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財政部九十三年度委託研究計畫

(六)

颱風洪水保險基金之研究

研究計畫名稱：颱風洪水保險制度之運作

科資編號：PG9306-0322

委託單位：中華民國財政部

研究單位：美商達信保險經紀人股份有限公司

編印日期：中華民國九十四年六月二十四日

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第六章 颱風洪水保險基金之研究

在這一章，本研究將洪災保險認定在第二種方案（火險自動涵蓋）的情形之下來進行長期之保險基金財務分析。在此方案之下，若投保火險者無論是居住在公寓的第一或高樓層，或者是獨棟，已購買火險者必須更新契約同時購買颱風洪水險。

本研究將針對此一方案根據 Guy Carpenter 所建立之財務分析模型來進行模擬，此模型可用來研究不同保險基金來源的影響，也具有預測未來預算之功能，故也可作為管理洪災基金的基本工具。

洪災基金的財務模型是一個試算表形式的電腦程式，它可以根據一些情境設定來作單一情境的模擬，或者是計算不同期間不同時點的財務平衡機率分佈。模型中所有的假設值均為確定(deterministic)的，唯一會隨機(Stochastic)變動的假設是損失金額。換言之，在進行模擬時唯一會隨機改變的投入變數為毛損失金額(gross loss amount)，故只有與損失有關的金額會隨之變動，例如已付損失、再保損失、現金以及投資收入等。

以下之分析均建立在基金累積及賠償之長期均衡觀念之上，所謂的長期均衡可定義為一種基金資產的累積必須足夠償付主要損失的概念。本研究將計算此基金必須存在多少年，以及在建立起足以支付如納莉颱風般重大損失的基金之前所可能經歷的年平均損失。

6.1 基金來源之研究

為便於進行合適的財務分析，本研究將洪災基金的運作視為獨立個體，並稱之為「洪災基金」。洪災基金的運作被視為類似保險公司，保費收入及投資資產的收入視為基金收入，而支出面則保險佣金、營運費用、再保險成本以及分配底層的 10 億元給保險公司。換言之，此基金在收入面所使用的假設包括：

1. 洪災基金的成立是由政府與民間保險業者來共同承擔。
2. 洪災基金由保費所組成，並且分配給所有風險分攤者。

3. 洪災基金的管理費將從基金中支出，並且沒有任何固定資產、員工或辦公室。
4. 洪災基金的虧損將由政府來補足。

本章根據 Guy Carpenter 所建立之財務評估模型進行保費收入與金額之財務規劃，計算時也應用到台灣洪水研究團隊所提供的淹水情境模擬結果來設算 2005 至 2020 年可能的洪災損失。

在模擬之情境設計上，首先以完全沒有損失當作基準情境，而對照的情境則以方案二之下的平均每年損失期望值來作為模擬之假設。此一假設與其他風險相比，有相當大的差別。以地震來說，災害不會每年發生，且當中間隔時間可能為好多年，但是對於每年均有可能會發生水災且造成損失的臺灣來說，此假設並不會太過不切實際。

在說明結果之前，必須先聲明本章的內容是由 Guy Carpenter & Company 所提供的財務分析模型得到的結果，當中並沒有作任何增減。因為模型與資料上的限制，分析結果都是在有限之假設條件下，根據模型及分析人員的專業判斷做出來的，故可能因為估計或分析方向而與實際之規劃有所出入。而本章所採用的加總超越機率函數(aggregate exceeding probability curve)則是由台灣洪災研究團隊所提供的。

關於基金收入之預測是假設方案將由 2005 年開始實施，故以 2005 年為基礎，逐年延伸至 2020 年。在 2005 年，保險業者所設計的颱風洪水險的保險費率是根據本研究的洪災模型所計算出的年平均費率(AAL)再加上 30% 而得，之後每年的保費將隨著通貨膨脹率每年成長 1.5%。

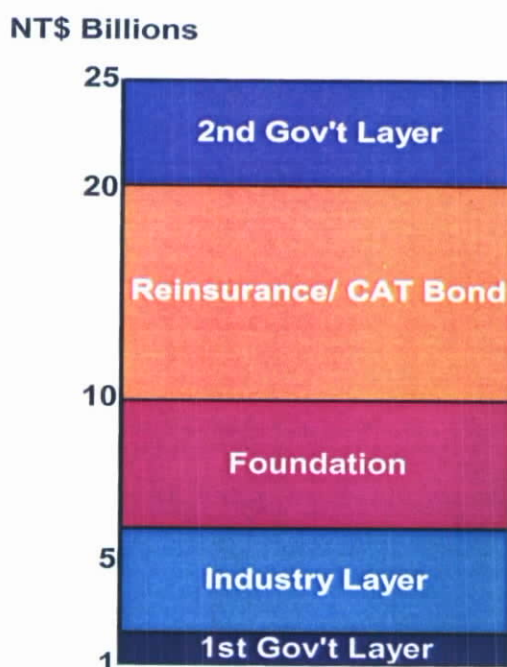
6.2 基金運用與管理方式之探討

本節將敘述本模型在支出面的主要假設。首先，基金所收到的保費收入將會分配至以下各項目中：

1. 支付佣金
2. 支付再保險(依照一固定金額且暫時性，直到真正的再保規劃完成為止)
3. 各參與保險公司所承攤的風險分配金額。
4. 如果沒有任何損失，剩餘的資產歸於洪災基金。

整個洪災基金的架構（由底層至頂層）如下圖所示：

- | | |
|----------------------------|---------------------------------------|
| (1). 政府底層 | NT\$1.0 billion xs. NT\$ 0 |
| (2). 產險公司層 | NT\$4.0 billion xs. NT\$1.0 billion |
| (3). 基金層(Foundation layer) | NT\$5.0 billion xs. NT\$5.0 billion |
| (4). 再保險/巨災債券層 | NT\$10.0 billion xs. NT\$10.0 billion |
| (5). 政府頂層 | NT\$5.0 billion xs. NT\$20.0 billion |



6.3 累積基金收入與理賠支出維持長期性均衡之分析

(一) 確定情境的結果(Deterministic Result):

模型的第一個模擬為一確定性之下之情境。

下列模型結果為假設方案開始實施的前三年沒有任何損失，但三年之後的損失是採隨機方式所設定的。

1. 基金之損益表 (2005-2012)

Flood Pool

Income Statement - No loss until 2008, random events thereafter

(NT\$ in 000's unless stated otherwise)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|--|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|
| Premium Income | 1,424,941 | 1,473,710 | 1,528,679 | 1,590,400 | 1,654,612 | 1,721,417 | 1,790,920 | 1,863,228 |
| Change in Unearned Premium | 712,471 | 24,384 | 27,485 | 30,860 | 32,106 | 33,402 | 34,751 | 36,154 |
| Earned Premium | 712,471 | 1,449,326 | 1,501,195 | 1,559,540 | 1,622,506 | 1,688,015 | 1,756,168 | 1,827,074 |
| Investment Income | 80,036 | 113,216 | 150,599 | 185,859 | 215,830 | 204,477 | 173,999 | 177,528 |
| Total Income | 792,506 | 1,562,541 | 1,651,794 | 1,745,399 | 1,838,336 | 1,892,491 | 1,930,167 | 2,004,601 |
| Incurring Losses | 0 | 0 | 0 | 381,147 | 513,454 | 3,753,643 | 1,033,857 | 885,589 |
| Commissions to Insurers | 42,748 | 44,211 | 45,860 | 47,712 | 49,638 | 51,643 | 53,728 | 55,897 |
| CRC Admin Fee | 35,624 | 36,843 | 38,217 | 39,760 | 41,365 | 43,035 | 44,773 | 46,581 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 327,186 | 338,384 | 351,006 | 365,178 | 379,922 | 395,261 | 411,220 | 427,823 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Interest on Loan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Losses and Expenses | 455,558 | 469,438 | 485,083 | 883,797 | 1,034,380 | 4,293,583 | 1,593,577 | 1,465,890 |
| Net income | 336,948 | 1,093,103 | 1,166,710 | 861,602 | 803,956 | (2,401,091) | 336,590 | 538,712 |

1. 基金之損益表-續 (2013-2020)

Flood Pool

Income Statement - No loss until 2008, random events thereafter

(NT\$ in 000's unless stated otherwise)

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Premium Income | 1,938,456 | 2,016,721 | 2,098,146 | 2,182,859 | 2,270,992 | 2,362,683 | 2,458,076 | 2,557,321 |
| Change in Unearned Premium | 37,614 | 39,133 | 40,713 | 42,356 | 44,066 | 45,846 | 47,697 | 49,622 |
| Earned Premium | 1,900,842 | 1,977,588 | 2,057,433 | 2,140,502 | 2,226,925 | 2,316,837 | 2,410,379 | 2,507,699 |
| Investment Income | 191,844 | 204,753 | 226,344 | 248,565 | 270,633 | 290,202 | 317,607 | 364,634 |
| Total Income | 2,092,686 | 2,182,342 | 2,283,778 | 2,389,067 | 2,497,558 | 2,607,039 | 2,727,986 | 2,872,333 |
| Incurred Losses | 1,267,592 | 1,105,370 | 668,949 | 1,442,883 | 758,093 | 1,805,516 | 186,505 | 616,430 |
| Commissions to Insurers | 58,154 | 60,502 | 62,944 | 65,486 | 68,130 | 70,880 | 73,742 | 76,720 |
| CRC Admin Fee | 48,461 | 50,418 | 52,454 | 54,571 | 56,775 | 59,067 | 61,452 | 63,933 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 445,096 | 463,067 | 481,764 | 501,215 | 521,451 | 542,505 | 564,408 | 587,196 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 57,380 | 69,884 | 82,893 | 99,322 | 118,379 | 138,205 |
| Interest on Loan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Losses and Expenses | 1,869,303 | 1,729,357 | 1,323,491 | 2,134,040 | 1,487,342 | 2,577,290 | 1,004,486 | 1,482,484 |
| Net income | 223,383 | 452,984 | 960,287 | 255,028 | 1,010,216 | 29,749 | 1,723,500 | 1,389,849 |

2.基金之資產負債表 (2005-2012)

Flood Pool

Balance Sheet - No loss until 2008, random events thereafter

(NT\$ in 000's unless stated otherwise)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|
| Invested Assets | 2,930,674 | 4,044,097 | 5,233,711 | 6,216,316 | 7,080,105 | 5,516,896 | 5,202,499 | 5,734,272 |
| Written Premium Receivable | 118,745 | 122,809 | 127,390 | 132,533 | 137,884 | 143,451 | 149,243 | 155,269 |
| Total assets | 3,049,419 | 4,166,906 | 5,361,101 | 6,348,850 | 7,217,989 | 5,660,348 | 5,351,742 | 5,889,541 |
| Gross loss and LAE Reserve | 0 | 0 | 0 | 95,287 | 128,363 | 938,411 | 258,464 | 221,397 |
| Gross Unearned Premium | 712,471 | 736,855 | 764,340 | 795,200 | 827,306 | 860,709 | 895,460 | 931,614 |
| Loan Outstanding | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total liabilities | 712,471 | 736,855 | 764,340 | 890,487 | 955,670 | 1,799,119 | 1,153,924 | 1,153,011 |
| Statutory Capital and Surplus | 2,336,948 | 3,430,051 | 4,596,761 | 5,458,363 | 6,262,319 | 3,861,228 | 4,197,818 | 4,736,530 |
| Liabilities and Surplus | 3,049,419 | 4,166,906 | 5,361,101 | 6,348,850 | 7,217,989 | 5,660,348 | 5,351,742 | 5,889,541 |
| Check | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital and Surplus Position | | | | | | | | |
| Beginning Capital and Surplus | 2,000,000 | 2,336,948 | 3,430,051 | 4,596,761 | 5,458,363 | 6,262,319 | 3,861,228 | 4,197,818 |
| Net Income | 336,948 | 1,093,103 | 1,166,710 | 861,602 | 803,956 | (2,401,091) | 336,590 | 538,712 |
| Capital Injection | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ending Capital and Surplus | 2,336,948 | 3,430,051 | 4,596,761 | 5,458,363 | 6,262,319 | 3,861,228 | 4,197,818 | 4,736,530 |

2.基金之資產負債表續 (2013-2020)

Flood Pool

Balance Sheet - No loss until 2008, random events thereafter

(NT\$ in 000's unless stated otherwise)

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|
| Invested Assets | 6,084,501 | 6,529,540 | 7,414,649 | 7,898,457 | 8,774,197 | 9,104,007 | 10,462,501 | 12,001,183 |
| Written Premium Receivable | 161,538 | 168,060 | 174,845 | 181,905 | 189,249 | 196,890 | 204,840 | 213,110 |
| Total assets | 6,246,039 | 6,697,600 | 7,589,494 | 8,080,361 | 8,963,447 | 9,300,897 | 10,667,341 | 12,214,293 |
| Gross loss and LAE Reserve | 316,898 | 276,343 | 167,237 | 360,721 | 189,523 | 451,379 | 46,626 | 154,107 |
| Gross Unearned Premium | 969,228 | 1,008,360 | 1,049,073 | 1,091,429 | 1,135,496 | 1,181,341 | 1,229,038 | 1,278,660 |
| Loan Outstanding | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total liabilities | 1,286,126 | 1,284,703 | 1,216,310 | 1,452,150 | 1,325,019 | 1,632,720 | 1,275,664 | 1,432,768 |
| Statutory Capital and Surplus | 4,959,913 | 5,412,897 | 6,373,184 | 6,628,211 | 7,638,428 | 7,668,176 | 9,391,676 | 10,781,525 |
| Liabilities and Surplus | 6,246,039 | 6,697,600 | 7,589,494 | 8,080,361 | 8,963,447 | 9,300,897 | 10,667,341 | 12,214,293 |
| Check | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital and Surplus Position | | | | | | | | |
| Beginning Capital and Surplus | 4,736,530 | 4,959,913 | 5,412,897 | 6,373,184 | 6,628,211 | 7,638,428 | 7,668,176 | 9,391,676 |
| Net Income | 223,383 | 452,984 | 960,287 | 255,028 | 1,010,216 | 29,749 | 1,723,500 | 1,389,849 |
| Capital Injection | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ending Capital and Surplus | 4,959,913 | 5,412,897 | 6,373,184 | 6,628,211 | 7,638,428 | 7,668,176 | 9,391,676 | 10,781,525 |

3. 基金之現金流量表 (2005-2012)

Flood Pool

Cash Flow Statement - No loss until 2008, random events thereafter

(NT\$ in 000's unless stated otherwise)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|
| Beginning Portfolio | 2,000,000 | 2,930,674 | 4,044,097 | 5,233,711 | 6,216,316 | 7,080,105 | 5,516,896 | 5,202,499 |
| <i>Sources of cash</i> | | | | | | | | |
| Premium Received | 1,306,196 | 1,469,646 | 1,524,099 | 1,585,257 | 1,649,261 | 1,715,850 | 1,785,128 | 1,857,202 |
| Capital Injection from Government | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Loan (to cover cashflow shortfall) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1,306,196 | 1,469,646 | 1,524,099 | 1,585,257 | 1,649,261 | 1,715,850 | 1,785,128 | 1,857,202 |
| <i>Uses of cash</i> | | | | | | | | |
| Loss and LAE Paid | 0 | 0 | 0 | 285,860 | 480,377 | 2,943,596 | 1,713,803 | 922,656 |
| Commissions to Insurers | 42,748 | 44,211 | 45,860 | 47,712 | 49,638 | 51,643 | 53,728 | 55,897 |
| CRC Admin Fee | 35,624 | 36,843 | 38,217 | 39,760 | 41,365 | 43,035 | 44,773 | 46,581 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 327,186 | 338,384 | 351,006 | 365,178 | 379,922 | 395,261 | 411,220 | 427,823 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Amount of Loan Payment (Principal + Interest) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 455,558 | 469,438 | 485,083 | 788,510 | 1,001,303 | 3,483,535 | 2,273,524 | 1,502,956 |
| Net Cash Flow | 850,638 | 1,000,208 | 1,039,015 | 796,746 | 647,958 | (1,767,685) | (488,396) | 354,246 |
| Subtotal | 2,850,638 | 3,930,881 | 5,083,112 | 6,030,458 | 6,864,275 | 5,312,420 | 5,028,500 | 5,556,745 |
| Investment Income | 80,036 | 113,216 | 150,599 | 185,859 | 215,830 | 204,477 | 173,999 | 177,528 |
| Ending portfolio | 2,930,674 | 4,044,097 | 5,233,711 | 6,216,316 | 7,080,105 | 5,516,896 | 5,202,499 | 5,734,272 |
| Investment Yield | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% |

3. 基金之現金流量表-續 (2013-2020)

Flood Pool

Cash Flow Statement - No loss until 2008, random events thereafter

(NT\$ in 000's unless stated otherwise)

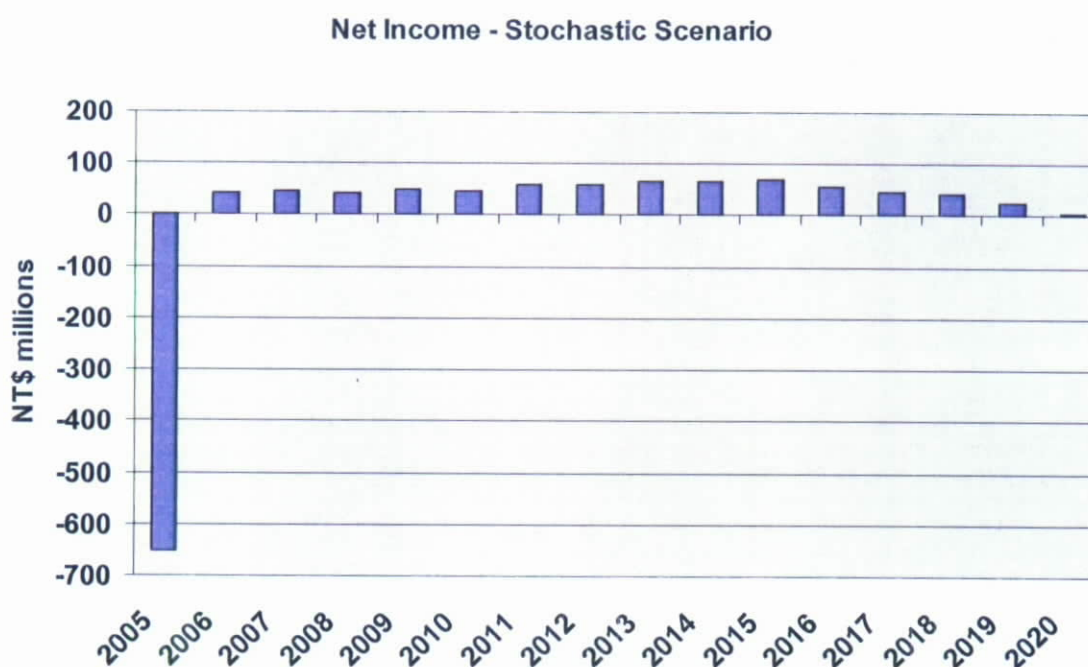
| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|
| Beginning Portfolio | 5,734,272 | 6,084,501 | 6,529,540 | 7,414,649 | 7,898,457 | 8,774,197 | 9,104,007 | 10,462,501 |
| <u>Sources of cash</u> | | | | | | | | |
| Premium Received | 1,932,187 | 2,010,199 | 2,091,361 | 2,175,799 | 2,263,647 | 2,355,042 | 2,450,127 | 2,549,051 |
| Capital Injection from Government | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Loan (to cover cashflow shortfall) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1,932,187 | 2,010,199 | 2,091,361 | 2,175,799 | 2,263,647 | 2,355,042 | 2,450,127 | 2,549,051 |
| <u>Uses of cash</u> | | | | | | | | |
| Loss and LAE Paid | 1,172,091 | 1,145,926 | 778,055 | 1,249,400 | 929,291 | 1,543,661 | 591,258 | 508,948 |
| Commissions to Insurers | 58,154 | 60,502 | 62,944 | 65,486 | 68,130 | 70,880 | 73,742 | 76,720 |
| CRC Admin Fee | 48,461 | 50,418 | 52,454 | 54,571 | 56,775 | 59,067 | 61,452 | 63,933 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 445,096 | 463,067 | 481,764 | 501,215 | 521,451 | 542,505 | 564,408 | 587,196 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 57,380 | 69,884 | 82,893 | 99,322 | 118,379 | 138,205 |
| Amount of Loan Payment (Principal + Interest) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1,773,803 | 1,769,913 | 1,432,597 | 1,940,556 | 1,658,540 | 2,315,435 | 1,409,239 | 1,375,003 |
| Net Cash Flow | 158,384 | 240,286 | 658,764 | 235,243 | 605,107 | 39,607 | 1,040,888 | 1,174,048 |
| Subtotal | 5,892,656 | 6,324,787 | 7,188,304 | 7,649,892 | 8,503,564 | 8,813,804 | 10,144,894 | 11,636,549 |
| Investment Income | 191,844 | 204,753 | 226,344 | 248,565 | 270,633 | 290,202 | 317,607 | 364,634 |
| Ending portfolio | 6,084,501 | 6,529,540 | 7,414,649 | 7,898,457 | 8,774,197 | 9,104,007 | 10,462,501 | 12,001,183 |
| Investment Yield | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% |

(二) 隨機情境的結果(Stochastic Results)

接下來說明的是在完全隨機基礎之下的模擬結果，換言之，模型會自動產生各種不同大小之損失事件及其發生之頻率(機率)，再根據這些隨機的結果去計算各主要變數(例如淨所得、資本及盈餘)的年平均值(即期望值)。

1. 淨收入

以下為所有隨機事件的淨收入，由於第一年的保費在下半年才有淨賺，此基金在第一年的赤字將達新台幣 6 億 5 千萬元。

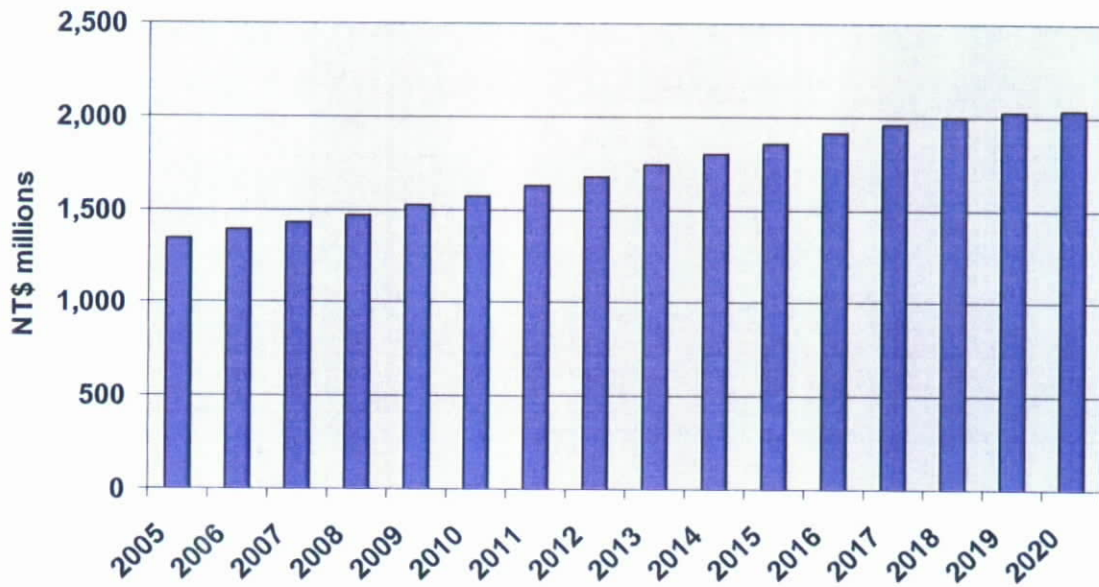


2. 資本及盈餘

對於資本和盈餘部位的影響如下：

基金第一(2005)年開始時盈餘為新台幣 13.5 億，到 2020 年時，基金盈餘將累積至新台幣 20.3 億元。

Capital and Surplus Position - Stochastic Scenario



如果假設類似納莉颱風事件再度發生，則洪災基金的損失將達到新台幣 30 億元，且到 2020 年時，政府仍必須投入相當的資金來挹注此基金。

The Financial Projection Model

0. Disclaimer

The model, data, and analysis provided by Guy Carpenter & Company, Inc. (“Guy Carpenter”) herein or in connection herewith are provided “as is”, without warranty of any kind whether express or implied. Neither Guy Carpenter nor its affiliates, or their respective officers, directors, agents, modelers, or subcontractors (collectively, “Providers”) guarantee or warrant the correctness, completeness, currentness, merchantability, or fitness for a particular purpose of such model, data and analysis. In no event will any Provider be liable for loss of profits or any other indirect, special, incidental and/or consequential damage of any kind howsoever incurred or designated, arising from any use of the data and analysis provided herein or in connection herewith. Moreover, providers are not responsible for any changes made by you in the data, assumptions, variables or any other component of the model.

This presentation model is not intended to be a complete actuarial communication. Upon request, we can prepare one. We are available to respond to questions regarding the model and the underlying assumptions of our analysis.

There are many limitations on actuarial modeling and analyses, including uncertainty in the estimates and reliance on data. We will provide additional information regarding these limitations upon request.

As with any financial model and analysis, the results presented herein are subject to significant variability. While these estimates represent our best professional judgment, it is probable that the actual results will differ from those projected. The degree of such variability could be substantial and could be in either direction from our estimates.

The estimated cash flows may vary significantly from amounts actually collected, particularly in the event that a reinsurer is unwilling or unable to perform in accordance with the terms of the reinsurance contract.

In performing this analysis, we used the aggregate exceeding probability curve provided by the team for Taiwan flood. We did not perform an independent review of this information.

Methodology

For our analysis, we assume that a Flood Fund is set up by the government of Taiwan to facilitate a risk sharing partnership between private insurance companies and the Government covering insured residential flood losses. The Flood Fund collects premium for the flood risk from the direct insurance companies and redistributes the premium to the various risk-sharing partners (including itself).

The Flood Fund pays a fee for all administrative services. The Fund has no fixed assets, employees, or offices.

It is assumed that any shortfall in the Flood Fund is completely funded by the Government.

Forecasts have been prepared on an annual basis extending to 2020.

The Flood Fund financial model is an EXCEL spreadsheet model that projects financial statements into the future based on sets of assumptions. The model can be used to generate single scenario based financial statements or it can run simulations that show probability distributions of financial balances at different points in time over the projection period.

With the exception of losses, which can be stochastically generated, all other assumptions are deterministic. In other words, in a simulation, the only input that varies is the gross loss amount, and the only calculated balances that vary are those dependent on the loss amount, such as paid losses, reinsured losses, cash, and investment income.

Key Model Assumptions

In this section, we outline the major assumptions underlying the model.

The amount of direct earthquake premium written by insurers for 2005 (assuming the program starts in 2005) is calculated by grossing up by 30 percent the AAL produce by the flood model. For subsequent years, the premium account is increased by an inflation rate of 1.5 percent.

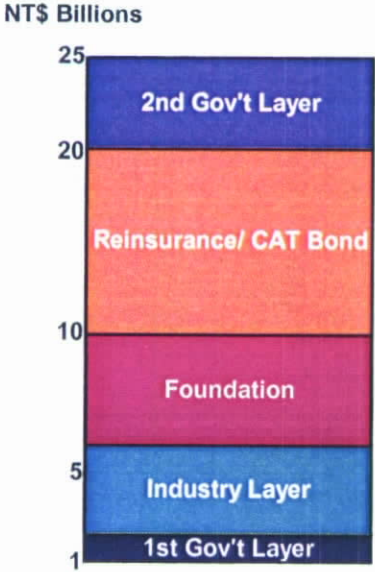
Funds received from premiums are then distributed in the following categories:

- Payment of commissions.
- Payment for reinsurance (a flat amount, which is really a placeholder until a reinsurance program is finalized).
- Allocation to direct insurers for their share of the risk.

If there are no losses, then the remaining assets go to the Flood Fund.

The Flood program structure is detailed in the graphic below:

| | | | |
|----------------------------------|------------------|-----|------------------|
| 1 st Government layer | NT\$ 1.0 billion | xs. | NT\$ 0 |
| Industry layer | NT\$ 4.0 billion | xs. | NT\$ 1.0 billion |
| Foundation layer | NT\$ 5.0 billion | xs. | NT\$ 5.0 billion |
| Reinsurance/ Cat Bond layer | NT\$10.0 billion | xs. | NT\$10.0 billion |
| 2 nd Government layer | NT\$ 5.0 billion | xs. | NT\$20.0 billion |



Deterministic Result:

The first illustration of the model is for a given scenario. The following run illustrates the model output in a hypothetical scenario of no losses the first three years and losses chosen on a random basis for the subsequent years.

Flood Pool

Income Statement - No loss until 2008, random events thereafter

(NT\$ in 000's unless stated otherwise)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|--|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|
| Premium Income | 1,424,941 | 1,473,710 | 1,528,679 | 1,590,400 | 1,654,612 | 1,721,417 | 1,790,920 | 1,863,228 |
| Change in Unearned Premium | 712,471 | 24,384 | 27,485 | 30,860 | 32,106 | 33,402 | 34,751 | 36,154 |
| Earned Premium | 712,471 | 1,449,326 | 1,501,195 | 1,559,540 | 1,622,506 | 1,688,015 | 1,756,168 | 1,827,074 |
| Investment Income | 80,036 | 113,216 | 150,599 | 185,859 | 215,830 | 204,477 | 173,999 | 177,528 |
| Total Income | 792,506 | 1,562,541 | 1,651,794 | 1,745,399 | 1,838,336 | 1,892,491 | 1,930,167 | 2,004,601 |
| Incurred Losses | 0 | 0 | 0 | 381,147 | 513,454 | 3,753,643 | 1,033,857 | 885,589 |
| Commissions to Insurers | 42,748 | 44,211 | 45,860 | 47,712 | 49,638 | 51,643 | 53,728 | 55,897 |
| CRC Admin Fee | 35,624 | 36,843 | 38,217 | 39,760 | 41,365 | 43,035 | 44,773 | 46,581 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 327,186 | 338,384 | 351,006 | 365,178 | 379,922 | 395,261 | 411,220 | 427,823 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Interest on Loan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Losses and Expenses | 455,558 | 469,438 | 485,083 | 883,797 | 1,034,380 | 4,293,583 | 1,593,577 | 1,465,890 |
| Net income | 336,948 | 1,093,103 | 1,166,710 | 861,602 | 803,956 | (2,401,091) | 336,590 | 538,712 |

Flood Pool
Income Statement - No loss until 2008, random events thereafter
(NTS in 000's unless stated otherwise)

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Premium Income | 1,938,456 | 2,016,721 | 2,098,146 | 2,182,859 | 2,270,992 | 2,362,683 | 2,458,076 | 2,557,321 |
| Change in Unearned Premium | 37,614 | 39,133 | 40,713 | 42,356 | 44,066 | 45,846 | 47,697 | 49,622 |
| Earned Premium | 1,900,842 | 1,977,588 | 2,057,433 | 2,140,502 | 2,226,925 | 2,316,837 | 2,410,379 | 2,507,699 |
| Investment Income | 191,844 | 204,753 | 226,344 | 248,565 | 270,633 | 290,202 | 317,607 | 364,634 |
| Total Income | 2,092,686 | 2,182,342 | 2,283,778 | 2,389,067 | 2,497,558 | 2,607,039 | 2,727,986 | 2,872,333 |
| Incurred Losses | 1,267,592 | 1,105,370 | 668,949 | 1,442,883 | 758,093 | 1,805,516 | 186,505 | 616,430 |
| Commissions to Insurers | 58,154 | 60,502 | 62,944 | 65,486 | 68,130 | 70,880 | 73,742 | 76,720 |
| CRC Admin Fee | 48,461 | 50,418 | 52,454 | 54,571 | 56,775 | 59,067 | 61,452 | 63,933 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 445,096 | 463,067 | 481,764 | 501,215 | 521,451 | 542,505 | 564,408 | 587,196 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 57,380 | 69,884 | 82,893 | 99,322 | 118,379 | 138,205 |
| Interest on Loan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Losses and Expenses | 1,869,303 | 1,729,357 | 1,323,491 | 2,134,040 | 1,487,342 | 2,577,290 | 1,004,486 | 1,482,484 |
| Net income | 223,383 | 452,984 | 960,287 | 255,028 | 1,010,216 | 29,749 | 1,723,500 | 1,389,849 |

Flood Pool

Balance Sheet - No loss until 2008, random events thereafter

(NTS in 000's unless stated otherwise)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|
| Invested Assets | 2,930,674 | 4,044,097 | 5,233,711 | 6,216,316 | 7,080,105 | 5,516,896 | 5,202,499 | 5,734,272 |
| Written Premium Receivable | 118,745 | 122,809 | 127,390 | 132,533 | 137,884 | 143,451 | 149,243 | 155,269 |
| Total assets | 3,049,419 | 4,166,906 | 5,361,101 | 6,348,850 | 7,217,989 | 5,660,348 | 5,351,742 | 5,889,541 |
| Gross loss and LAE Reserve | 0 | 0 | 0 | 95,287 | 128,363 | 938,411 | 258,464 | 221,397 |
| Gross Unearned Premium | 712,471 | 736,855 | 764,340 | 795,200 | 827,306 | 860,709 | 895,460 | 931,614 |
| Loan Outstanding | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total liabilities | 712,471 | 736,855 | 764,340 | 890,487 | 955,670 | 1,799,119 | 1,153,924 | 1,153,011 |
| Statutory Capital and Surplus | 2,336,948 | 3,430,051 | 4,596,761 | 5,458,363 | 6,262,319 | 3,861,228 | 4,197,818 | 4,736,530 |
| Liabilities and Surplus | 3,049,419 | 4,166,906 | 5,361,101 | 6,348,850 | 7,217,989 | 5,660,348 | 5,351,742 | 5,889,541 |
| Check | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital and Surplus Position | | | | | | | | |
| Beginning Capital and Surplus | 2,000,000 | 2,336,948 | 3,430,051 | 4,596,761 | 5,458,363 | 6,262,319 | 3,861,228 | 4,197,818 |
| Net Income | 336,948 | 1,093,103 | 1,166,710 | 861,602 | 803,956 | (2,401,091) | 336,590 | 538,712 |
| Capital Injection | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ending Capital and Surplus | 2,336,948 | 3,430,051 | 4,596,761 | 5,458,363 | 6,262,319 | 3,861,228 | 4,197,818 | 4,736,530 |

Flood Pool

Balance Sheet - No loss until 2008, random events thereafter

(NTS in 000's unless stated otherwise)

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|
| Invested Assets | 6,084,501 | 6,529,540 | 7,414,649 | 7,898,457 | 8,774,197 | 9,104,007 | 10,462,501 | 12,001,183 |
| Written Premium Receivable | 161,538 | 168,060 | 174,845 | 181,905 | 189,249 | 196,890 | 204,840 | 213,110 |
| Total assets | 6,246,039 | 6,697,600 | 7,589,494 | 8,080,361 | 8,963,447 | 9,300,897 | 10,667,341 | 12,214,293 |
| Gross loss and LAE Reserve | 316,898 | 276,343 | 167,237 | 360,721 | 189,523 | 451,379 | 46,626 | 154,107 |
| Gross Unearned Premium | 969,228 | 1,008,360 | 1,049,073 | 1,091,429 | 1,135,496 | 1,181,341 | 1,229,038 | 1,278,660 |
| Loan Outstanding | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total liabilities | 1,286,126 | 1,284,703 | 1,216,310 | 1,452,150 | 1,325,019 | 1,632,720 | 1,275,664 | 1,432,768 |
| Statutory Capital and Surplus | 4,959,913 | 5,412,897 | 6,373,184 | 6,628,211 | 7,638,428 | 7,668,176 | 9,391,676 | 10,781,525 |
| Liabilities and Surplus | 6,246,039 | 6,697,600 | 7,589,494 | 8,080,361 | 8,963,447 | 9,300,897 | 10,667,341 | 12,214,293 |
| Check | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital and Surplus Position | | | | | | | | |
| Beginning Capital and Surplus | 4,736,530 | 4,959,913 | 5,412,897 | 6,373,184 | 6,628,211 | 7,638,428 | 7,668,176 | 9,391,676 |
| Net Income | 223,383 | 452,984 | 960,287 | 255,028 | 1,010,216 | 29,749 | 1,723,500 | 1,389,849 |
| Capital Injection | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ending Capital and Surplus | 4,959,913 | 5,412,897 | 6,373,184 | 6,628,211 | 7,638,428 | 7,668,176 | 9,391,676 | 10,781,525 |

Flood Pool

Cash Flow Statement - No loss until 2008, random events thereafter

(NTS in 000's unless stated otherwise)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|
| Beginning Portfolio | 2,000,000 | 2,930,674 | 4,044,097 | 5,233,711 | 6,216,316 | 7,080,105 | 5,516,896 | 5,202,499 |
| <u>Sources of cash</u> | | | | | | | | |
| Premium Received | 1,306,196 | 1,469,646 | 1,524,099 | 1,585,257 | 1,649,261 | 1,715,850 | 1,785,128 | 1,857,202 |
| Capital Injection from Government | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Loan (to cover cashflow shortfall) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1,306,196 | 1,469,646 | 1,524,099 | 1,585,257 | 1,649,261 | 1,715,850 | 1,785,128 | 1,857,202 |
| <u>Uses of cash</u> | | | | | | | | |
| Loss and LAE Paid | 0 | 0 | 0 | 285,860 | 480,377 | 2,943,596 | 1,713,803 | 922,656 |
| Commissions to Insurers | 42,748 | 44,211 | 45,860 | 47,712 | 49,638 | 51,643 | 53,728 | 55,897 |
| CRC Admin Fee | 35,624 | 36,843 | 38,217 | 39,760 | 41,365 | 43,035 | 44,773 | 46,581 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 327,186 | 338,384 | 351,006 | 365,178 | 379,922 | 395,261 | 411,220 | 427,823 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Amount of Loan Payment (Principal + Interest) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 455,558 | 469,438 | 485,083 | 788,510 | 1,001,303 | 3,483,535 | 2,273,524 | 1,502,956 |
| Net Cash Flow | 850,638 | 1,000,208 | 1,039,015 | 796,746 | 647,958 | (1,767,685) | (488,396) | 354,246 |
| Subtotal | 2,850,638 | 3,930,881 | 5,083,112 | 6,030,458 | 6,864,275 | 5,312,420 | 5,028,500 | 5,556,745 |
| Investment Income | 80,036 | 113,216 | 150,599 | 185,859 | 215,830 | 204,477 | 173,999 | 177,528 |
| Ending portfolio | 2,930,674 | 4,044,097 | 5,233,711 | 6,216,316 | 7,080,105 | 5,516,896 | 5,202,499 | 5,734,272 |
| Investment Yield | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% |

Flood Pool
Cash Flow Statement - No loss until 2008, random events thereafter

(NTS in 000's unless stated otherwise)

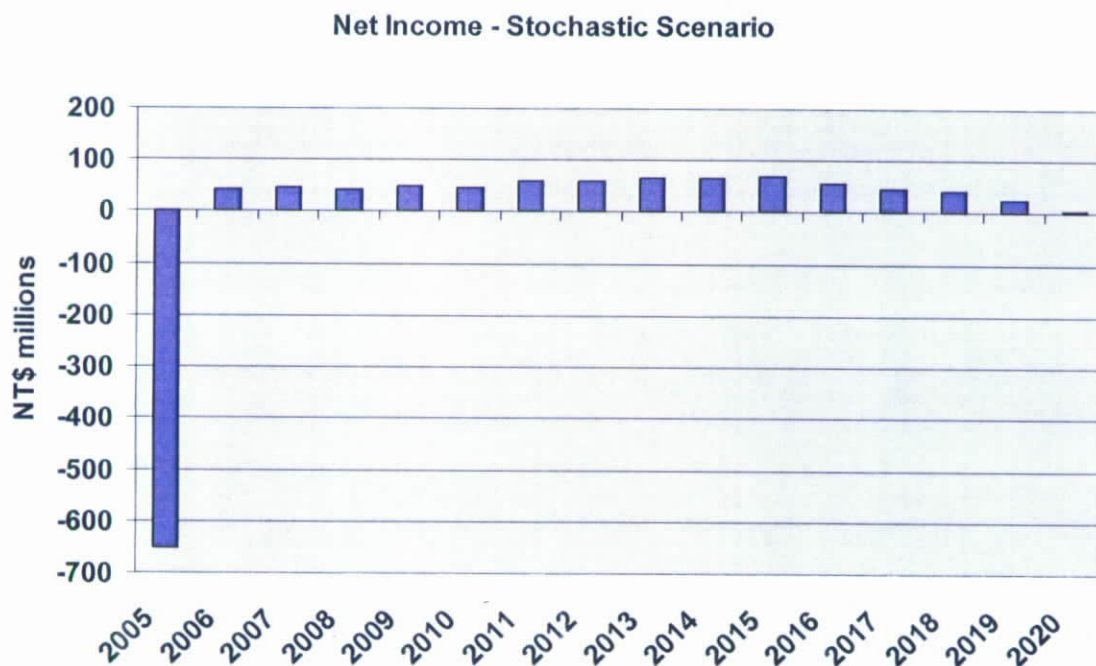
| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|
| Beginning Portfolio | 5,734,272 | 6,084,501 | 6,529,540 | 7,414,649 | 7,898,457 | 8,774,197 | 9,104,007 | 10,462,501 |
| Sources of cash | | | | | | | | |
| Premium Received | 1,932,187 | 2,010,199 | 2,091,361 | 2,175,799 | 2,263,647 | 2,355,042 | 2,450,127 | 2,549,051 |
| Capital Injection from Government | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Loan (to cover cashflow shortfall) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1,932,187 | 2,010,199 | 2,091,361 | 2,175,799 | 2,263,647 | 2,355,042 | 2,450,127 | 2,549,051 |
| Uses of cash | | | | | | | | |
| Loss and LAE Paid | 1,172,091 | 1,145,926 | 778,055 | 1,249,400 | 929,291 | 1,543,661 | 591,258 | 508,948 |
| Commissions to Insurers | 58,154 | 60,502 | 62,944 | 65,486 | 68,130 | 70,880 | 73,742 | 76,720 |
| CRC Admin Fee | 48,461 | 50,418 | 52,454 | 54,571 | 56,775 | 59,067 | 61,452 | 63,933 |
| Provision for Fluctuating Reinsurance Cost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Premium paid to Insurers | 445,096 | 463,067 | 481,764 | 501,215 | 521,451 | 542,505 | 564,408 | 587,196 |
| Premium paid to Reinsurers | 50,000 | 50,000 | 57,380 | 69,884 | 82,893 | 99,322 | 118,379 | 138,205 |
| Amount of Loan Payment (Principal + Interest) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1,773,803 | 1,769,913 | 1,432,597 | 1,940,556 | 1,658,540 | 2,315,435 | 1,409,239 | 1,375,003 |
| Net Cash Flow | 158,384 | 240,286 | 658,764 | 235,243 | 605,107 | 39,607 | 1,040,888 | 1,174,048 |
| Subtotal | 5,892,656 | 6,324,787 | 7,188,304 | 7,649,892 | 8,503,564 | 8,813,804 | 10,144,894 | 11,636,549 |
| Investment Income | 191,844 | 204,753 | 226,344 | 248,565 | 270,633 | 290,202 | 317,607 | 364,634 |
| Ending portfolio | 6,084,501 | 6,529,540 | 7,414,649 | 7,898,457 | 8,774,197 | 9,104,007 | 10,462,501 | 12,001,183 |
| Investment Yield | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% | 3.30% |

Stochastic Results

We next illustrate how the model works on a fully stochastic basis, meaning that the model generates result for all possible events sets and their corresponding probabilities. The model then calculates annual averages for key variables, including Net Income and Capital and Surplus.

Net Income

Running the full stochastic event set results in a net income as shown below. Due to the fact that in the first year of the program premiums are only earned over the second half of the year, the fund records a deficit of NT\$ 651.2 million.



Capital and Surplus

The DFA flood model was then run using the full stochastic event set a second time to see the impact on its capital and surplus position. The fund starts with a surplus of NT\$ 1.35 billion in its first year of inception (2005). By 2020, the fund accumulates a surplus of NT\$ 2.03 billion. As a means of comparison, the flood model estimates that a repeat of Typhoon Nari with the flood insurance program in place would result in a loss to the Flood Fund of NT\$ 3 billion. By 2020, the government would

still have to contribute a significant amount to flood victims if an event similar to Typhoon Nari were to occur.

Capital and Surplus Position - Stochastic Scenario

