore, we define a set of null hypotheses: $H_0^y: \theta_i = 0$, $H_0^x: \Theta = 0'$, and alternative hypotheses: $H_1^y: \theta_i \neq 0$, $H_1^x: \Theta \neq 0'$, where $\Theta = (\theta_2, \theta_3, \theta_4)'$. Hence, the joint null hypothesis of interest in Equation (1) is given by:

$$H_0: H_0^y \cap H_0^x$$

and the alternative hypothesis is correspondingly stated as:

$$H_1: H_1^y \cup H_1^x$$

Accordingly, the relevant statistic to test (2) is the F-test$^3$. Such test is used to examine the existence of a stable and long-run relationship. Note that the asymptotic distributions of the F-statistic are non-standard irrespective of whether the variables are I(0) or I(1). Since the asymptotic distributions of these two statistics are non-standard, Pesaran et al. (2001) provide bounds testing procedure which has two sets of asymptotic critical values. One set assumes all variables are I(0) and the other assumes that all variables are I(1). If the computed F-statistic falls above upper limit of the bound critical value, then the null hypothesis is rejected which means the variables are cointegrated. Conversely, if the computed F-statistic falls below the lower bound critical value, then the variables are concluded to be cointegrated and the null hypothesis cannot be rejected. Finally, the case within the band would be inconclusive.

Furthermore, if the linear trend $t$ is unrestricted$^4$, null hypothesis $H_0^y: \theta_i = 0$ also has to be test to insure the existence of such long-run relationship. A similar bounds testing procedure (see Pesaran et al. (2001)) is provided and the testing statistic is to be checked against a non-standard t-statistic table for critical values, which are much higher than the standard ones.

$^3$ Notice that if the linear trend $t$ is restricted, the joint testing hypothesis (2) and (3) has to be re reconstructed. We define another constituent hypotheses $H_0^\alpha: \alpha_i = 0$ and $H_1^\alpha: \alpha_i \neq 0$ and the joint testing hypothesis (2) and (3) would be $H_0: H_0^\alpha \cap H_0^x$ and $H_1: H_1^\alpha \cup H_1^x \cup H_1^y$

$^4$ Notice that there are two different forms of Equation (1) separated by whether the linear trend is restricted or not. see Pesaran et al., (2001)
Once cointegration is determined, the augmented autoregressive distributed lag model, ARDL \((m, p, q, r)\) is estimated using the following equation,

\[
b(L, m)y_i = a_0 + a_1 t + \sum_{i=0}^p c_i r_{t-i} + \sum_{i=0}^q d_i u_{t-i} + \sum_{i=0}^r e_i p_{t-i} + \varepsilon_i
\]

Where \(b(L, m) = 1 - b_1 L - \cdots - b_n L^n\) and \(L\) is a lag operator such that \(L^{l} = l_{t-j}\).

The maximum of lags \((n)\) in Equation (1) must be retained to determine the orders of lag \((m, p, q, r)\) in Equation (4) for the optimal structure for the ARDL specification. The estimated orders of ARDL \((m, p, q, r)\) model in the four variables \((y_t, r_t, u_t, p_t)\) are selected by searching across the \((n + 1)^4\) ARDL models, spanned by the orders of lag \((m, p, q, r)\) equal to 0,1, …\(n\), using the Akaike Information Criterion (AIC). After identifying the appropriate ARDL model, we have to at the second stage estimate long-run coefficients of underwriting profits and the associated ARDL error correction models. The conditional long-run model for voluntary termination rate can be obtained from the reduced form solution of Equation (4) as follows:

\[
y_i = \lambda a_0 + \lambda a_1 t + \lambda(\sum_{i=0}^p c_i) r_i + \lambda(\sum_{i=0}^q d_i) u_t + \lambda(\sum_{i=0}^r e_i) p_t + \lambda \varepsilon_i
\]

Where \(\lambda = \frac{1}{b(L, m)}\)

Meanwhile, the error correction (EC) representation of the ARDL model, which involves an ECM term, can be estimated by rearranging the original equation by OLS. Under ARDL approach, the existence of a unique valid long run relationship among variables, and hence a sole error-correction term, is the basis for estimation and inference. The short run, or difference-based, relation cannot be supported unless a unique and stable equilibrium relationship holds in a significant statistical sense. The error-correction mechanism is described as follows:

\[
\Delta y_i = \hat{\delta}_0 + \hat{\delta}_1 t + \sum_{i=0}^{m-1} \hat{\beta}_j \Delta l_{t-i} + \hat{\gamma}_0 \Delta r_i + \sum_{i=1}^{p-1} \hat{\gamma}_i \Delta r_{t-i} + \hat{\delta}_0 \Delta u_t + \sum_{i=1}^{q-1} \hat{\delta}_i \Delta u_{t-i} + \hat{\eta}_0 \Delta p_t + \sum_{i=1}^{r-1} \hat{\eta}_i \Delta p_{t-i}
\]

\[
- b(L, m) EC_{t-1} + \varepsilon_t
\]

Where \(EC_{t-1} = y_{t-1} - \lambda(\sum_{i=0}^p \hat{c}_i) r_{t-1} - \lambda(\sum_{i=0}^q \hat{d}_i) u_{t-1} - \lambda(\sum_{i=0}^r \hat{e}_i) p_{t-1}\)
Notice that $\hat{c}_i$, $\hat{d}_i$ and $\hat{e}_i$ are coefficients estimated from Equation (4), and $b(L,m)$ measures the speed of adjustment to the long-run equilibrium. Such ARDL-ECM is one kind of conditional ECM because there are exogenous current period determinants, $\Delta r_i, \Delta u_i, \Delta p_i$ in Equation (6), while VECM is not.

4. Empirical Results

4.1 Bound Testing
In testing the null hypothesis of no cointegration in Equation (1), the critical issue is to choose the maximum lag ($n$). Bahmani-Oskooee and Bohl (2000) have shown that the results of cointegration are usually sensitive to the order of VAR. Because of smaller samples in this study, we carefully impose our order of lag from 1 to 2 on the first difference of each variable. Furthermore, to distinguish the dependent from the explanatory variables and clearly identify exogenous variable within the system, we take all interested variables as dependents in turns and compute relevant F-statistics and t-statistics for bound testing procedure. The results of both cases of restricted and unrestricted trend are reported in Table 1.

<table>
<thead>
<tr>
<th>Dependent variables/</th>
<th>Relevant non-standard statistics</th>
<th>Restricted Trend</th>
<th>Unrestricted Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order of lag</td>
<td>F-statistic</td>
<td>F-statistic</td>
<td>t-statistic</td>
</tr>
<tr>
<td>Voluntary termination rates $\Delta y_i$</td>
<td>8.3133*** 8.2458***</td>
<td>-4.2112**</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>9.2174*** 10.9656***</td>
<td>-5.6496***</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4.1034 3.9684</td>
<td>-0.50595</td>
<td></td>
</tr>
<tr>
<td>Policy loans proxy $\Delta p_i$</td>
<td>1.4473 1.5032</td>
<td>-1.3581</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1.0843 1.3382</td>
<td>-1.9671</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.8307 3.5133</td>
<td>-3.4744</td>
<td></td>
</tr>
<tr>
<td>Interest rate $\Delta r_i$</td>
<td>2.3766 2.8802</td>
<td>-0.12498</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1.8605 2.2966</td>
<td>-3.0179</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** For non-standard F statistic, the critical value bounds with unrestricted trend are (4.01, 5.07) at the 95% significance level and (5.17, 6.36) at the 99% significance level. The critical value bounds with restricted trend are (3.38, 4.23) at the 95%
significance level and (4.30 5.23) at the 99% significance level. For non-standard t statistic, the relevant critical value bounds with unrestricted trend are (-3.41, -4.16) at the 95% significance level and (-3.96, -4.73) at the 99% significance level. ** Denotes that the statistic falls above the 95% upper bound and *** denotes that the statistic falls above the 99% upper bound.

Take termination rate as dependent variable, the null hypothesis of the absence of a long-run relationship is rejected at lags from 1 to 2. For other variables, however, all the statistics fall well below the lower bound of the critical value both in the F-test and the t-test procedure. The existence presented here is very clear that there exists a unique long-run relationship within the surrender dynamics. Interest rate and unemployment rate, which represent macroeconomic effects, could be treated as long-run forcing variables for the explanation of policy surrenders. Such results are consistent with findings of Kuo et al (2004) that surrender behavior of policy holders is unrelated to the macroeconomic system.

4.2 ARDL Analysis
In the second stage, the maximum order of lag must be selected to assure an optimal structure of Equation (4). Due to the small size of our, we choose order 1 as the maximum lag because it is already significant at 99% level for the F-test and 95% level for the t-test procedures. Thus, one of 16 (= (1 + 1)^4) ARDL models has to be chosen via the Akaike Information Criterion (AIC). The formulated ARDL model and their estimates are reported in Table 2.

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>ARDL(1,0,0,1) selected based on Akaike Information Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>0.30262 [0.27120]</td>
</tr>
<tr>
<td>t</td>
<td>-0.010467 [0.0041564]**</td>
</tr>
<tr>
<td>yr</td>
<td>0.77566 [0.048895]**</td>
</tr>
<tr>
<td>r</td>
<td>0.14428 [0.034633]**</td>
</tr>
<tr>
<td>u</td>
<td>0.14731 [0.049339]**</td>
</tr>
<tr>
<td>pt</td>
<td>-0.25075 [0.14526]*</td>
</tr>
<tr>
<td>p0</td>
<td>0.22832 [0.14380]</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.96739</td>
</tr>
<tr>
<td>F-stat.</td>
<td>258.1021***</td>
</tr>
<tr>
<td>Durbin's h-statistic</td>
<td>0.98163</td>
</tr>
<tr>
<td>LM Serial correlation F test</td>
<td>0.78595</td>
</tr>
</tbody>
</table>
As expected, such modeling framework provides efficient estimates of parameters and all diagnostic testing are statistically insignificant, suggesting no evidence of misspecification. The computed F-statistics clearly reject the null hypothesis that all regressors have zero coefficients, suggesting that such ARDL model fits the data reasonably well. In particular, our study covers a longer period (half century), and thus needs more thoughtful inspection for structural stability. The CUSUM test for examining the stability of our model shows that the cumulative sum of residuals are within the critical band of 95% level of significance, indeed they follow a central path indicating a high level of parameter stability (see Fig. 2). Similarly, the CUSUM of squares test reveal that the plot of the cumulative sum of squares of recursive residuals goes through the centre of the critical band with 95% level of significance (see Fig. 3). These results suggest our model’s parameters are stable over the entire sample period.

Fig. 2 Plot of cumulative sum of recursive residuals.
Note: The straight lines represent critical bounds at 95% significance level

Fig. 3 Plot of cumulative sum of squares of recursive residuals.
Note: The straight lines represent critical bounds at 95% significance level
Table 3. Conditional Error Correction Representation of ARDL Model  
(Dependent Variable: First Difference of voluntary surrender rate)

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>$AIC-ARDL(1,0,0,1)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>0.30262 [0.27120]</td>
</tr>
<tr>
<td>$t$</td>
<td>-0.010467 [0.0041564]**</td>
</tr>
<tr>
<td>$EC_{t-1}$</td>
<td>-0.22434 [0.048895]***</td>
</tr>
<tr>
<td>$\Delta r_t$</td>
<td>0.14428 [0.034633]***</td>
</tr>
<tr>
<td>$\Delta u_t$</td>
<td>0.14731 [0.049339]***</td>
</tr>
<tr>
<td>$\Delta p_t$</td>
<td>-0.25075 [0.14526]*</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.51205</td>
</tr>
<tr>
<td>F-stat</td>
<td>11.4273***</td>
</tr>
<tr>
<td>DW-statistic</td>
<td>1.7480</td>
</tr>
<tr>
<td>LM Serial correlation F test</td>
<td>0.78595</td>
</tr>
<tr>
<td>Heteroscedasticity</td>
<td>0.90356</td>
</tr>
</tbody>
</table>

Note: Observations 1951-2004; [ ] denotes standard error. * significant at the 90% significance level;  
** significant at the 95% significance level; *** significant at the 99% significance level.

The conditional error correction representations of our empirical model are reported in Table 3. As emergency fund and interest rate hypotheses suggest, both unemployment rate and interest rate have positive influences over the termination rate with strong statistical significance in both long run and short run. Such results confirm our hypotheses 1 and 2 without unambiguously. Unlike findings of Kuo et al (2004), which involved the lagged changes of variables, only current period changes of variables exist in our conditional ECM which means that policyholders can observe macroeconomic impacts and make decisions as sooner as within a year. Also, the error correction term in the long run is highly significant, which indicates the existence of a unique cointegration within the surrender dynamics. The coefficient of error correction means that there is a 22% adjustment in period $t$ to the disequilibrium in period $t-1$. The adjusted R-square of 0.51 in our conditional ECM suggests that nearly a half variation of from the surrender behavior can be explained by economically relevant variables. In addition to macroeconomic effects, there are still a number of socioeconomic and demographic factors to influencing the surrender behavior (Black and Skipper, 2000). Incorporating these factors would be necessary in a more comprehensive model of surrender dynamics.
The significantly positive coefficient of the loan proxy reveals that a crowding-out effect does exits between the behavior of policy loans and surrenders. Compared with macroeconomic effects, the adjustment of surrender rate to changes of policy loans is only partial. For policyholders, taking a loan against a life insurance policy is one alternative to surrendering the policy for its cash values. The difference is that a policy loan retains the insurance policy and its protection in force, while policy surrenders do not. To keep the protection, policyholders may prefer to adopt policy loans rather than policy surrenders when they have financial needs. Another incentive for policyholders to adopt policy loans is the surrender charges which induce policyholders to withdrawal less than their own cash value when they choose to terminating a policy. Such provision, as a penalty for early policy termination, encourages policyholders to leave funds with the insurance company for at least a minimum time and thus, discourage voluntary termination of policies.

Another possible reason to explain the existence of crowding-out effect is the popular automatic premium loan provision. Under such provision, an overdue premium is automatically borrowed from the cash value at the end of the grace period. The amount of the premium due will be advanced automatically as a policy loan against the policy as long as the policy has a sufficient net cash value. The purpose of this provision is to protect against unintentional surrender and provides considerable financial flexibility and consequently, enhances crowding-out effect between loans and surrenders. Furthermore, the unique feature of automatic continuation of policy loans results in more outstanding policy loans and weakens the incentive to surrender a policy. Policyholders who utilize policy loans are not legally required to repay the loan. There is no repayment schedule and in fact, the loans never have to be repaid unless the policyholders wish to do so. Any dues and unpaid interests will be paid automatically by a further loan against the policy’s cash value. A Policy is still effective if the total amount of debt does not exceed the cash value, which aggravates the crowding-out effect.

5. Conclusion and Recommendations

Employing an ARDL and associated conditional ECM, we have presented solid evidence supporting the emergency fund and interest rate hypotheses for policy surrenders. We also validate the existence of a unique cointegration relationship within the surrender dynamics. Surrender behavior depends on the deviation from a long-term equilibrium, the current period innovations of macroeconomic effects, and
the changes of policy loan behavior. The emergency fund and interest rate hypotheses are supported in both the long and the short run. Our results extend the findings of Kuo et al (2004) and avoid inconclusive explanations.

We also verify our new crowding-out effect hypothesis that characterizes the distinction between policy surrenders and policy loans. Our results suggest that a policy loan is not only an alternative to the withdrawal of cash values, but also a means to counter potential surrender behavior. All provisions related to policy loans would exacerbate utilizing loans and accelerate the increasing of loan size, squeezing the incentives to surrender. It would be interesting to see if such effect is only a temporary one. In practice, policy loans are usually viewed as the first step toward surrender (Richardson and Hartwell, 1951), and if applying policy loans is a beneficial to potential surrenders, it would encourage further surrender behavior. For future research, a cohort study has to be constructed to examine the existence of such lead-lag effect between policy loans and policy surrenders.

Another important implication of our study is in the forecasting of lapse. For risk management purpose, lapse forecasting scheme is a core element under the ALM framework. Insurance companies would adopt more aggressive investment strategy when they expect lower surrender rates, or hold more liquid or conservative assets portfolio when their forecast of lapse is higher. By means of anticipating macroeconomic movements, the forecasts of surrender rate would help actuaries determining appropriate policy reserves as well as giving assistance to formulating advisable investment guidelines. Our conditional ECM gives a reliable model and efficient estimates for the surrender dynamics of macroeconomic system. For the unsystematic part, such as characteristics of policyholders, insurance companies could add their own lapse experience into our model to produce their eventual forecasts.

References

American Council of Life Insurance, various years, The Life Insurance Fact Book, ACLI, Washington, DC.