

## Chapter Four: Methodology

### <1> Assessment of Risk Management Strategy — Comparing Its Cost of Risks

#### 1.1 Introduction

If we want to choose a appropriate risk management strategy, not only we should identify the influence that risks would affect an insurance corporation ( Risk identification and analysis ) , but also we should assess whether the risk management strategy could benefit insurance corporation. But the question is, how do we assess a risk management strategy?

From Equation (2.2) mentioned before, we know that as long as costs are defined to include all the effect on value of risks and risk management, minimizing the cost of pure risks is the same thing as maximizing firm value. So it means that, when we assess a risk management strategy, first we should evaluate whether it can decrease its cost of risks or not.

Before we analysis the cost of risks for risks management strategy of PCC, we should realize how to use PCC structure to reduce our non-life insurance industry's risk. General speaking, our non-life insurance industry may use two types of PCC mechanism to manage their underwriting risks. One is securitization, using PCC as a Special-Purpose-Vehicle (SPV), such as company-specific loss ratio securities<sup>1</sup> or cap bonds etc. The other is using PCC as a rent-a-captive mechanism.

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<sup>1</sup> S Bouriaux and D. Russell (2002)

If we want to adopt risk securitization, we should consider the following three elements: (1) two-side capital market, (2) proper pricing and (3) feasible issue cost. But if we consider the size of insurance companies, except a few large insurance companies, we would see that most of them are not suitable for adopting risk securitization to cover the issue cost.<sup>2</sup> So I suggest that Taiwan non-life insurance industry may consider PCC as rent-a-captive mechanism to management their underwriting risks. In the following we will focus on comparing commercial reinsurance mechanism with PCC as rent-a-captive.

In this paper we will compare two risk management strategies, commercial reinsurance and PCC as rent-a-captive, and analyze which risk management strategy can decrease cost of risks more effectively. We use historical data<sup>3</sup> and Discounted Cash Flow Method to simulate and analysis whether commercial reinsurance or PCC structure as rent-a-captive one could decrease its cost of risks more effectively when an insurance company manages its underwriting risks under the same ceding condition.

In order to analyze the effects of risk management decisions that involve cash flows over multiple periods, it is necessary to discount the expected net cash flows to present value. In this paper, we will use discounted cash flow analysis to evaluation the cost of risks for the two strategies over multiple periods.

## **<2> Evaluation the cost of risks for PCC and Commercial**

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<sup>2</sup> C. Chen (2000), 151-153

<sup>3</sup> In this paper, historical data includes direct written premium income, direct claim paid, investment income etc., excludes reinsurance premium ceded and claim recovered from reinsurance. Because we simulate that each the insurance company cedes their risks under following simulation.

# Reinsurance

## 2.1 Evaluation the cost of risks for commercial reinsurance

If one insurance company adopts commercial reinsurance mechanism to manage its underwriting risk, the major components of its cost of risks include :

- (1) Expected loss on net retention : the self retained losses of the insurance company
- (2) Actually paid reinsurance premium :

Actually paid reinsurance premium means the net amount that the cedant actually paid to the reinsurance premium to reinsurer.<sup>4</sup> So actual paid reinsurance premium will equal to :

$$GP_R = NP_R + C_R + A_R \dots\dots\dots (4.1)$$

$$AP_R = GP_R - C_R = NP_R + A_R \dots\dots\dots (4.2)$$

Where :

- $GP_R$  = Gross ceded reinsurance premium
- $NP_R$  = Net ceded reinsurance premium
- $AP_R$  = Actually paid reinsurance premium
- $C_R$  = Reinsurance commission
- $A_R$  = Administration expense of reinsurance

According to the law of large numbers, as long as risk exposure is large enough, the expected loss covered by reinsurance will tend to equal to actual loss covered by reinsurance. And the calculation of Actually Paid Reinsurance Premium also will be :

$$NP_R = EL_R \approx L_R \dots\dots\dots (4.3)$$

$$AP_R = EL_R + A_R \approx L_R + A_R \dots\dots\dots (4.4)$$

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<sup>4</sup> In practice, including Quota Share and Surplus Treaty, cedants usually deduct the reinsurance commission first, and then pay the net amount of reinsurance premium to reinsurers. So, for reinsurers, the real amount that reinsurers received is the net reinsurance premium (reinsurance commission deducted)

where :

$EL_R$  = Expected Loss covered by reinsurance

$L_R$  = Actual loss covered by reinsurance.

And according to the equation ( 4.4 ) , the ratio of Reinsurance

Administration Expense Loading will be :

$$= \frac{A_R}{NP_R} = \frac{AP_R - EL_R}{EL_R} \approx \frac{AP_R - EL_R}{L_R}$$

According to above equation and the Statistics of Taiwan No-life Industry for recent 20 years, If reinsurance administration expense loading is measured annually against “units of exposure”, we can get that the ratio of reinsurance administration expense loading is around 15%

- ( 3 ) Total cost of capital ( expected rate of return if the capital has not been used for reinsurance ) : We measure the rate of investment return on the capital by the total invest net income of domestic non-life insurance companies dividing total working capital of domestic non-life insurance companies. For example, in 2002<sup>5</sup>, the opportunity cost of capital(per dollar) of Taiwan domestic non-life insurance industry is around 3.5%. Then total opportunity cost of capitals equal to total capital times 3.5%.

So we get the equation of cost of risks for commercial reinsurance mechanism is :

$$CR_R = NL_R + AP_R + CC_R = NL_R + EL_R + A_R + CC_R \dots\dots\dots (4.5)$$

Where :

$CR_R$  = cost of risks for commercial reinsurance ;

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<sup>5</sup> In 2003, total working capital of Taiwan domestic non-life insurance is NT\$137,234million, and the total net investment income of Taiwan domestic non-life insurance is NT\$4,801million.  
Source : Non-life Insurance Association of the R.O.C.and Insurance Institute of the Republic of China.

$NL_R$  = Expected loss on net retention ;

$CC_R$  = Total cost of capital ( expected return if the capital has not been used for reinsurance )

## 2.2 Evaluation the cost of risks for using PCC as a rent-a-captive

If the insurance company use PCC as a rent-a-captive mechanism to manage its underwriting risk, the major component of its cost of risks includes :

- (1) Expected loss on net retention : the self retained claim amount of the insurance company
- (2) Captive reinsurance premium

Its captive reinsurance premium will equal to :

$$CP_p = EL_p + A_p \dots\dots\dots (4.6)$$

where :

$CP_p$  = Captive Reinsurance Premium

$EL_p$  = Expected Loss covered by captive reinsurance

$A_p$  = Expense Loading of PCC

Expense loading of PCC, including funding fee, operating cost and management cost etc., will be affected by the domicile of PCC. For example, if our domestic insurance company want to set up a captive cell in the domicile of Guernsey, the estimated funding cost is around £26,100 at the first year and the annual operating cost (per cell) is around £206,000 each year ; .

- (3) Investment income from PCC :

When the insurance company sets up a cell for PCC, it needs the PCC manager to manage its setup capital, and the PCC manager's business plan

should agree with cell parent. The relation between PCC manager and cell parent would be like a trust. The investment income of PCC should payback to the cell parent according to cell parent's share of PCC through dividend. The return ratio will depend on its investment object. If our strategies of investment focus on safety and liquidity, the average rate of return will be around 2~4%. To be conservation, in the following research we will assume the rate of return of PCC is 2%. The investment income is a negative term for cost of risks.

- (4) Total cost of capital ( Expected return if the capital has not been used for PCC ): Again, total opportunity cost of capitals equal to 3.5% times amount of capital.

So we get the equation of cost of risks for PCC as follows :

$$CR_p = NL_p + CP_p - I_p + CC_p = NL_p + EL_p + A_p - I_p + CC_p \dots (4.7)$$

Where :

$$\begin{aligned}
 CR_p &= \text{cost of risks for PCC ;} \\
 NL_p &= \text{Expected loss on net retention ;} \\
 &= \text{Investment income from PCC} \\
 I_p &= \text{Cost of capital ( expected rate on return if the capital has not} \\
 CC_p &= \text{been used for PCC )}
 \end{aligned}$$

### 2.3 The cost of risks which PCC can decrease

In order to consider the effect of multiple periods, it is necessary to discount the expected net cash flows to present value. Thus, compared with commercial reinsurance, the present value of total cost of risks which PCC can decrease would

be:

$$DCR_t = CR_{R,t} - CR_{P,t} \dots\dots\dots(4.8)$$

$$DCR = \sum_{t=1}^T PV(CR_{R,t}) - \sum_{t=1}^T PV(CR_{P,t}) \dots\dots\dots(4.9)$$

where :

$CR_{R,t}$  = cost of risks for Commercial Reinsurance in year t,

$CR_{P,t}$  = cost of risks for PCC in year t,

$DCR_t$  = the cost of risks which PCC can decrease in year t,

$DCR$  = the present value of total cost of risks which PCC can decrease.

If  $DCR > 0$ , it means that using PCC as a rent-a-captive mechanism can decrease the cost of risks more than using reinsurance mechanism, vice versa. It also means that PCC can add up the firm value more than reinsurance mechanism

And then:

$$DCR = \sum_{t=1}^T PV(NL_{R,t} + EL_{R,t} + A_{R,t} + CC_{R,t}) - \sum_{t=1}^T PV(NL_{P,t} + EL_{P,t} + A_{P,t} - I_{P,t} + CC_{P,t}) \dots\dots\dots(4.10)$$

If ceded terms and ceded ratio of insurance company through PCC and reinsurance are the same, it means that  $NL_{R,t} = NL_{P,t}$   $EL_{R,t} = EL_{P,t}$  then the above equation

will equal to :

$$DCR = \sum_{t=1}^T PV(A_{R,t} + CC_{R,t}) - \sum_{t=1}^T PV(A_{P,t} - I_{P,t} + CC_{P,t}) \dots\dots\dots(4.11)$$

Where the subscript  $t$  represents the year ( $t=1,2,\dots,5$ )

## 2.4 Illustration of comparing the cost of risks of PCC with Commercial Reinsurance

To illustrate the difference of cost of risks between PCC and reinsurance, we use a simple case to explain the difference of cost of risks between PCC & reinsurance :

Assume that there is an AAA Company which wants to evaluate the feasibility of PCC. The annual direct premium is NT\$3,000M. In the past, AAA Company use reinsurance under the term of Aggregated Excess Loss Reinsurance NT\$1,500M xs NT\$4,500M, AAA Company has an Incurred Loss 2,500M each year. We assume that Premium to Surplus Ratio is 2 to1, equal 50% solvency ratio<sup>6</sup> ( it means that paid up capital should not be less than half of premium income of Protected Cell Company ) .

We assume the funding fee and the relative cost of PCC is around £26,100 ( NT\$1.47M )<sup>7</sup> in the first year and the annual operating cost (per cell) is around £206,000 ( NT\$11.63M ) each year<sup>8</sup>. The rate of return of PCC is 2% and the opportunity cost of capital (per capital) of AAA Company is 3.5%

Besides, Both PCC and reinsurance also have other cost of risks such as cost of residual uncertainty, cost of risk control, etc. But we consider that these two strategies have no significant variance on such cost of risks. To simplify it, we

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<sup>6</sup> Besides minimum capital requirement, PCC should also consider its solvency margin. In this paper we assume that if PCC considers its solvency margin, its premium to surplus ratio should be 2 to1, equal to 50% solvency ratio.

<sup>7</sup> The official web site of Guernsey Financial Services Commission  
<http://www.gfsc.guernseyci.com/insurance/index.html>

<sup>8</sup> Willis Group 2003, Captive Management in Guernsey  
<http://www.williscaptives.com/captives/documents/CaptiveManagementBrochure.pdf>



ignore such cost of risks in the following analysis.

Their difference of cost of risks between PCC & reinsurance are illustrated as Table 4-1, and from the illustration of Table 4-1, we can get that :

1. If we ignore the uncertainty of loss and possibility of insolvency of PCC, it is apparent that using PCC as rent-a-captive can decrease the cost of risks more than commercial reinsurance.
2. Like other risk retention methods, the longer we use PCC as rent-a-captive, the more we can save its cost of risk.
3. Although using PCC as rent-a-captive can decrease the loading of ceding premium when compare with commercial reinsurance, however, it will increase the opportunity cost of capital because it need the certain amount of paid-up capital.

**Table 4-1 :**

**Cost of risks of AAA Company when it adopts PCC structure as a  
rent-a-captive**

Unit : NT\$ million

	Year 1	Year 2	Year 3	Year 4	Year 5
Paid-up Capital	1,500.00				
Expected Loss on Net Retention	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
Expect Loss covered by PCC	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Loading of PCC	13.1	11.63	11.63	11.63	11.63
Net Premium of PCC	1,013.10	1,011.63	1,011.63	1,011.63	1,011.63
Retain Earnings by Investment Income	30.00	30.60	31.21	31.84	32.47
Aggregated Retain Earnings	30.00	60.60	91.81	123.65	156.12
Opportunity cost of capital	87.96	86.86	85.79	84.69	83.58
<b>Cost of Risks</b>	<b>2,571.06</b>	<b>2,567.89</b>	<b>2,566.21</b>	<b>2,564.48</b>	<b>2,562.74</b>

Notes :  $I_{P,t} = (P_{P,t} + I_{P,t-1}) \times 2\%$

$$CC_{P,t} = (P_{P,t} + EL_{P,t} + A_{P,t} - I_{P,t-1}) \times 3.5\%$$

Where :

$P_{P,t}$  =Paid-up capital

**Table 4-2 :****Cost of risks of AAA Company when it arranges commercial reinsurance**

Unit : NT\$ million

	Year 1	Year 2	Year 3	Year 4	Year 5
Paid-up Capital	0				
Expected Loss on Net Retention	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
Expect Loss covered by reinsurance	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Loading of Reinsurance	150.00	150.00	150.00	150.00	150.00
Actually paid reinsurance premium	1,150.00	1,150.00	1,150.00	1,150.00	1,150.00
Retain Earnings by Investment Income	0.00	0.00	0.00	0.00	0.00
Opportunity cost of capital	40.25	40.25	40.25	40.25	40.25
<b>Cost of Risks</b>	<b>2,690.25</b>	<b>2,690.25</b>	<b>2,690.25</b>	<b>2,690.25</b>	<b>2,690.25</b>

## **<3> Empirical analysis the difference in cost of risks between PCC as rent-a-captive and commercial reinsurance**

### **3.1 Introduction**

According to above illustration, it seems that PCC can save the loading and then decrease its cost of risks. But is PCC always better than commercial reinsurance? It seems that it is not always the case.

In this paper we simulate and calculate the cost of risks by assuming that the domestic non-life insurance companies buy single excess loss ratio reinsurance treaty based on the historical data. Besides, we simulate and calculate the cost of risks if domestic non-life insurance companies adopt the risk management strategy of PCC as rent-a-captive in 1998. Then we compare the different cost of risks between these two strategies, reinsurance and PCC, under the same ceding term and historical data to analyze which one is the optimal risk management strategy for domestic non-life insurance companies.

To focus on the comparison of differences between these two costs of risks, we assume that all the sample companies are under the same ceding terms and condition whether we adopt PCC as rent-a-captive or commercial reinsurance.<sup>9</sup>

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<sup>9</sup> The following analysis assumes all the insurance companies cede their risks under single excess loss ratio reinsurance treaty. It is different with practice and actual operation environment. In practice, insurance company usually buys several types of reinsurance treaties, by line/layer, by proportional or non-proportional, to decrease their risk uncertainty due to insufficient market data and loss experience. But in this paper, to simplify and compare their difference of cost of risks between commercial reinsurance and Protected Cell Company used as rent-a-captive. We simulate and assume all the insurance companies cede their risks under the same ceding terms and conditions.

In the following of this paper, in order to observe the effect of different independent variables, we will simulate eight scenarios to analyze which circumstance that we adopt PCC as rent-a-captive will be the optimal risk management strategy,

### **3.2 Research assumptions**

Before the analysis, there are seven assumptions that we should notice :

#### **1. Ceding terms and condition :**

As we mentioned before, to simplify the analysis, this paper assumes that whether we adopt commercial reinsurance or using PCC as rent-a-captive, all insurance companies are under the same term and condition : Excess of Loss ratio reinsurance<sup>10</sup>. We initially assume that all the insurance company have the same Excess of Loss ratio reinsurance treaty : Excess of Loss ratio reinsurance, Cover is for 90% of losses in excess of a 70% paid loss ratio on this underlying portfolio of treaties up to a 120% paid loss ratio<sup>11</sup> ( scenario 1 ). Then, in order to find out the optimal situation for PCC as rent-a-captive, we will also analyze whether different ceding terms and conditions would affect its cost of risks

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<sup>10</sup> Among several type of reinsurance treaties, non-proportional reinsurance treaty is the simplest way to calculate its expense loading of reinsurance premium. And among several type of non-proportional reinsurance treaties, excess of loss ratio reinsurance treaty is more suitable for us to simulate because we only need the loss ratio and written premium in current 5 years, not complicate risk profile, to calculate to its net reinsurance premium(burning cost)

<sup>11</sup> C. Chen (1999), 278-279, and such term and condition are widely used in practice.

**2. Calculation of net reinsurance premium :**

In this paper, we adopt burning cost to calculate the net reinsurance premium (pure loss cost). We hereby calculate the burning cost based on the claim experience at least the last five years (C. Chen 1997) . The calculation on burning cost is :

$$B = \frac{EL}{P} = \dots\dots\dots(4.12)$$

Where,

$B$  = burning cost

$EL$  = layer-claims expectation

$P$  = protect premium volume<sup>12</sup>.

Then,

$$B \times (1 + \rho) = PR$$

$$GP \times PR_r = AP_r$$

Where,

$\rho$  = loading of reinsurance

$PR_r$  = reinsurance premium rate

$GP$  = GNPI(gross net premium income )

$AP_r$  = Actual reinsurance premium<sup>13</sup>

It is notable that, to focus on the comparison of difference between these two costs of risks we should use the same ceding condition whether we adopt PCC or commercial reinsurer. Thus their burning cost should be the same.

Following the above ceding terms and conditions, we use historical data<sup>14</sup>

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<sup>12</sup> Swiss Re 1997, “Proportional and non-proportional reinsurance”, 31

<sup>13</sup> Swiss R 2000, “Non-proportional reinsurance accounting”, 54

<sup>14</sup> In this paper, historical data includes direct written premium income, direct claim paid, investment

to simulate and calculate the burning cost of each sample insurance company if it cedes its risks under single excess of loss ratio treaty rate from 1998 to 2002 as Table4-3 as follows.

**Table 4-3 :**

**The burning cost for each domestic non-life insurance company  
( 1998~2002 )**

Name of insurance Company	Net Burning Cost				
	Year 1998	Year 1999	Year 2000	Year 2001	Year 2002
Taiwan	6.21%	8.23%	7.97%	7.44%	6.94%
Chung Kuo	7.40%	6.50%	7.12%	6.31%	5.72%
Tai Ping	14.64%	13.04%	15.57%	16.18%	18.08%
Fubon	1.85%	2.33%	4.71%	4.22%	3.80%
Zurich	5.64%	5.00%	6.65%	5.94%	5.85%
Taian	1.69%	1.65%	1.82%	1.64%	1.48%
Mingtai	2.31%	2.07%	2.76%	2.53%	2.60%
Central	19.81%	20.69%	21.18%	19.02%	17.15%
First	5.98%	5.30%	4.70%	4.23%	6.25%
Kuo Hua	5.07%	4.40%	3.82%	3.73%	3.87%
Union	8.86%	7.83%	6.86%	6.07%	9.24%
Shin Kong	9.23%	8.61%	8.97%	8.09%	7.65%
South China	6.99%	7.09%	6.21%	5.52%	5.00%

Notes : Under Excess of Loss ratio reinsurance for 90% of losses in excess  
of a 70% loss ratio up to a 120% paid loss ratio

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income etc., excludes reinsurance premium ceded and claim recovered from reinsurance. Because we simulate that each the insurance company cedes their risks under single excess of loss ratio treaty.

### **3. Cost of capital :**

For different insurance companies, there should be different cost of capital. To calculate the opportunity cost of capital of each company, we calculate its actual net investment income of each insurance company and then divide it by its actual working capital.

The actual opportunity costs of capital of each company from 1998 to 2002 are listed in Table 4-4 as follows :



**Table 4-4 Actual opportunity cost of capital of each company from 1998 to 2002**

Name of insurance Company	cost of capital				
	Year 1998	Year 1999	Year 2000	Year 2001	Year 2002
Taiwan	2.79%	3.96%	6.99%	7.80%	8.87%
ChungKuo	5.42%	7.65%	7.98%	5.06%	3.12%
TaiPing	2.31%	5.57%	-0.90%	9.74%	11.64%
Fubon	7.34%	6.37%	4.99%	4.49%	7.72%
Zurich	4.26%	5.61%	4.16%	3.88%	0.28%
Taian	3.06%	6.28%	-6.71%	5.79%	1.73%
Mingtai	4.79%	4.83%	3.76%	4.66%	3.20%
Central	9.04%	-0.21%	-0.05%	0.22%	-1.53%
First	-0.16%	3.88%	3.26%	3.30%	6.04%
KuoHua	8.42%	1.09%	-1.64%	1.81%	0.52%
Union	7.90%	5.21%	8.54%	6.04%	5.39%
ShinKong	1.38%	5.98%	-0.13%	4.91%	-2.26%
SouthChina	2.56%	4.72%	-4.42%	4.75%	2.98%

*Source : Insurance Institute of ROC*

We should note that if the opportunity cost of capital of one company is negative, it means that at that time one company's actual return of investment is below zero.

If the opportunity cost of capital of one company is higher, it means that its opportunity cost of capital is expensive. If there are two projects of which

expected rate of return are the same, but the former capital requirement is higher than the later, the later project may be declined by shareholders.

#### **4. Paid-up capital :**

Protected Cell Company, like other captive, also needs the minimum level of capital that must be injected in to a captive when the minimum capital is required by the regulatory within PCC domiciles.<sup>15</sup>, Take Guernsey for example, the minimum capital requirement of each captive is £ 100,000. In this paper, we assume the PCC is set up in Guernsey and the minimum capital required is £ 100,000 ( around NT\$6,000,000 ) .

In addition to minimum capital requirement, PCC should also consider its solvency margin. In this paper we assume that if PCC considers its solvency margin, its premium to surplus ratio should be 2 to1, equal to 50% solvency ratio<sup>16</sup>.

In this paper we will simulate two situations: One is the minimum capital required by the regulatory within PCC domiciles, the other is that, considering solvency margin of a captive, we assume that premium to surplus ratio should 2 to1.

#### **5. Technical reserves.**

Like traditional insurance companies, captives engage in one of two types of reserve management methods for financing the claims arising from their

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<sup>15</sup> “Directory of world captive domiciles”, Business insurance, march 15,2004, P36

<sup>16</sup> Bawcutt ( 1987 ) suggests that for a captive in the early years of operation it is recommended that the solvency margin, which is the percentage of capital-free reserves over the net premiums retain by the captive, be kept at a comparatively high level : it may be prudent to establish at 50% solvency ratio.

liabilities. One is the capitalization method and the other is the compensation method. In this paper we assume that the PCC manages loss reserve under the capitalization method, even if no claim occurred at that year. All the underwriting profit should be reserved for the future claims<sup>17</sup>.

## **6. Earned surplus**

For PCC as Rent-a-Captive, this paper assumes that there are two conditions will affect the earned surplus of PCC : ( 1 ) the investment income of PCC and ( 2 ) the underwriting loss (aggregated) which is net retained by PCC. Earned surplus is negative of cost of risks.

## **7. Discount rate :**

In this paper we use “annual average interbank overnight call-loan rate” as discount Rate.

## **8. Pure captive**

We assume that PCC as rent-a-captive is a pure captive, and each cell only takes its parent company business. It means that if PCC suffers loss that exceeds its paid-up capital and technical reserves, the default risk will be born solely by its parent company. Due to a pure captive, if any one cell of PCC runs into insolvency, we assume no indirect financial distress cost (such as legal fee, court fees) would occur.

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<sup>17</sup> J. Bannister (1999)

## <4> **Definitions of variables**

To properly measure the circumstance under which PCC as rent-a-captive can increase its firm value, we consider 4 factors :

### **1. Ceding term and condition :**

It seems that it is not always the case that PCC is better than commercial reinsurance. We think that it should depend on ceding term and condition basis because of the two reasons :

- (1) If it doesn't have a certain amount of ceding premium, it cannot cover PCC setup and operation expense
- (2) PCC and other retention methods are not suitable for taking peak risks business ( Parkinson 2002 ) .

In this paper we basically assume that all insurance companies have the same term and condition : Excess of Loss ratio reinsurance. At the initial scenario, the reinsurance cover is for 90% of losses in excess of a 70% loss ratio on this underlying portfolio of treaties up to a 120% loss ratio (Chi-Yao Chen. 1996). Then we also simulate other ceding terms and conditions as follows to analyze the effects of different ceding terms and conditions,

- (a) Cover is for 90% of losses in excess of a 80% loss ratio on this underlying portfolio of treaties up to a 130% paid loss ratio.
- (b) Cover is for 90% of losses in excess of a 60% loss ratio on this underlying portfolio of treaties up to a 120% paid loss ratio.

## **2. Retrocession**

The captive is initially designed to take the burning cost and eliminating the peak risks to preserve stability and protect the captive's balance. PCCs, like other captives, may be considered not suitable for taking peak risk business. In this paper we will use the factor "retrocession" to analyze whether retrocession can decrease PCC's cost of risks.

## **3. Operation Period**

The author assumes that, like other risk retention methods, the longer we use PCC as rent-a-captive, the more we can save its cost of risk. So, in this paper, we analyze separately its cost of risks under different operation periods : 3 years and 5 years to find whether the longer we use PCC as rent-a-captive the more we can save its cost of risk.

## **4. Paid-up Capital**

To analyze which amount of paid-up capital of PCC is optimal for insurance company. We also simulate two situations, (1) the minimum capital required by the regulatory within PCC domiciles. For example, like Guernsey, the minimum capital requirement of each captive is £ 100,000, (2) to meet the solvency margin of a captive, we assume that premium to surplus ratio is 2 to 1, thus paid up capital should not less than half of premium income of PCC.

## <5> Data Collection

In this paper we use cash flow analysis to empirically analyze the cost of risks compared commercial reinsurance with PCC used as rent-a-captive. We use the historical data of non-life insurance companies of recent five years (1998~2002) to simulate, analyze and compare the different cost of risks between these two strategies, reinsurance and PCC .

Before we calculate its cost of risks, first we should get (1) reinsurance premium loading and (2) opportunity cost of capital(per capital). Thus we use historical data of reinsurance premiums ceded, claims recovered from reinsurers to calculate to reinsurance premium loading ( we refer to the recent 20 years of historical data ) and the then we use historical data (1998~2002) of financial income and working capital to calculate its opportunity cost of capital(per capital)

Next we use historical data of direct written premium and direct claim to simulate each sample company's ① loss on net retention, ② burning cost and net ceding premium, ③ PCC's underwriting profit(loss) and technical reserves, ④ PCC 's retrocession premium ( if PCC arranged retrocession ) , ⑤ capital required (if the solvency ratio is considered). Except burning cost and retrocession premium we refer the data from 1988 to 2002<sup>18</sup>, all of above simulate we refer to the data from 1998 to 2002

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<sup>18</sup> To appropriately calculate the burning cost (net reinsurance premium), we need at least 5 years of the historical data. Besides, to evaluate the retrocession premium (1998~2002), we should evaluate PCC's risk portfolio from 1993~1997, and to calculate the PCC's risk portfolio from 1993~1997, we also need historical data from 1988~1992. Thus, in this paper we used historical data of direct premium and claim from 1988~2002 to calculate the burning cost and retrocession premium.

All of above historical data source is from “Yearbook of Insurance”, published by Insurance Institute of ROC. Due to data constrained, we only focus on domestic non-life insurance company. To appropriately evaluate the burning cost as follow, we exclude the firms that are newly set up after 1988. We also exclude the firm which is merged by other company within the period 1988~2002. Finally, there are 13 firms included in this sample.

The data of funding cost and annual operating fee of PCC-since we assume that PCC was set up in the domicile of Guernsey-are from the Guernsey Financial Services Commission<sup>19</sup>. And our data source of interbank overnight call loan rate (weighted average) is from “Financial Statistics Monthly”, published by Central Bank of Republic of China (Taiwan).

## < 6 > Simulation of scenarios

Scenario 1 is the basis, and then we will add other scenarios to analyze whether different independent variables would effect its benefit of PCC.

### **Scenario 1 (basis)**

1. Ceding term and condition : We assume and simulate that no matter insurance companies adopt PCC and commercial reinsurance risk management strategy, both of them arrange the same ceding term and condition : Excess of Loss ratio

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<sup>19</sup> <http://www.gfsc.guernseyci.com/>

reinsurance, cover is for 90% of losses in excess of a 70% loss ratio on this underlying portfolio of treaties up to a 120% paid loss ratio.

2. PCC didn't buy any retrocession reinsurance.
3. Paid-up capital : To meet the solvency margin of a captive, the premium to surplus ratio is two to one.
4. Operation period : from year 1998 to 2002 (5 years)
5. Cost of capital : We get each company's opportunity cost of capital by calculating its actual net investment income and then divide by its working capital.
6. 100% Technical reserves for underwriting profit of PCC, but if PCC suffers loss and gets into insolvency, the default risk will be born solely by its parent company ( pure captive ) .
7. Discounting rate : Interbank overnight call-loan rate".

#### **Scenario 2 :**

1. PCC did buy retrocession reinsurance to protect its underwriting risk.
2. Other assumption are as the same as Scenario 1

#### **Scenario 3 :**

1. Both PCC and commercial reinsurance risk management strategy arrange their ceding term and condition, excess of loss ratio reinsurance: cover is for 90% of losses in excess of a **80%** loss ratio up to a **130%** paid loss ratio.
2. Other assumption are as the same as Scenario 1.

#### **Scenario 4 :**



1. Both PCC and commercial reinsurance risk management strategy arrange their ceding term and condition, excess of loss ratio reinsurance: cover is for 90% of losses in excess of a **60%** loss ratio up to a **120%** paid loss ratio.
2. Other assumption are as the same as Scenario 1.

**Scenario 5 :**

1. Both PCC and commercial reinsurance risk management strategy arrange their ceding term and condition, excess of loss ratio reinsurance: cover is for 90% of losses in excess of a **60%** loss ratio up to a **120%** paid loss ratio.
2. PCC did buy retrocession reinsurance to protect its underwriting risk.
3. Other assumption are as the same as Scenario 1.

**Scenario 6 :**

1. Both PCC and commercial reinsurance risk management strategy arrange their ceding term and condition, excess of loss ratio reinsurance: cover is for 90% of losses in excess of a **60%** loss ratio up to a **120%** paid loss ratio.
2. Operation period : From 1998 to 2000 (3 years)
3. Other assumption are as the same as Scenario 1.

**Scenario 7 :**

1. Both PCC and commercial reinsurance risk management strategy arrange their ceding term and condition, excess of loss ratio reinsurance: cover is for 90% of losses in excess of a **60%** loss ratio up to a **120%** paid loss ratio.
2. PCC did buy retrocession reinsurance to protect its underwriting risk.
3. Operation period : From 1998 to 2000 (3 years)

4. Other assumption are as the same as Scenario 1.

**Scenario 8 :**

1. Both PCC and commercial reinsurance risk management strategy arrange their ceding term and condition, excess of loss ratio reinsurance: cover is for 90% of losses in excess of a **60%** loss ratio up to a **120%** paid loss ratio.
2. PCC did buy retrocession reinsurance to protect its underwriting risk.
3. Paid-up capital : In this scenario, paid-up capital only meets the minimum capital required by the regulatory within PCC domiciles. Solvency margin in this scenario is not considered.
4. Other assumption are as the same as Scenario 1.