PRICING UNEMPLOYMENT INSURANCE – AN UNEMPLOYMENT-DURATION-ADJUSTED APPROACH

BY

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ABSTRACT

This study incorporates the survival analysis of unemployment duration into the insurance pricing framework to measure the fairly-priced premium rate for Taiwan's unemployment insurance (UI) program. Our results suggest that the fair premiums range from 0.2041% to 0.2436% under the 1999-2002 scheme and from 0.1388% to 0.1521% under the 2003-2009 scheme for various possible levels of average unemployment duration in Taiwan, and they are all lower than the current UI premium rate, 1%. This result explains in part why there is a persistent surplus in the UI program. The sensitivity analysis results indicate that the fair premium rate decreases with the hazard rate of exiting from unemployment and increases with the probability of entering into unemployment. The effect of the entering probability is found to be larger than that of the exiting probability. We also provide a wide range of systematic risk coefficient (β) values generated from three alternative methods to measure its impact on fair premium rates and find that the effect of β on premium rates is stronger under the 1999-2002 scheme than that of the 2003-2009 scheme.

KEYWORDS

Unemployment Insurance, Fair Premium Rate, Unemployment Duration, Survival Analysis, CAPM.

I. INTRODUCTION

Unemployment protection programs are a long-established part of the social safety net that aim to provide temporary income support to workers during spells of unemployment and to abate the macroeconomic impact of layoffs on a country's economy. Unemployment protection programs vary quite a bit due to country- or region-specific concerns. There are five major types of unemployment protection programs around the world according to Vroman and Brusentsev (2005): unemployment insurance, unemployment assistance, social assistance, temporary employment, and accrued rights from past employment.

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Table 1 reports the detailed descriptions and offering countries of these programs. Unemployment insurance is the most commonly-used program worldwide as shown in Table 1.

Unemployment insurance (UI) in most countries is nationalized and people who work are required to pay a compulsory insurance premium. In fact, most unemployment insurance schemes charge a flat percentage of a worker's income earned between some minimum and maximum levels, and the premiums that an individual pays are not intended to be actuarially fair to reflect the individual's unemployment risks that are being underwritten.[1] UI programs that provide temporary income support during periods of unemployment can ease the anxiety and concerns associated with joblessness, yet, the unemployment protection programs themselves should not lead to other worries such as the adequacy of program benefits. In other words, at the aggregate level the unemployment insurance fund must set the premium rate at least to maintain its own solvency. This minimum solvency condition requires that the pricing of the insurance premium equates the expected present value of the benefits paid with the premium income.[2]

Two key issues are involved in the determination of a pricing scheme for the UI program. One is the choice of an insurance pricing framework that allows for the appropriate discount rate for the unemployment risks. The other is finding a proper estimate for the unemployment duration in order to correctly calculate the expected unemployment benefits. With respect to the choice of an insurance pricing framework, there is wide agreement that expected premium revenues should cover program costs, and a simple implementation of this principle is equating the present value of premium income to the present value of loss payments. According to this basic premium calculation principle, Beenstock (1985) proposed a model for deriving actuarially fair premiums for unemployment insurance in which unemployment risk is diversifiable and benefits are deterministic. The risk-free rate is adopted as the discount rate. Bronars (1985) followed the property-liability insurance literature and allowed the unemployment risk to be undiversifiable and specified a risk-adjusted discount rate for UI by estimating the systematic risk coefficient (β) of the insurance policy from the capital asset pricing model (CAPM). Since insurance policies are never traded in the capital markets, Myers and Cohn (1987) suggested β can be inferred indirectly from β of the common stock of the insurance companies. Myers and Cohn (1987)'s suggestion may work well for a private market insurance policy, but is not applicable to government insurance like

[1] However, Beenstock and Brasse (1986) noted that there is a private market in which premiums and benefits vary according to the different unemployment risks underwritten.

[2] For private insurance, a safety loading in the premiums together with an adequate capital allocation should be considered to set the solvency degree at an appropriate high level. However, for public insurance, such as UI programs in most countries, the appropriate solvency degree of the program or the sufficiency of premiums may depend on government's policy and commitment, and therefore are hard to define clearly. This study simply requires that the expected value of the benefits paid equals the premium income as a benchmark for discussion related to the premium setting of UI programs.

UI. Empirically, Bronars (1985) proxied β by using UI loss data for a study of the U.S. economy, while Beenstock and Brasse (1986) used unemployment rates to estimate β for their application to Britain. Blake and Beenstock (1988) further generalized the theoretical UI pricing model by allowing the unemployment probability to be stochastic.[3] However, this line of literature on unemployment insurance has failed to estimate benefits according to the duration of unemployment, which leads to the second issue – the correct measurement of unemployment benefits.[4]

A typical practice to calculate unemployment benefits for a representative agent involves a multiplication of the unemployment probability with the estimated length of unemployment duration, and a common approach to estimate the length of unemployment duration for a representative agent is to apply the average length of observed unemployment duration. As discussed by Shavell and Weiss (1979) among many others, using the average length of observed unemployment duration as an estimate of the length of unemployment duration to calculate the unemployment benefit is generally incorrect, because of the censored problem encountered by not being able to observe the complete length of unemployment spell for those who are still unemployed. In order to provide a better measurement of the UI benefits, the survival analysis derived from the job search literature (see Lippman and McCall, 1976; Devine and Kiefer, 1993) should be applied to deal with the censoring problem through an appropriate specification of the distribution function that is commonly applied in the empirical literature on unemployment duration.

Though no survival analysis has been adopted in the UI pricing literature, Gourieroux and Scaillet (1997) applied survival analysis in pricing mortgages with unemployment insurance, in which a simple exponential distribution with constant hazard rate was assumed. In the literature of health insurance a probabilistic multistate structure is a common modeling framework for analyzing the average duration of a claim regarding disability benefits. For example, Pitacco (1995) used the Markov and semi-Markov stochastic processes to develop a general approach for the actuarial modeling of disability benefits. Transition intensities (and probabilities) are specified to calculate the average duration of a claim and claim inception rates by cause of disability in such a model (see Hoem, 1972, 1976; Waters, 1984, 1989; Jones, 1993; Haberman and Pitacco, 1999; Cordeiro, 2002 for more examples). These methods are not meant to resolve the censoring issue in estimating the unemployment duration. Thus, the survival analysis derived from the job search literature (See Lippman and McCall, 1976; Devine and Kiefer, 1993) is applied in this study to deal with the censoring problem.

[3] Most of the recent UI literature focuses on the impact of the UI system rather than the premium setting itself. Please see Baker and Rea (1998), Arellano and Bentolila (2002), Wang and Williamson (2002), Brown and Ferrall (2003), Roed and Zhang (2003), and Alessie and Bloemen (2004) for examples.

[4] Unemployment duration denotes the time elapsed since an insured's entry into the unemployment state until he/she is re-employed.

This study extends the insurance pricing framework of Bronars (1985) and Blake and Beenstock (1988) by incorporating survival analysis to measure the unemployment duration and to derive the fair premium rate for the UI program in Taiwan. The UI program there was implemented in 1999, and two major changes of regulations regarding the maximum length of the unemployment benefits have been undertaken since its inception. This provides us an opportunity to examine the role of the measurement issue of unemployment duration in pricing the UI premium.

The rest of the paper is organized as follows. Section II presents the insurance pricing framework and the Weibull specification for estimating the expected unemployment duration. Section III describes the key parameters as well as their sources. Section IV reports the estimated fair premiums for the UI program and the sensitivity analysis. The concluding section contains a brief summary of this study.

II. The Model

This section begins by introducing the CAPM-based insurance pricing model and the specification of the Weibull distribution used to estimate the unemployment duration. We then set up our formulae to determine the actuarially fair premium rate for the UI program in Taiwan.

The Insurance Pricing Framework

The fairly-priced insurance premium requires that the present value of expected premium income ($PV(I)$) equals the present value of expected loss payments ($PV(L)$). This corresponds to the basic premium calculation principle: the equivalence principle. To implement this principle, the choice of the discount rate is a critical matter. Fairley (1979) applied the CAPM to derive risk-adjusted rates of return for property-liability insurers. Important extensions of the Fairley model by Myers and Cohn (1987) and Hill and Modigliani (1987) provide empirical evidence on its reliability and stability.[5] Bronars (1985), Beenstock and Brasse (1986), and Blake and Beenstock (1988) took up the CAPM-based framework to study unemployment insurance with different focuses.

For simplicity, assuming away other miscellaneous fee income, expenses, and taxes, we can express the present values of the expected premium (I) and expected loss (L) relationship as the following:

$$PV(I) = PV(L) \tag{1}$$

$$PV(I) = \sum_{n=0}^{N} I_n / (1 + R_f)^n \tag{2}$$

[5] For other extensions, see Urritia (1986), Cummins and Harrington (1987), Derrig (1994), Lee and Yu (2002), and Duan and Yu (1994, 2005), etc.

$$PV(L) = \sum_{n=0}^{N} L_n / (1 + E(R_L))^n, \tag{3}$$

where $n = 0, 1, \ldots, N$, and 0 represents policy inception, N is the date of the last cash flow under the policy, I_n denotes the expected premiums received at time n, L_n denotes the expected losses paid at time n, R_f denotes the risk-free rate of interest, and R_L denotes the risk-adjusted return from CAPM for insurance liabilities. In other words, R_L have the following relationship with the market portfolio returns, R_m.

$$E(R_L) - R_f = \beta(E(R_m) - R_f). \tag{4}$$

The Weibull Specification for Unemployment Duration

In calculating the benefit payment we need to estimate the expected duration for the claims paid. As unemployment duration has the problem of incomplete spells, it is inappropriate to use the statistical average of the unemployment duration in calculating the benefit payment. To estimate the completed unemployment duration, a survival analysis derived from the job search theory should be applied.[6] We describe the procedure for calculating the benefit payment as follows.

Let T denote unemployment duration, $T \in (0, \infty)$, and $f(t)$ is the probability density function of T. The probability that the unemployment duration is less than t can then be expressed as:[7]

$$F(t) = \Pr(T \leq t) = \int_0^t f(t)\,dt, \tag{5}$$

where $F(t)$ denotes the cumulative distribution function of T. For an individual who has been unemployed for t periods, the conditional probability density that he will leave the unemployed status (either transit to the employed or out-of-labor-force status) at time t is defined to be the hazard function ($h(t)$) and can be written as:

$$h(t)dt = \Pr\left(t < T \leq t + dt \mid T > t\right) = f(t) / S(t), \tag{6}$$

where $S(t)$ is the survival function defined to be:

$$S(t) = \Pr(T \geq t) = \int_t^\infty f(t)\,dt, \quad S(0) = 1, \ S(\infty) = 0. \tag{7}$$

As the Weibull distribution is most commonly used to describe unemployment duration in the literature (see Lancaster 1979, Lynch 1985, Moffitt 1985,

[6] More detailed surveys of the applications of job search models can be found in Mortensen (1986).

[7] For a more complete discussion, see Kalbfleisch and Prentice (1980).

Atkinson and Micklewright 1991, Hunt 1995, and Chuang 1999), we assume that the unemployment duration here follows the Weibull distribution when calculating the benefit payment of the UI program. The hazard function and the survival function corresponding to the Weibull distribution are:

$$S(t) = \exp(-(\lambda t)^p) \tag{8}$$

$$h(t) = f(t)\,/\,S(t) = \lambda p(\lambda t)^{p-1}, \tag{9}$$

where p is the shape parameter, which determines the shape of the distribution, and λ is the scale parameter, which measures the time unit.[8] The probability density function for the Weibull distribution can be derived from the survival function and the expected value of the unemployment duration is then given as:

$$\begin{aligned} E(T) &= \int_0^\infty tf(t)\,dt \\ &= \int_0^\infty t\lambda p(\lambda t)^{p-1}\exp(-(\lambda t)^p)\,dt. \end{aligned} \tag{10}$$

In addition to the assumption about the unemployment duration, the rules of benefit payment are also relevant to the calculation. We apply our model to the UI system in Taiwan as an example for demonstration.

Application to Taiwan's UI Scheme

The UI program in Taiwan was first established under the Labor Insurance law in 1968 and was implemented on January 1, 1999 to help economically-insecure families affected by unemployment.[9] Two major amendments related to benefit payments were undertaken in 1999 and 2002, respectively. Table 2 reports the details of these amendments. The program covers private and public-sector employees between ages 15 and 60, but excludes self-employed persons, civil servants, teachers, and military personnel. The unemployment benefits provide the beneficiary 60% of the average monthly earnings of the last 6 months before unemployment. The maximum benefit coverage under the UI program for the 1999-2002 time period depends on an individual's work history. Specifically, the maximum benefit payable is 6 months of benefits for a work history up to 5 years; 12 months for 5-10 years of work history; and 16 months for more than 10 years of work history. The current UI program of 2009 was re-structured and re-established under the Employment Insurance

[8] It is possible that parameters p and λ may be related to unemployed workers' characteristics such as age, gender, and education level. A way to deal with this possibility is to re-parameterize p and λ as functions of these factors. However, to focus on the censoring issue in the measurement of unemployment duration and to simplify our analysis, this study assumes that parameters p and λ are constant in our model.

[9] A more detailed description of the UI program in Taiwan is presented in the Appendix.

law in May 2002 and became effective in 2003. Under the current scheme, the maximum benefit was simplified and limited only up to 6 months for insured workers who have at least one year of work history. As a result, we present the application to Taiwan's UI program for the 1999-2002 scheme and the 2003-2009 scheme separately in the following.

1. *1999-2002 UI Scheme*

Based on the aforementioned regulations implemented in the 1999-2002 period, we can derive the expected duration of benefit payments for a representative claimant as:[10]

$$\begin{aligned} D = \alpha_1 * &\left\{ \sum_{t_1=1}^{180} \left[t_1 * \lambda p(\lambda t_1)^{p-1} * \exp(-(\lambda t_1)^p) \right] + \right. \\ &\left. \sum_{t_1=181}^{\infty} \left[180 * \lambda p(\lambda t_1)^{p-1} * \exp(-(\lambda t_1)^p) \right] \right\} \\ + \alpha_2 * &\left\{ \sum_{t_2=1}^{360} \left[t_2 * \lambda p(\lambda t_2)^{p-1} * \exp(-(\lambda t_2)^p) \right] + \right. \\ &\left. \sum_{t_2=361}^{\infty} \left[360 * \lambda p(\lambda t_2)^{p-1} * \exp(-(\lambda t_2)^p) \right] \right\} \\ + (1 - \alpha_1 - \alpha_2) * &\left\{ \sum_{t_3=1}^{480} \left[t_3 * \lambda p(\lambda t_3)^{p-1} * \exp(-(\lambda t_3)^p) \right] + \right. \\ &\left. \sum_{t_3=481}^{\infty} \left[480 * \lambda p(\lambda t_3)^{p-1} * \exp(-(\lambda t_3)^p) \right] \right\}, \end{aligned} \tag{11}$$

where D denotes the expected duration of benefit payment, α_1 is the probability that this individual has an insurance history less than five years, α_2 is the probability that this individual has five to ten years of insurance history, and $(1 - \alpha_1 - \alpha_2)$ is the probability that this individual has an insurance history of more than ten years.

Combining the CAPM-based insurance pricing framework and the Weibull specification, we express the present value of the expected benefit payment under the old scheme ($PV(L_o)$) as the following:[11]

$$PV(L_o) = 0.6 * W * U * \left\{ \sum_{t=1}^{D} \left[1/\exp\left[t * \left(R'_f + \beta * (E(R'_m) - R'_f) \right) \right] \right] \right\} \tag{12}$$

[10] For the purpose of calculation, the integral in equation (10) is replaced by the summation in equation (11). The time unit is set in "days" to approximate the continuous time specification in the duration model. This approximation may underestimate the value of expected duration of benefit payments.

[11] To simplify our model, we assume that each individual only applies for the UI benefit once in a lifetime.

where R'_f and R'_m are the monthly returns and L_o denotes the expected benefit payment to a representative individual under the 1999-2002 scheme. Term W denotes the insured monthly earnings and U is the unemployment probability.

2. *2003-2009 UI Scheme*

The major change in rules related to the maximum length of benefit is that it no longer depends on the work history of the insured worker. As long as the insured worker is qualified for the UI application, the maximum length of benefit payment is six months. According to this rule, the expected length of benefit for each claim becomes:

$$D = \sum_{t=1}^{180} \left[t * \lambda p(\lambda t)^{p-1} * \exp(-(\lambda t)^p) \right] + \sum_{t=181}^{\infty} \left[180 * \lambda p(\lambda t)^{p-1} * \exp(-(\lambda t)^p) \right]. \tag{13}$$

The simplifying assumption – that each individual only applies for the UI benefit once in a lifetime applied in the prior case – is not quite reasonable under this new scheme. We therefore introduce one more variable into our model – frequency of unemployment – denoted by k, to allow for the possibility of multiple claims in a lifetime. By assuming that k follows a Poisson distribution, we express the present value of the expected benefit payment under the new scheme ($PV(L_n)$) as follows:

$$PV(L_n) = \sum_{k=1}^{\overline{K}} \frac{\mu^k e^{-\mu}}{k!} * k * \left\{ \delta * 0.6 * W * \sum_{t=1}^{D} \left[1/\exp\left[t * \left(R'_f + \beta * (E(R'_m) - R'_f) \right) \right] \right] \right\}, \tag{14}$$

where μ denotes the parameter of the Poisson distribution, δ represents the probability that an unemployed individual is qualified to receive UI benefits, and L_n denotes the expected benefit payment to a representative individual under the 2003-2009 scheme.

Fairly-Priced Premium Rate (*Y*)

Assuming a representative individual works and pays the premium for 48 years in his/her lifetime,[12] then the present value of the expected premium income ($PV(I)$) received from the representative individual is expressed as:

[12] This number is computed by subtracting the average years of schooling (11 years) and childhood (6 years) from the retirement age (65).

$$PV(I) = \sum_{t=0}^{47} \left[(Y * W) / \exp[t * R_f] \right], \tag{15}$$

where Y denotes the premium rate. The fairly-priced UI premium can be derived by solving Y from equating $PV(L_o)$ (or $PV(L_n)$) and $PV(I)$.

III. The Measurement of Parameters

Based on equations (12) to (15), we group the model parameters into three types. The first type relates to the unemployment situation, such as the parameters (p and λ) of the Weibull distribution, the unemployment probability (for the 1999-2002 scheme), and the Poisson distribution parameter μ (for the 2003-2009 scheme). The second type describes the insurance characteristics of the UI program, such as the proportions of insured workers with various years of insurance history (for the 1999-2002 scheme), workers' insured earnings, and probability of qualifying for unemployment benefits (for the 2003-2009 scheme). The third type includes variables and parameters of the capital markets, such as the systematic risk coefficient (β), risk-free rate of interest, and the rate of return of market portfolio.

Table 3 reports the sources and measurements of parameters used in our model. The parameter values of the Weibull distribution are calculated by solving the mean and variance formulae simultaneously based on the estimated values of means in the recent literature and variance from simulated data. As the estimated mean of unemployment duration reported in the literature ranges from 60 weeks to 180 weeks, we calculate three pairs of p and λ, denoted by p_L and λ_L, p_M and λ_M, and p_H and λ_H, corresponding to the low (60 weeks), median (120 weeks), and high (180 weeks) mean cases, respectively, for our computation of the fair premium rate. Regarding the unemployment probability for Taiwan, we use the reported ratio of the number of workers transiting from an employment to unemployment status from the Manpower Utilization Survey as our measure. The Poisson distribution parameter is estimated through the data of the unemployment rates reported from the Manpower Utilization Survey.

As to those parameters related to the insured workers' characteristics, we take the information of the tenure of current employment in the past ten years to compute the proportions of workers with less than 5 years, 5-10 years, and more than 10 years of insurance history. Since the insured earnings, W, appear in both the present value of expected premium income and the present value of expected benefit payment, we cancel it out when solving for the premium, Y. Thus, there is no measurement issue regarding the variable of insured earnings, W. The probability of qualifying for unemployment benefits (δ) under the 2003-2009 scheme is measured by multiplying the ratio of the involuntary unemployment and the approval rate of UI application.

This study uses three alternative methods to measure the systematic risk, β, for unemployment insurance liability. The first method infers the UI liability

β from β of the property-liability companies using CAPM. The second method follows Bronars (1985)'s approach by treating UI loss returns as policy returns in CAPM. The third method follows Beenstock and Brasse (1986) by using unemployment rates to proxy policy returns to estimate β. We use β generated from the first method as our base value for the following analysis and conduct a sensitivity analysis covering the range of β values generated from the other two methods. The risk-free rate of interest is measured using government bond data from the Central Bank of Taiwan. The market portfolio's rate of return is computed using stock index data from Taiwan Stock Exchange.

IV. Discussion of Results

According to the measurements and sources of the parameters reported in Table 3, the parameter values used in our model for calculating the fair premiums of the UI program are given as follows:

$p_L = 1.4575$	$\lambda_L = 0.0022$	$p_M = 3.1215$	$\lambda_M = 0.0011$
$p_H = 4.9600$	$\lambda_H = 0.0007$	$U = 0.0240$	$\delta = 0.5180$
$\alpha_1 = 0.5175$	$\alpha_2 = 0.1924$	$\mu = 0.0422$	$\overline{k} = 5$
$\beta = 0.7250$	$R_f = 0.0238$	$R'_f = 0.0020$	$R'_m = 0.1713.$

Given these parameter values, the fair premium rates solved from our model under the 1999-2002 scheme are 0.2041% for the low mean case, 0.2410% for the median mean case, and 0.2436% for the high mean case. These values are lower than the 1% premium rate charged by the government.

The estimated fair premium rates are even lower under the 2003-2009 scheme. They are 0.1388% for the low mean case, 0.1519% for the median mean case, and 0.1521% for the high mean case. We notice that the range of the fair premium rates for the low to high mean cases is larger under the 1999-2002 scheme than that under the 2003 scheme. This reflects the fact that the possible variation in the benefit payment duration under the design of the 1999-2002 scheme is larger than that under the 2003-2009 scheme. In addition, the difference between the low mean and median mean cases is larger than the difference between the median mean and high mean cases for both the 1999-2002 and the 2003-2009 schemes.

We show that the estimated fair premium rates for the UI program under both the 1999-2002 and the 2003-2009 schemes are lower than the current premium rate, 1%, for all cases considered in this study. That is, the current premium rate paid by the employed worker is overcharged. In addition, a flat premium system in general leads to a cross subsidy from the low-risk individuals, who are more likely to be employed, to the high-risk individuals, who are more likely to be the unemployed. An overcharged flat premium system tends to widen the gap of subsidy.[13] It also explains in part why there is a persistent surplus of the UI fund in Taiwan as shown in Table A of the Appendix. However, to what extent the estimated premium rate varies with the parameter values and whether the current rate can generate sufficient premium income to ensure the stability of the program remain to be investigated. Some sensitivity analyses are undertaken in the following to shed some light on the responsiveness of the fair premium to various economic conditions.

Sensitivity Analysis

The fairly-priced premium rates under alternative parameter values are computed and presented in Tables 4-9 and the fair premiums for the base case are in bold face. The parameter values for the base case are the same as those given above. Our discussion of the sensitivity analysis results will follow the three types of parameters described in the previous section.

The effect of the shape parameter (p) is mainly from the estimated duration of benefit payment through its influence on the distribution of unemployment duration. As shown in Table 4, the estimated duration increases monotonically with p for all three cases with different levels of unemployment duration under both the 1999-2002 and the 2003-2009 schemes. In addition, when $p > 1$, the fair premium is less responsive to changes in p, because as reported in Table 4 the estimated unemployment duration (D) does not change significantly as p varies. The estimated values of p under the Weibull distribution based on Taiwan's data drawn from different time periods all indicate that $p > 1$. In other words, the shape of the unemployment duration distribution will not significantly affect the fair premium rate for the UI program since the expected unemployed duration is not very sensitive to changes in p.

Table 5 reports the sensitivity analysis results of varying λ. As shown in equation (9), given p, the value of λ determines the hazard rate of exiting from unemployment. For $p > 1$, the hazard rate increases with λ – that is, the unemployed are more likely to transit into employment as λ increases. Therefore, the expected duration of benefit payment decreases with λ. Thus, the fair premium required to balance $PV(I)$ and $PV(L)$ decreases as λ increases, because the estimated unemployment duration decreases with λ as shown in Table 5. Although the direction of changes in the fair premium with respect to λ is the same under both the 1999-2002 scheme and the 2003-2009 scheme, the changing magnitude of the fair premium is larger under the 1999-2002 scheme than it is under the 2003-2009 scheme. We also note that the fair premium rate is more sensitive to changes in λ as compared to changes in p. Moreover, the literature shows that personal characteristics such as age and educational level, as well as job search variables such as search method and reservation wages, are significant

[13] For a fairly-priced premium system, premiums should be set according to each individual's unemployment risk. A flat premium in general overcharges the low-risk individuals and undercharges the high-risk individuals. Since high-risk individuals are more likely to be unemployed, a flat premium implies that low-risk individuals subsidize the high risk individuals.

determinants of the hazard rate of exiting from unemployment. Changes in these characteristics of unemployed workers consequently affect the fair premium through their influences on the hazard rate of exiting from unemployment.

The sensitivity analysis results of varying unemployment probability, U, under the 1999-2002 scheme are intuitively plausible. When the probability of entering into unemployment is higher, the number of unemployed workers increases. The expected benefit payments will also increase and the fair premium rate for the UI program has to be higher to cover the growth in benefit payments. The corresponding role representing the unemployment probability under the 2003-2009 scheme in our pricing model is the parameter of Poisson distribution, μ. The sensitivity analysis results with respect to μ are also reported in Table 6. The probability of ever needing to claim the UI benefit rises as μ increases. As a result, the estimated fair premium rate becomes larger in order to balance the increase in the expected payment. In addition, the magnitude of the changes in Y shown in Table 6 suggests that the fair premium for the UI program is more responsive to changes in U or μ than to changes in p and λ, the parameters describing the distribution of the unemployment duration.

Table 7 reports the effects of changing parameters, describing the insured workers' characteristics such as α_1 and α_2 under the 1999-2002 scheme. Our results indicate that these parameters have smaller effects on the fair premium rate than the parameters related to the unemployment situation as shown in Tables 4-6. In other words, the fair premium rate of the UI program is less sensitive to the proportion pattern of insured workers' insurance history. It is also found that the premium rate declines when α_1 or α_2 increases – that is, as more insured workers have a relatively shorter length of work history, the expected benefit payment duration will be shorter and therefore the premium rates turn lower.

The results of changing the probability of qualifying for unemployment benefits (δ) under the 2003-2009 scheme shown in Table 8 suggest that the fair premium rate increases as this probability rises. This finding is intuitively plausible, because the expected benefit payment rises as the probability of qualifying for unemployment benefits increases. As a result, the fair premium rate has to increase. However, we note that the fair premium rate will still be smaller than the current premium rate of 1% in the case when each unemployed insured worker is qualified to receive unemployment benefits ($\delta = 1$).

Table 9 reports the effect of β risk on the fair premiums. The base value of β, 0.725, is estimated using the index returns of Taiwan property-liability insurers from January 1999 to July 2009. The estimated β using UI loss returns to proxy policy returns is –0.026 (0.18 by Bronars (1985) for U.S. data during 1956-1982) and is 0.018 by using unemployment rates (0.662-1.302 by Beenstock and Brasse (1986) for British data during 1948-1982). It is found that the fair premium decreases with β and the change in magnitude can be substantial. As β represents the risk-adjusted discount rate for the UI future losses, the increase in the risk-adjusted rate lowers the present value of the expected losses, and so the fair premium rate required to balance the budget is smaller. The effect of β on premium rates is stronger under the 1999-2002 scheme than that of the 2003-2009 scheme. We also note that the fair premium rates are more responsive in the high-mean case, because the expected losses are higher in the high mean case and therefore β plays a more influential role.

V. Conclusions

This study introduces the survival analysis of the unemployment duration to the unemployment insurance pricing framework in order to measure the fair premium rate for unemployment insurance. We then apply this method to the UI program in Taiwan for both the 1999-2002 and the 2003-2009 schemes.

A Weibull distribution is adopted to estimate the expected unemployment duration in computing the UI benefit payments, and the CAPM-based insurance pricing framework is then applied to compute the fairly-priced premium rate for the UI program. Our results suggest that the fair premiums range from 0.2041% to 0.2436% under the 1999-2002 scheme and from 0.1388% to 0.1521% under the 2003-2009 scheme for various possible levels of average unemployment duration in Taiwan and are all lower than the current UI premium rate, 1%. This result explains in part why there is a persistent surplus in the UI program.

Sensitivity analysis are undertaken to shed more light on this issue. The sensitivity analysis results of the parameters related to the unemployment situation suggest that the fair premium rate of the UI program is more sensitive to the hazard rate of exiting from unemployment and unemployment probability than the shape of the unemployment duration distribution. Moreover, the fair premium rate decreases with the hazard rate of exiting from unemployment and increases with unemployment probability. Although this finding seems very intuitive, our sensitivity analysis further indicates that the fair premium for the UI program is more responsive to changes in the probability of entering into unemployment (U under the 1999-2002 scheme and μ under the 2003-2009 scheme) compared to changes in the hazard rate of exiting from unemployment. We also provide a wide range of β values generated from three alternative methods to measure its impact on fair premium rates and find the effect of β on premium rates is stronger under the 1999-2002 scheme than that of the 2003-2009 scheme.

In summary, this study provides insights about the fair premium and its determinants in the UI program in Taiwan. Our results further suggest that changes in parameters related to both labor market and capital market show less impact on the fair premium rates under the 2003-2009 scheme than that under the 1999-2002 scheme. Many extensions can be directed based on this study. For example, the unemployment risk may differ across cohorts by age, gender, or marital status, and it is worthwhile to extend our investigation to a specific cohort in future studies. Moreover, as mentioned earlier, the hazard rate of the Weibull distribution can also be parameterized as a function of worker characteristics such as age, gender, and occupation in order to reflect the potential difference in the hazard rate among insured workers. Another possible direction for future research is to model the dynamic of earnings profile into the UI pricing framework to reflect the stylized fact that the earnings profile is increasing over the life cycle with a decreasing rate.

TABLE 1

DESCRIPTION OF THE UNEMPLOYMENT PROTECTION PROGRAM AROUND THE WORLD

Type	**Description**	**Offering Countries**
Unemployment Insurance (UI)	UI makes payment to unemployed persons who meet certain eligibility criteria. The eligibility condition normally requires that the worker must have a minimum level of past employment and/or past wages and be separated from work under non-disqualifying conditions. Payments of UI are made periodically, but with limited potential duration.[a]	Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States, Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia, Armenia, Azerbaijan, Belarus, Georgia, Kyrgistan, Latvia, Lithuania, Moldova, Mongolia, Russia, Turkmenistan, Ukraine, Uzbekistan, Bangladesh, China, Japan, South Korea, Taiwan, Algeria, Egypt, Iran, Israel, South Africa, Argentina, Brazil, Chile, Ecuador, Uruguay, Venezuela
Unemployment Assistance (UA)	UA is paid to the unemployed with the additional constraints of a means test. Income and assets must fall below designated thresholds before the claimant can receive benefits. Potential duration of UA may or may not be limited, and payment levels typically vary by family size and composition.	Australia, Austria, Finland, France, Germany, Ireland, Netherlands, New Zealand, Portugal, Spain, Sweden, United Kingdom, Romania, Estonia, Hong Kong, Iraq, Tunisia, Mauritius, Brazil.[b]
Social Assistance (SA)	The unemployed may be compensated under SA programs that provide families and persons with a guaranteed minimum level of income. Unemployed SA recipients are usually required to register as job seekers at a public labor exchange and to be able and available for work. UA and SA programs differ in the support services typically utilized. UA recipients use labor market services such as job matching and training, while SA recipients utilize a wider range of services such as child care.	France and Germany
Temporary Employment	Some countries provide preferential rights to temporary employment for the unemployed. The employment measures include public works, temporary public service jobs, and employment in social investment fund projects and workfare. The jobs are typically temporary in duration with rate of pay at, or near, the minimum wage.	Common in Latin America and Sub-Saharan Africa

Type	Description	Offering Countries
Accrued Rights from Past Employment	In a few countries, unemployment is one allowable contingency for the provident funds that are supported by contributions from employers and workers into individual accounts. While some share of the individual's account balance may be accessed to the unemployed, the potential payments are strictly limited by the total balance.	India[c]

a. There are some exceptions in the payment design. For example, in Ecuador, the UI program makes a single lump sum payment to eligible unemployed persons.
b. Many OECD countries offer both the UI and UA programs to unemployed persons.
Source: Unemployment Compensation Throughout the World, A Comparative Analysis by Vroman and Brusentsev (2005)
c. Sources of the offering countries information are: "Are you letting your provident fund do its job?" Deepti Bhaskaran (2008) http://www.livemint.com/2008/08/03234020/Are-you-letting-your-provident.html

TABLE 2

DESCRIPTION OF MAJOR AMENDMENTS OF TAIWAN'S UI SCHEME

Year \ Items	Qualifying Conditions	Unemployment Benefits
Promulgated on December 28, 1998 (Start of implementation on January 1, 1999)	An insured person who while unemployed has other work, which provides a monthly income exceeding 80% of the minimum wage, is ineligible for unemployment benefits.	The applicant is paid a monthly unemployment benefit of 50% of his average monthly insurance salary. The maximum length of benefits is 6 months for those with 5 or less cumulated years of insurance coverage, 12 months for those with 5-10, and 16 months for these with more than 10 cumulated years of insurance coverage.
Amended on July 30, 1999	An insured person who while unemployed has other work, which provides a monthly income exceeding the minimum wage, is ineligible for unemployment benefit.	The applicant is paid a monthly unemployment benefit of 60% of his average monthly insurance salary. The maximum length of benefits is 6 months for those with 5 or less cumulated years of insurance coverage, 12 months for those with 5-10, and 16 months for those with more than 10 cumulated years of insurance coverage.
Promulgated on May 15, 2002 (Start of implementation on January 1, 2003)	An insured person who while unemployed has other work, which provides a monthly income exceeding the minimum wage, is ineligible for unemployment benefit. If the monthly income does not exceed the minimum wage, then he may claim unemployment benefit in addition to the monthly income. If the combined total exceeds 80% of the average monthly insurance salary, then the additional amount will be deducted from unemployment benefit, but if the combined amount is less than the minimum wage, then no deduction will be made.	The applicant is paid a monthly unemployment benefit of 60% of his average monthly insurance salary over the six-month period prior to leaving work and withdrawing from the labor insurance program, for a maximum of six months. A person who claims unemployment benefit for the maximum six months shall have his cumulated years of insurance coverage recalculated from zero.

TABLE 3

PARAMETER MEASUREMENT AND DATA SOURCES

Parameters	**Measurement**	**Data Sources**
Shape parameter (p) of Weibull distribution	Solved from mean and variance formulae of Weibull distribution	Mean values are taken from recent literatures and variance is computed from simulated data
Scale parameter (λ) of Weibull distribution	Solved from mean and variance formulae of Weibull distribution	Mean values are taken from recent literatures and variance is computed from simulated data
Unemployment probability (U)	Proportion of previously- employed workers who become unemployed in the current month	Report on the Manpower Utilization Survey Taiwan Area
Proportion of insured workers with less than 5 years of insurance history (α_1)	Proportion of workers with job tenure less than 5 years (taking an average of this number for the past 10 years from 1990 to 1999)	Report on the Manpower Utilization Survey Taiwan Area
Proportion of insured workers with 5-10 years of insurance history (α_2)	Proportion of workers with job tenure between 5 to 10 years (taking an average of this number for the past 10 years from 1990 to 1999)	Report on the Manpower Utilization Survey Taiwan Area
Poisson distribution parameter (μ)	Estimated from the unemployment rate based on the probability density function of the Poisson distribution	Report on the Manpower Utilization Survey Taiwan Area
Probability of qualifying for unemployment benefits (δ)	Multiplication of the ratio of the involuntary unemployment and the approval rate of UI application	Report on the Manpower Utilization Survey Taiwan Area and the Statistical Report of the Employment Insurance
Systematic risk coefficient (β)	Estimated from the CAPM using equation (4). UI risk is proxied by three variables: returns of property liability insurers, UI loss returns, and unemployment rates.	Taiwan Economic Journal, Report on Human Resources Survey, and the Statistical Report of the Employment Insurance.

TABLE 4

FAIR PREMIUMS (Y) UNDER ALTERNATIVE VALUES OF THE SHAPE PARAMETER (p) OF UNEMPLOYMENT DURATION DISTRIBUTION

The estimated unemployment duration (***D***) and fair premiums both increase with ***p***, but they are more sensitive to ***p*** in the Low Mean case than the Median and High Mean cases.

1999-2002 Scheme								
Low Mean Duration			**Median Mean Duration**			**High Mean Duration**		
p	***D***	***Y*(%)**	***p***	***D***	***Y*(%)**	***p***	***D***	***Y*(%)**
0.4	6.097	0.169	2.0	9.503	0.235	3.2	10.014	0.243
0.8	6.652	0.182	2.4	9.688	0.238	3.8	10.037	0.243
1.2	7.366	0.197	2.8	9.807	0.240	4.4	10.047	0.244
1.458	**7.712**	**0.204**	**3.122**	**9.872**	**0.241**	**4.960**	**10.051**	**0.244**
1.6	8.223	0.214	3.4	9.937	0.242	5.2	10.053	0.244
2.2	8.581	0.220	4.0	9.986	0.243	5.6	10.054	0.244
2.8	8.818	0.224	4.6	10.006	0.243	6.0	10.054	0.244

2003-2009 Scheme								
Low Mean Duration			**Median Mean Duration**			**High Mean Duration**		
p	***D***	***Y*(%)**	***p***	***D***	***Y*(%)**	***p***	***D***	***Y*(%)**
0.4	4.098	0.105	2.0	5.923	0.150	3.2	5.998	0.152
0.8	4.671	0.120	2.4	5.964	0.151	3.8	6.000	0.152
1.2	5.193	0.133	2.8	5.983	0.152	4.4	6.000	0.152
1.458	**5.416**	**0.139**	**3.122**	**5.991**	**0.152**	**4.960**	**6.000**	**0.152**
1.6	5.701	0.145	3.4	5.996	0.152	5.2	6.000	0.152
2.2	5.854	0.149	4.0	5.999	0.152	5.6	6.000	0.152
2.8	5.927	0.151	4.6	5.999	0.152	6.0	6.000	0.152

The fair premiums for the base case are in bold face. Other parameter values are specified in Section IV. The Low Mean Duration sets the mean unemployment duration of the Weibull distribution at 60 weeks, the Median Mean Duration at 120 weeks, and the High Mean Duration at 180 weeks.

TABLE 5

FAIR PREMIUMS (Y) UNDER ALTERNATIVE VALUES OF HAZARD RATE PARAMETER (λ)

A higher value of the hazard rate indicates that the unemployed are more likely to transit into employment. The hazard rate should therefore be negatively related to the estimated benefit payment duration (***D***) and fair premiums (***Y***). Alternative values of λ have different effects on the values of fair premiums.

1999-2002 Scheme								
Low Mean Duration			**Median Mean Duration**			**High Mean Duration**		
λ(%)	***D***	***Y*(%)**	**λ(%)**	***D***	***Y*(%)**	**λ(%)**	***D***	***Y*(%)**
0.04	9.808	0.240	0.01	10.055	0.244	0.01	10.055	0.244
0.10	9.173	0.230	0.05	10.039	0.243	0.03	10.055	0.244
0.16	8.442	0.218	0.09	9.956	0.242	0.05	10.055	0.244
0.22	**7.712**	**0.204**	**0.11**	**9.872**	**0.241**	**0.07**	**10.051**	**0.244**
0.26	7.249	0.195	0.19	9.180	0.230	0.17	9.763	0.239
0.32	6.609	0.181	0.29	7.797	0.206	0.27	8.410	0.217
0.38	6.038	0.168	0.39	6.554	0.180	0.37	7.026	0.190

2003-2009 Scheme								
Low Mean Duration			**Median Mean Duration**			**High Mean Duration**		
λ(%)	***D***	***Y*(%)**	**λ(%)**	***D***	***Y*(%)**	**λ(%)**	***D***	***Y*(%)**
0.04	5.948	0.151	0.01	6.000	0.152	0.01	6.000	0.152
0.10	5.805	0.148	0.05	5.999	0.152	0.03	6.000	0.152
0.16	5.622	0.144	0.09	5.995	0.152	0.05	6.000	0.152
0.22	**5.416**	**0.139**	**0.11**	**5.991**	**0.152**	**0.07**	**6.000**	**0.152**
0.26	5.270	0.135	0.19	5.949	0.151	0.17	5.997	0.152
0.32	5.046	0.130	0.29	5.816	0.148	0.27	5.972	0.151
0.38	4.819	0.124	0.39	5.560	0.142	0.37	5.871	0.149

The fair premiums for the base case are in bold face. Other parameter values are specified in Section IV. The Low Mean case sets the mean unemployment duration of the Weibull distribution at 60 weeks, the Median Mean case at 120 weeks, and the High Mean case at 180 weeks.

TABLE 6

FAIR PREMIUMS (Y) UNDER ALTERNATIVE PARAMETER VALUES RELATED TO PROBABILITY OF ENTERING INTO UNEMPLOYMENT (U AND μ)

A higher value of U or μ leads to more unemployed workers, higher expected benefit payments, and higher fair premiums. The values of U or μ should therefore be positively related to the fair premiums (Y) in all three cases.

1999-2002 Scheme			
U	**Low Mean Duration *Y*(%)**	**Median Mean Duration *Y*(%)**	**High Mean Duration *Y*(%)**
0.016	0.136	0.161	0.162
0.020	0.170	0.201	0.203
0.024	**0.204**	**0.241**	**0.244**
0.030	0.255	0.301	0.304
0.040	0.340	0.402	0.406
0.050	0.425	0.502	0.507

2003-2009 Scheme			
μ	**Low Mean Duration *Y*(%)**	**Median Mean Duration *Y*(%)**	**High Mean Duration *Y*(%)**
0.01	0.033	0.036	0.036
0.03	0.099	0.108	0.108
0.04218	**0.139**	**0.152**	**0.152**
0.06	0.197	0.216	0.216
0.08	0.263	0.288	0.288
0.10	0.329	0.360	0.361
0.12	0.395	0.432	0.433

The fair premiums for the base case are in bold face. Other parameter values are specified in Section IV. The Low Mean case sets the mean unemployment duration of the Weibull distribution at 60 weeks, the Median Mean case at 120 weeks, and the High Mean case at 180 weeks.

TABLE 7

FAIR PREMIUMS (Y) UNDER ALTERNATIVE VALUES OF PROBABILITY OF LESS THAN 5 YEARS OF INSURANCE HISTORY (α_1) AND PROBABILITY OF FIVE TO TEN YEARS OF INSURANCE HISTORY (α_2)

The premium rate declines when α_1 or α_2 increases. Higher values of α_1 and α_2 imply that more insured workers have a relatively shorter length of work history. Thus, the expected benefit payment duration will be shorter and the premium rates become lower.

1999-2002 Scheme								
Low Mean Duration			**Median Mean Duration**			**High Mean Duration**		
α_1	D	Y(%)	α_1	D	Y(%)	α_1	D	Y(%)
0.36	8.564	0.220	0.36	11.369	0.261	0.36	11.625	0.264
0.42	8.240	0.214	0.42	10.799	0.254	0.42	11.025	0.257
0.48	7.915	0.208	0.48	10.229	0.246	0.48	10.426	0.249
0.5175	**7.712**	**0.204**	**0.5175**	**9.872**	**0.241**	**0.5175**	**10.051**	**0.244**
0.54	7.590	0.202	0.54	9.659	0.238	0.54	9.827	0.240
0.60	7.265	0.195	0.60	9.089	0.229	0.60	9.227	0.231
0.66	6.940	0.188	0.66	8.519	0.219	0.66	8.628	0.221
Low Mean Duration			**Median Mean Duration**			**High Mean Duration**		
α_2	D	Y(%)	α_2	D	Y(%)	α_2	D	Y(%)
0.05	7.946	0.209	0.05	10.392	0.248	0.05	10.620	0.252
0.11	7.847	0.207	0.11	10.173	0.245	0.11	10.380	0.248
0.17	7.748	0.205	0.17	9.954	0.242	0.17	10.141	0.245
0.1924	**7.712**	**0.204**	**0.1924**	**9.872**	**0.241**	**0.1924**	**10.051**	**0.244**
0.23	7.650	0.203	0.23	9.735	0.239	0.23	9.901	0.241
0.29	7.551	0.201	0.29	9.516	0.236	0.29	9.662	0.238
0.35	7.452	0.199	0.35	9.297	0.232	0.35	9.423	0.234

The fair premiums for the base case are in bold face. Other parameter values are specified in Section IV. The Low Mean case sets the mean unemployment duration of the Weibull distribution at 60 weeks, the Median Mean case at 120 weeks, and the High Mean case at 180 weeks.

TABLE 8

FAIR PREMIUMS (Y) UNDER ALTERNATIVE VALUES OF PROBABILITY OF QUALIFYING FOR BENEFITS (δ)

The fair premium rate increases as δ rises. The expected benefit payment will rise as the probability of qualifying for unemployment benefits increases. As a result, the fair premium rate has to increase.

	2003-2009 Scheme		
δ	**Low Mean Duration** Y**(%)**	**Median Mean Duration** Y**(%)**	**High Mean Duration** Y**(%)**
0.20	0.054	0.059	0.059
0.40	0.107	0.117	0.117
0.5181	**0.139**	**0.152**	**0.152**
0.60	0.161	0.176	0.176
0.80	0.214	0.235	0.235
1.00	0.268	0.293	0.294

The fair premiums for the base case are in bold face. Other parameter values are specified in Section IV. The Low Mean case sets the mean unemployment duration of the Weibull distribution at 60 weeks, the Median Mean case at 120 weeks, and the High Mean case at 180 weeks.

TABLE 9

FAIR PREMIUMS (Y) UNDER ALTERNATIVE VALUES OF SYSTEMATIC RISK (β)

A higher β value leads to a higher risk-adjusted discount rate for UI payments and a lower fair premium. Term β should therefore be negatively related to the fair premium in all three cases. Here, the β value estimated using the proxy of UI loss returns, unemployment rates, and property-liability index returns is –0.026, 0.018, and 0.725 respectively.

1999-2002 Scheme

β	Low Mean Duration Y(%)	Median Mean Duration Y(%)	High Mean Duration Y(%)
–0.40	0.458	0.654	0.672
–0.20	0.393	0.539	0.551
–0.026	**0.345**	**0.457**	**0.467**
0.00	0.338	0.446	0.455
0.018	**0.334**	**0.439**	**0.448**
0.20	0.293	0.373	0.379
0.40	0.254	0.314	0.318
0.60	0.222	0.266	0.269
0.725	**0.204**	**0.241**	**0.244**
0.90	0.182	0.211	0.213
1.00	0.171	0.195	0.197

2003-2009 Scheme

β	Low Mean Duration Y(%)	Median Mean Duration Y(%)	High Mean Duration Y(%)
–0.40	0.253	0.292	0.293
–0.20	0.227	0.259	0.259
–0.026	**0.206**	**0.233**	**0.234**
0.00	0.203	0.230	0.230
0.018	**0.201**	**0.227**	**0.228**
0.20	0.183	0.204	0.205
0.40	0.164	0.182	0.182
0.60	0.148	0.163	0.163
0.725	**0.139**	**0.152**	**0.152**
0.90	0.127	0.138	0.138
1.00	0.121	0.131	0.131

The fair premiums for the base case are in bold face. Other parameter values are specified in Section IV. The Low Mean case sets the mean unemployment duration of the Weibull distribution at 60 weeks, the Median Mean case at 120 weeks, and the High Mean case at 180 weeks.

APPENDIX

DESCRIPTION OF THE UI PROGRAM IN TAIWAN

Table A reports the statistics describing the status of the UI program during the years 1999-2008. As shown in Table A, the number of unemployed workers who apply for UI benefits increases dramatically during the first four years as information of the UI program becomes more available to the public. The number of applicants has stayed at a more stable level, accounting for about 65-70% of the total unemployment from 2003 on. In addition to helping unemployed workers during their unemployment period, another function of the UI program is to provide job placement and job training opportunities to unemployed workers. However, according to the statistics reported in Table A, only a few UI claimants found new jobs through the job placement scheme and even fewer applicants had received job training through this program. This indicates that the job placement and job training mechanism under the UI program are not very effective.

As to the financing of the benefits, the UI program in Taiwan is part of the labor insurance system which charges a flat premium rate of 6.5%, and 1% of the 6.5% is contributed to the UI fund. Precisely, the source of funds for UI or the 1% premium paid is comprised of employers (0.7%), employees (0.2%), and the government (0.1%). For example, in 1999 the premium income of Labor Insurance was NT$130 billion, and about NT$20 billion was assigned to the UI fund. Benefit payments in 1999 totaled to about NT$0.5 billion and rose to NT$1.7 billion in 2000 as the number of UI applicants increased. It is worth noting that the benefit payments dropped somewhat in 2003 after the re-regulation in the maximum length of benefit payment to 6 months only. The UI program has experienced a large budget surplus up to now.

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[14] The exchange rate of the US dollar is around NT$33 during the years 1999-2009.

TABLE A

DESCRIPTIVE STATISTICS OF THE UI PROGRAM IN TAIWAN

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of UI Applicants (1)	43,101	107,701	494,396	615,157	336,833	221,510	254,582	278,764	300,089	389,472
Number of Applicants Approved for UI Benefits (2)	39,471	105,227	485,851	611,646	325,340	212,097	250,600	276,811	298,859	370,190
Rate of Receipt of UI Benefits (3) = (2) / (1)	91.58	97.70	98.27	99.43	96.59	95.75	98.44	99.30	99.59	95.05
Number of Job Placements	554	360	1,653	4,849	6,456	10,364	10,237	12,158	25,028	39,149
Number of Job Training	150	128	317	2,075	7,004	5,227	6,350	6,006	8,469	9,723
Premium Receivable (NT$ million dollars)	20,760	22,525	23,456	22,423	16,261	17,083	17,815	18,659	19,281	19,680
Benefit Payment (NT$ million dollars)	516	1,665	7,825	10,204	5,459	3,680	4,406	4,958	5,353	6,646

Source: General Condition of Employment Insurance, Council of Labor Affairs, Taiwan.

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