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Isle of Man: Financial Sector Assessment Program Update—Technical Note—Stress Testing: Banking and Insurance

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FINANCIAL SECTOR ASSESSMENT PROGRAM UPDATE

ISLE OF MAN

STRESS TESTING: BANKING AND INSURANCE

TECHNICAL NOTE

APRIL 2009

INTERNATIONAL MONETARY FUND
MONETARY AND CAPITAL MARKETS DEPARTMENT

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GLOSSARY

BU	Bottom-up approach
BPS	Basis points
CAR	Capital adequacy ratio
UK FSA	UK Financial Services Authority
FSAP	Financial sector assessment program
FSC	Financial Supervision Commission
FX	Foreign exchange
IOM	Isle of Man
IMF	International Monetary Fund
IPA	Insurance and Pension Authority
NPL	Nonperforming loan
PD	Probabilities of default
RMM	Required minimum margin
TD	Top-down approach
ULC	Unit-linked contract

I. INTRODUCTION[1]

1. **Stress tests were undertaken as part of the Isle of Man (IOM) Financial Sector Assessment Program (FSAP) Update in order to assess the resilience of the financial system to a variety of potential strains.** They complement other approaches to assessment, for example, through evaluation of the degree of observance of prudential standards, analysis of financial soundness indicators, and a decomposition of financial ratios. The value of stress testing is that it yields quantitative results that relate to specific aspects of financial sector exposures, such as exposure to various forms of market risk or credit risk. Hence, results can be broadly comparable across risk factors and, to some extent, even across countries. Stress testing is also more forward-looking and more adaptable than an analysis of financial soundness indicators and takes into account non-linearities and the interaction among balance sheet components.

2. **However, stress testing is limited in several regards, most importantly in that it focuses mainly on impact effects and often ignores feedback effects through changes in behavior in the wider economy.** A stress test does not involve estimation of effects in general equilibrium where financial institutions (and others) react over time by adjusting their portfolio and other aspects of their operations. Hence, stress tests cannot provide very robust estimates of how a financial system would respond over the medium term to large disturbances, especially those that do not correspond closely to historical experience.

3. **The stress tests for the IOM FSAP Update were designed to yield as comprehensive and detailed a picture as possible within the constraints of the approach and available data.** To this end, the procedures for conducting the tests exploited to the fullest extent possible the stress testing capacity available at financial institutions and supervisory authorities. In particular, stress tests were performed both by individual institutions based on the parameters and scenarios agreed between the authorities and Fund staff, and, at an aggregate level and in many instances, by the authorities themselves; results could then be checked for consistency. The results are reported in sufficient detail to illuminate the behavior of the respective sector as whole as well as the dispersion of results across institutions. Furthermore, several relevant variables (for example, applicable asset risk weights), were reported for each test to aid in interpretation.

4. **It was decided to cover both the banking and the insurance sectors; both are of systemic and of international importance.** As far as possible and relevant, parallel tests were conducted for the two sectors. However, because of differences in the business of the two sectors and in the regulatory and accounting framework under which they operate,

[1] Prepared by Andrea M. Maechler and Ian Tower.

testing procedures and the presentation of results must differ. Since the system is relatively concentrated, a high degree of coverage was achieved.

5. **The stress tests assess the sensitivity of banks and insurance companies to single factor shocks to interest rates, exchange rates, credit quality, and liquidity.** The risk factor tests assume that some relevant variable such as the exchange rate shifts suddenly, while all else remains the same. The magnitude of effects is estimated by revaluing items in the balance sheet. The starting point for all tests was the institutions' financial positions at end-June 2008, or the latest available.

6. **No macroeconomic shock was conducted to examine the two-way linkages between the health of the Manx real sector economy and its financial system.** Reflecting the relatively plain vanilla nature of the institutions' balance sheets, no scenario analysis was conducted to assess the impact of multi-factor shocks. In particular, no macroeconomic shock was conducted to examine how an economic slowdown in the IOM would affect the domestic financial system (the impact is believed to be minimal, as GDP representing less than 3 percent of total financial system assets), nor how a deterioration in the financial system would be transmitted to the real economy (the impact could be substantive, with 39 percent of GDP accounted for by financial services at end-2006).

7. **The remainder of this note explains the stress testing methodology and results in more detail.** The next section looks at the banking sector stress tests, and defines the sample of banks, the methodology, the selection and calibration of the tests, the various metrics used to interpret results, and the details of the results themselves. The following section looks at the insurance sector test; the added complications relevant for insurance (especially life insurance) relative to banking stress tests are explained.

II. BANKING SECTOR

A. Coverage

8. **The stress tests covered 12 locally incorporated banks, except in the case of liquidity tests, which included in addition four foreign branches.** All of the institutions included in the tests are part of a foreign banking group and, together, accounted for 81 percent of the total assets of the Manx banking sector.[2] For the incorporated bank sample (i.e., excluding foreign banks), six of the foreign subsidiaries belonged to United Kingdom (UK) banking groups and accounted for 74 percent of the total assets of the sample (or 60 percent of total banking sector assets); four subsidiaries belonged to Irish banking groups and accounted for 21 percent of sample (or 17 percent of total banking sector assets); one of

[2] Including overseas branches of IOM banks. Data as of end-March 2008.

the subsidiaries belonged to an Icelandic banking group and represented 2.3 percent of the sample (or 2 percent of total banking sector assets); and another subsidiary belonged to a South African group and represented 2.4 percent of the sample (or 2 percent of total banking sector assets).[3] Table 1 provides an overview of the structure of the banking sector aggregate balance sheet.

9. **To assess the short-term vulnerability of the banking system to a liquidity shock, four large foreign branches were added to the sample.** The branches represented 14.6 percent of banking sector assets (and 18 percent of the sample). Three of them were owned by Jersey incorporated foreign subsidiaries, which belonged themselves to a United Kingdom (UK) banking group; the last one was owned by a UK bank.

B. Methodology

10. **Two different approaches to stress tests were used: (i) the so called top-down (TD) approach, where the regulatory authorities preformed the tests for individual institutions on the basis of reported supervisory data; and the bottom-up (BU) approach, where individual institutions conducted the tests based on their internal risk management:**

- The stress testing approach used in the BU exercise builds on the expertise of the individual banks (the Financial Services Commission (FSC) helped ensure consistency across institutions). The tests on credit and market risks were performed using the institution's own internal risk models. The stress tests included all positions (i.e., long and short positions) of the banking group (i.e., banking and trading books, insurance activities, etc.), which were sensitive to a certain risk.

- The TD stress tests depend solely on the FSC modeling of supervisory data. Similar to the BU approach, the TD approach consisted of tests of the market and credit portfolios of the banks. In addition, the TD approach allowed for an analysis of the entire Manx banking system based on supervisory data.

11. **The results were reported on an institution-specific basis and with sufficient detail to allow analysis of the results and their individual drivers, including underlying assumptions.** The shocks were assumed to occur instantaneously and the impact of each shock is to be estimated individually, assuming that all other variables remain constant. The impact was estimated by calculating the effect on end-June 2008 positions and results were obtained in thousands of GBP.

[3] The four foreign branches included in the liquidity tests accounted for 18 percent of the total sample assets (or 15 percent of total banking sector assets).

Table 1. Isle of Man: Balance Sheet of Domestically Incorporated Banks, by Sector 1/

	GBP thousands	In percent of total	In percent of sub-group	In percent of GDP
Total assets	**58,882,720**	**100.0**	**100.0**	**3,461.8**
Total loans	56,405,947	95.8	95.8	3,316.2
Branches	18,191,598	30.9	32.3	1,069.5
external loans	4,410,841	7.5	24.2	259.3
corporate	702,553	1.2	15.9	41.3
retail	1,329,086	2.3	30.1	78.1
Residential mortgage lending	2,379,202	4.0	13.1	139.9
inter-bank	13,780,757	23.4	75.8	810.2
of which: intra-group	13,734,944	23.3	99.7	807.5
Subsidiaries/domestic	38,214,349	64.9	67.7	2,246.7
external loans	3,546,304	6.0	9.3	208.5
corporate	1,348,966	2.3	38.0	79.3
retail	416,327	0.7	11.7	24.5
Residential mortgage lending	1,781,011	3.0	50.2	104.7
inter-bank	34,668,045	58.9	90.7	2,038.2
of which: intra-group	31,614,595	53.7	91.2	1,858.7
Marketable assets	404,569	0.7	0.7	23.8
Branches	0	0.0	0.0	0.0
Subsidiaries	404,569	0.7	100.0	23.8
Sovereign & PSE lending	249,874	0.4	0.4	14.7
Branches	0	0.0	0.0	0.0
Subsidiaries	249,874	0.4	100.0	14.7
Other	1,822,330	3.1	3.1	107.1
Branches	1,504,152	2.6	82.5	88.4
Subsidiaries	318,178	0.5	17.5	18.7
Total liabilities	**58,882,720**	**94.5**	**105.9**	**3,461.8**
Total deposits	55,620,499	32.5	100.0	3,270.0
Branches	19,123,642	19.3	34.4	1,124.3
Customer	11,364,538	10.5	59.4	668.1
Retail	6,182,247	8.8	54.4	363.5
Corporate/trust/fiduciary	5,182,291	13.1	45.6	304.7
Inter-bank	7,702,924	11.0	40.3	452.9
of which: intra-group	6,477,389	0.1	84.1	380.8
Other	56,180	62.0	0.3	3.3
Subsidiaries/domestic	36,496,857	54.9	100.0	2,145.7
Customer	32,340,997	28.4	88.6	1,901.4
Retail	16,718,787	26.5	51.7	982.9
Corporate/trust/fiduciary	15,622,210	4.5	48.3	918.4
Inter-bank	2,660,735	2.4	7.3	156.4
of which: intra-group	1,417,385	2.5	53.3	83.3
Other	1,495,125	1.7	4.1	87.9
Other liabilities	1,024,497	3.8	1.7	60.2
Capital and reserves	2,237,724	0.0	3.8	131.6

Sources: FSC Quarterly Prudential Returns, Economic Affairs Monthly Returns, and staff estimates.

1/ Based on end-June 2008 unconsolidated data (i.e., excluding overseas branches of domestically incorporated banks

12. **Although the methodologies of both the BU and the TD approach are fairly sophisticated, nonetheless, as always, caveats apply.** For both types of stress tests, an important caveat is the lack of an interaction or feedback component between the different financial institutions in the stress tests. In other words, the setup of the exercise prevents full modeling of the externalities that vulnerabilities in parts of the financial system might levy on other parts of the system. However, some attempts are made to deal with this issue on a limited basis, for example, by performing sensitivity analyses around the base stress scenarios.

13. **Another major caveat relates to the lack of modeling of second round effects, including reaction of parent banks.** The banks will react to these different circumstances, which could improve (e.g., by raising capital) or worsen (through, e.g., "fire sales") the stress. However, such reactions are hard to model, especially in the case of institutions whose treasury functions are partly or wholly managed on a group-wide basis by their parent bank. The current convention is to stress test under the assumption of fixed portfolios. Another related difficulty is to account for the implicit or explicit parental support and other guarantees. For example, Manx banks are exempted from the standard 25 percent large exposure limit to capital for claims on their parent banks and other group credit institutions subject to certain criteria, and for claims on other banks of less than one year maturity where such claims are part of a bank's normal treasury operation. This exemption reflects the special role of Manx banks as deposit-collecting institutions for their groups and the high implicit parental support provided to them on a need-be basis. But with 70 percent of banks' assets held in the form of intra-group claims, the Manx banks are particularly vulnerable to correlation risk in the case of stress at the group level.

C. Metrics and Calibration of Shocks

14. **The impacts of the shocks are estimated as an absolute amount in GBP thousands over a one-year horizon, but for purposes of interpretation, results are presented relative to two main metrics:**

- the risk-weighted capital adequacy ratio (CAR). This measure captures the impact on capitalization itself. It does not rely on assumptions about profitability, and is important in assessing whether any bank becomes under-capitalized even temporarily. The impact relative to the capital ratio is also a useful measure in making international comparisons.

- the income gains/losses relative to pre-shock capital, in percent and percentage point change. This indicator measures the ability of banks to absorb a shock out of current income, without capitalization being affected.

15. **The calibration of the shocks is aimed to be such that the shocks represent "extreme but plausible" events, either defined on an ad-hoc or historical basis.** Broadly, the calibration corresponds to that used in recent FSAPs for comparable countries, allowing for potentially much larger shocks, as experienced during ongoing financial turmoil.

D. Results

16. **The results, which are presented in Table 2, are expressed in terms of two measures:** (i) the average percentage point change from the pre-shock capital (shown in the first row), with the minimum and maximum percentage change across banks (Columns 1–3); and (ii) the average income loss/gain in percent of pre-shock capital, with the minimum and maximum percent change across banks (Columns 4–6). The first six columns refer to the BU approach, whereas the remaining six columns refer to the TD approach. Overall, both approaches produce similar results, although the range of the TD results tends to be wider, due to supervisors less detailed knowledge of the banks' collateral and guarantees, some of which are managed at group level.

17. **These results present a conservative picture of the impact of the scenario.** The banks reported expected losses are directly translated into percentage points of capital. As noted above, this is a conservative way of presenting the results, because no account is taken of regular (i.e., before credit risk losses) banks profits. For most banks, these profits would form a first buffer against losses. Nonetheless, it is important to note that the stress tests mostly focus on expected losses (i.e., the impact on provisioning), and do not account for unexpected losses, which could rise significantly under extreme scenarios, particularly if the shocks are of a systemic nature.

Concentration risk

18. **The main potential areas of concern relate to concentration risk and potential spillovers from the parent banks or groups, which are difficult to capture quantitatively.** Linkages to parent banks are a source of strength, but also create vulnerabilities. Overall, the close linkages of domestically incorporated banks to financially sound and well-managed parent banks, which could support their affiliates if need be, underpin the resilience of the Manx banking system.

19. **Furthermore, Manx operations account for a non-negligible share of net group funding, which further raises the likelihood of parental support in the case of stress, particularly if the shock originates in the IOM.** Except for the affiliates of the very large global groups, domestically incorporated banks provided between 3 and 25 percent of their groups' customer funding (11 percent on unweighted average) and between 1 percent and 15 percent of total group funding (6 percent on unweighted average). Nonetheless, these

linkages also present important concentration risk, which creates vulnerabilities to financial problems at the group level (Box 1).

Box 1. Concentration Risk of Intra-Group Exposures: the Case of Kaupthing Singer & Friedlander (Isle of Man) Limited ("KSFIOM")

In the months following the IMF FSAP visit to the IOM, the economic situation in Iceland deteriorated further. The Icelandic banks effectively ceased to operate overseas and the parent bank (Kaupthing HF) of the IOM subsidiary (KSFIOM), failed to honor its guarantee to support its wholly-owned Manx subsidiary.

In response to regulatory initiatives taken by the FSC, KSFIOM had eliminated its net exposure to its parent during 2008. However, it had replaced this exposure with a similar exposure to Kaupthing Singer & Friedlander Limited (KSFUK), a UK-based subsidiary of the group and sister company of KFSIOM. However, when the UK FSA placed the KSFUK under administration, KFSIOM lost access to its assets placed in its sister company, forcing it to cease trading. At the time, the FSC suspended its banking license and placed it provisionally under a liquidator.

20. **The heavy intra-group exposure and reliance on group liquidity management introduces a considerable non-linearity in the risk profile of Manx banks.** While the likelihood of a major problem in a parent bank with a Manx affiliate remains low, the impact of such an event would be highly nonlinear, with limited impact on the affiliates in the case of mild stress and disastrous consequences in the event of a more severe stress. For example, the resilience of Manx affiliates to liquidity strains hinges upon parent banks' ability to provide adequate day-to-day liquidity and other financial guarantees when needed. Furthermore, in addition to liquidity risk, the local affiliate would also be facing substantive credit risk in the event of a financial deterioration at the group-level. For example, if hypothetically banks had to provision for claims on parents, 10 percent provisioning of their claims on the parent, for example, would wipe-out the capital basis of the Manx banking sector (see Test A4 in Table 2).

21. **The FSC is aware of the risks associated with these large exposures.** Therefore, it is examining how to mitigate some of the financial stability risk associated with banks' large intra-group exposures, including by inducing local banks to hold independent liquidity. So far, under normal conditions, the FSC has felt broadly comfortable with the exemption of intra-group bank exposures from the regulatory large exposure limit. However, in light of the recent and ongoing financial turmoil, market conditions have become more stressed and both liquidity and funding have become more constrained for large banking groups, raising questions about the potential risk associated with large intra-group exposures. The FSC has responded with the following measures:

- It has gained additional assurances during the past three to six months that centralized liquidity management and consolidated supervision of liquidity by home supervisors accounts explicitly for local subsidiaries and the off-shore market environment.

- It has also strengthened its monitoring of group liquidity, especially in cases where the funding provided by the local subsidiary is relatively large (i.e., greater than 5 percent) in comparison to group total retail funding.

The FSC is also considering a certain number of measures,[4] including:

- requiring some local banks to maintain locally a minimum level of independent liquidity on a need-be basis and depending on the financial standing of the parent;[5]

- determining key quantitative and qualitative criteria to assess liquidity risk for Manx banks (e.g., effectiveness of home supervisor and group liquidity management, level of group liquidity);

- strengthening liquidity reporting disclosure requirements; and

- gaining the right to require lower group exposure from local bank and/or higher collateral from parent.

Liquidity Risk

22. **The liquidity stress test examined how many days banks could withstand a daily withdrawal of liabilities with no access to additional external funding, including from its parent bank.** This test was computed on a *gross* basis (i.e., it did not allow banks to use assets to net out their liquidity mismatch position). This test is akin to a reputation crisis, where a bank must liquidate its assets to meet a sudden liability draw-down. The banks were asked to report the effects on their liquidity situation after 30, 60, and 90 days. For the purpose of liquidity risk, both bank subsidiaries and foreign branches were included in the exercise. The shocks are summarized in Box 2.

[4] See FSC internal position paper "Liquidity and Intra-group Exposures," August 2008. This document has been shared with the banks, but had not yet been disseminated publicly when this report was prepared.

[5] In light of countercyclical provisioning, it would be preferable not to have the minimum level of independent liquidity depend on the financial strength of the group (so as not to ask for additional liquidity the moment that the health of the parent is deteriorating) but rather on the size of the exposures.

Box 2. Liquidity Risk Shocks

- L1: A daily drawdown of liabilities on demand (including fiduciary deposits) and due within one month by 30 percent. Interbank market and intra-group funding is unavailable.
- L2: As Test 1 but in addition securities held become illiquid.

23. **Overall, the effects of liquidity stresses were generally modest, but the large reliance on parent bank/intra-group funding represent a vulnerability.** The head offices of many Manx banks run extensive liquidity stress tests at the group and regional level. Thus, as long as the source of the local deposit run is not related to financial vulnerabilities at the group level, the close relationship between Manx banks and their parents/groups provides an important buffer and the Manx banks are likely to remain in a position to meet their short-term liabilities.

24. **According to the stress test results, the banking system maintains ample liquidity buffers to absorb a dramatic deposit drain** (a 30 percent daily deposit drain is equivalent to a 50 percent withdrawal after two days and 75 percent withdrawal over five days). The system remained liquid after successfully meeting its liability drawdown for five consecutive days, under both scenarios.

25. **The impact of the shock, however, exhibited large differences across institutions, reflecting their different contractual liquidity arrangements with their parent banks.** Ten of the 16 institutions included in the exercise survived the first shock (L1) in the first critical week (i.e., five days) without requesting additional funding over and above existing group contractual arrangements (11 banks survived the more favorable second shock, L2). This resilience derives from the fact that: (i) many of the Manx banks benefit from a centralized liquidity management at group level (i.e., group treasury matches deposits with call or maturity-equivalent balances); and (ii) most of the assets are held in the form of callable (or highly liquid) assets with their parent banks. Of the five banks that did not survive the test, four of them belonged to foreign groups and had their intra-group assets spread out across maturity buckets at the group level, which prevented them from meeting a sharp deposit run on a contractual basis.

Credit Risk

26. **Credit risk assesses banks' ability to weather a deterioration in the quality of their assets.** Where available, the impact was estimated as a rise in banks' probability of default. In most cases, it was conducted by assuming that a fraction of a particular asset class was defaulting. The shocks are summarized in Box 3.

Box 3. Credit Risk Shocks

- C1: Doubling of all probabilities of default (PDs) on loans. If PDs are not available, default of the largest three exposures excluding the parent bank/other group banks.
- A1: 10 percent of banks' domestic non-interbank loan portfolio fails.
- A2: 10 percent of banks' mortgage loan portfolio fails.
- A3: 10 percent of banks' UK non-interbank loan portfolio fails.
- A4: 10 percent of banks' claims on their parent bank/other group banks are provisioned.

27. **The changes in PDs were translated into absolute amounts of additional expected losses in banks' different portfolios.** Banks reported these additional losses in GBP thousands. Subsequently, these losses were expressed in percentage point of pre-shock capital, which is equivalent to percent of risk-weighted assets. While in principle the banks would also be able to come up with estimates of unexpected losses, these were not included for reasons of consistency of reporting. For the TD approach, a 50 percent provisioning rate was assumed, in line with the risk weights applied to compute the risk-weighted assets.

28. **Credit risk is not a major risk factor.** This is shown in test C1, where none of the banks reported a change in their CAR that was greater than 30 basis points (bps). These results reflect banks' relatively small (non-interbank) loan portfolio and, to some extent, the way in which the shocks were calibrated.

29. **In terms of exposure, only 8 of the 12 banks included in the sample had a non-interbank loan portfolio, accounting for an overall 15 percent of these banks' total assets (and 10 percent of the sample's total assets).** However, there was a wide variation across banks in the degree of their exposure to credit risk. The share of (non-interbank) loans to total assets was below 5 percent for three banks (accounting for 20 percent of total assets), between 10 and 20 percent for another three banks (accounting for 44 percent of total assets); between 21 and 35 percent for another two banks (accounting for 7 percent of total assets); and for 75 percent for one bank (presenting less than one percent of total assets). Two banks, in particular, stood out: One bank's loan portfolio accounted over 65 percent of total (non-interbank) loans, but only 16 percent of this bank's total assets; in contrast, another

bank's loan portfolio accounted for 6 percent of total loans, but for almost 75 percent of its own balance sheet.

30. **In terms of shocks, where available, banks were asked to double their probability of default or to shock their three largest (non-intra-group) exposures, all of which started from very low levels.** To replicate a similar shock, and using the TD approach, the FSC assumed a 1 percent default on the banks' total (non-intragroup) loan portfolio. The results were slightly larger (averaging an 80 basis point CAR reduction), except for one bank which CAR would fall significantly below the minimum requirement. This bank is very small, representing less than one percent of the system's total assets.

31. **For sensitivity analysis purposes, stronger but more concentrated shocks were conducted on particular credit subcategories.** Although the results were more substantive, they confirmed banks' overall resilience to credit risk. For example, a macroeconomic shock that leads to a 10 percent default on banks' overall residential or UK (non-interbank) loan portfolio would reduce their CAR by, respectively, 1.2 percentage point and 0.3 percentage points. However, given the concentration of risk for some banks, the impact could be much larger on an individual basis. For example, the CAR would fall one percentage point below the required 11 percent buffer[6] for one of the small banks in the case of a UK-based shock, whereas even a moderate real estate shock could seriously deplete the capital of another small bank (whose exposure is fully secured against UK real estate property with an average loan-to-value of 60 percent), assuming no parental support to maintain capital levels. Overall, these negative effects remain small on a system-wide basis.

Market risks

32. **Market risk shocks gauge the direct effect of instantaneous shocks on balance sheet and capital or solvency ratios.** Market risk shocks are thus a useful measure for the effects of unexpected large shocks. Stress testing for market risks in this way is a generally accepted practice in risk management and is performed at high frequency (normally daily for certain parts of the trading book). Market risk stress tests are generally not designed to capture indirect effects, such as, for example, changes in credit risk resulting from shocks to market risk factors. Overall, however, Manx banks do not appear vulnerable to market risk, given the limited size of their trading books.

33. **Banks were asked to calculate the impact of a variety of major shocks on their portfolios, consisting of both the trading and banking books (Box 4).** The tests covered

[6] The FSC expects a bank to maintain a CAR buffer of at least 1 percent above its prescribed minimum CAR. The statutory minimum CAR is 8 percent but in practice all banks are currently operating to a CAR of 10 percent or higher pending completion and review of their internal capital adequacy assessment processes.

shocks to the sterling pound interest rate curve, sterling pound exchange rates, asset prices, and credit spreads. The interest rate risk test examined banks' ability to absorb sudden fluctuations in key interest rates; the foreign exchange (FX) risk tests assessed banks' resilience to a sudden devaluation in major foreign currencies; and the asset price tests examined banks' sensitivity to a sudden fall in equity prices and/or a downgrade in rated securities.

Box 4. Market Risk Shocks

Interest rate risk

- I1: Parallel upward shift of the sterling yield curve by 200 basis points.
- I2: Parallel downward shift of the pound sterling yield curve by 200 basis points.
- I3: Parallel upward shift of the dollar yield curve by 200 basis points.
- I4: Parallel downward shift of the dollar yield curve by 200 basis points.
- I5: Parallel upward shift of the euro yield curve by 200 basis points.
- I6: Parallel downward shift of the euro yield curve by 200 basis points.

Foreign Exchange Rate Risk

- F1: The pound depreciates by 20 percent against all other currencies.
- F2: The pound appreciates by 20 percent against all other currencies.
- F3: The dollar depreciates by 20 percent against all other currencies.
- F4: The dollar appreciates by 20 percent against all other currencies.

Asset Price Risk

- A1: Prices of all shares listed on foreign stock markets decline by 35 percent.
- A2: Rated securities are downgraded by two categories.

34. **All losses (gains) were directly deducted (added) from capital.** For changes in market prices or yields, relevant assets and liabilities are revalued and the changes netted. This is a conservative treatment of market-risk stress test findings, since, in practice, regular banks profits, which are substantial for most banks, form a first buffer against losses.

35. **Stress tests confirmed that the Manx banking system exhibits limited exposure to market shocks (Table 2).** The largest impact is to a parallel upward shift of the sterling yield curve (Test I1), which leads to a 10 bps reduction in the system-wide CAR. An interest rate shock would generally affect mainly the flow of net income on the banking book (i.e., changes in net interest income over the time required for both assets and liabilities to be repriced) rather than create instantaneous revaluation effects on the (minimal) trading book. In the case of Manx banks, even the income effect is very small, as they carry very small maturity mismatches on their balance sheets, either because of transfer pricing arrangements with their parents or other group-wide maturity matching arrangements. On average, a 200 bps upward shift of the sterling yield curve resulted in a 50 bps reduction in income (in

percent to pre-shock capital). For one bank, the test led to a 200 bps income loss (in percent of pre-shock capital) but did not affect its solvency as it started with a very high CAR.

36. **Most local banks have only a very limited, if any, independent treasury management capacity, which is conducted (and hedged) at a group level, significantly reducing their sensitivity to market risk shocks.**[7] Supervisory data confirmed banks' resilience against market risk shocks. The impact of most of the market-risk shocks were also calculated using the TD approach, using available off-site supervisory data (Columns 7–12). The results were in line with those of the bottom-up approach, although they were slightly larger, as supervisory data did not have the same granularity to model the repricing of liabilities.

37. **FX risk is largely mitigated through group-wide treasury management.** As a result, open currency positions are very limited and the parent banks absorb FX fluctuations. The largest impact follows a sterling pound depreciation, where the CAR of one bank falls by one percentage point, remaining above the regulatory requirement. Asset price risk has no materially significant impact, given banks' limited exposure (less than one percent of their balance sheet) to listed securities and other marketable assets (See Table 2).

[7] The Manx banks exhibit very limited currency and maturity mismatches as any such positions are hedged by the parent bank at the group level.

Table 2. Isle of Man: Stress Test Results for the Banks

Shocks	Bottom-Up						Top-Down					
	Average 1/	Min.	Max.	Income Loss/Gain	Min.	Max.	Average 1/	Min.	Max.	Income Loss/Gain	Min.	Max.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Percentage point change			In percent of pre-shock capital			Percentage point change			In percent of pre-shock capital		
Pre-shock capital	14.44	11.72	34.64	-	-	-	14.44	11.72	34.64	-	-	-
Interest Rate Risk												
I1: Parallel upward shift of the sterling yield curve by 200 basis points.	-0.09	-0.73	0.01	-0.53	-2.09	2.09	0.87	-1.63	1.62	6.05	-12.95	13.27
I2: Parallel downward shift of the sterling yield curve by 200 basis points.	0.02	-0.32	0.72	0.53	-2.15	2.07	-0.87	-1.62	1.63	-6.05	-13.27	12.95
I3: Parallel upward shift of the dollar yield curve by 200 basis points.	-0.02	-0.20	0.06	-0.07	-1.14	0.50	0.04	0.00	0.10	0.28	0.00	0.78
I4: Parallel downward shift of the dollar yield curve by 200 basis points.	0.00	-0.06	0.08	0.07	-0.50	1.14	-0.04	-0.10	0.00	-0.28	-0.78	0.00
I5: Parallel upward shift of the euro yield curve by 200 basis points.	-0.02	-0.18	0.04	-0.08	-0.98	0.37	0.07	-0.01	0.13	0.50	-0.06	1.05
I6: Parallel downward shift of the euro yield curve by 200 basis points.	0.00	-0.04	0.06	0.08	-0.37	0.98	-0.07	-0.13	0.01	-0.50	-1.05	0.06
FX Risk												
F1: The pound depreciates by 20 percent against all other currencies. 2/	-0.04	-1.06	0.01	0.01	-0.07	0.01	-0.02	-0.19	0.00	0.11	0.00	0.98
F2: The pound appreciates by 20 percent against all other currencies.2/	0.03	-0.01	0.84	-0.01	-1.10	0.00	0.03	0.00	0.19	-0.11	-0.98	0.00
F3: The dollar depreciates by 20 percent against all other currencies.2/	0.02	-0.01	0.48	0.00	-0.15	0.00	-0.01	-0.04	0.18	-0.06	-0.91	0.36
F4: The dollar appreciates by 20 percent against all other currencies. 2/	-0.02	-0.64	0.01	0.00	-0.06	0.00	-0.02	-0.18	0.04	0.06	-0.36	0.91
Credit Risk												
C1: Doubling of all probabilities of default (PDs) on loans. 4/	-0.08	-0.33	0.00	-0.66	-11.81	0.00	-0.78	-9.38	0.00	-5.80	-75.76	0.00
A1: If 10% of domestic nonbank loan fail 5/	-	-	-	-	-	-	-1.42	-8.26	0.00	-10.53	-44.78	0.00
A2: If 10% of mortgage loans fail 5/	-	-	-	-	-	-	-1.24	-21.63	0.00	-9.21	-164.52	0.00
A3: If 10% of UK nonbank loans fail 5/	-	-	-	-	-	-	-0.34	-5.30	0.00	-2.54	-37.13	0.00
A4: If 10% of parent bank fails 5/ 6/	-	-	-	-	-	-	-10.58	-	-	-73.97	-	-

Sources: FSC and staff estimates.

1/ Unweighted average across the twelve banks.
2/ Modeling spot risk (i.e., impact on net assets, RWA, and income).
3/ Modeling translation risk (i.e., shock absorbed fully by asset valuation effect).
4/ If PDs are not available, default of the largest three exposures excluding the parent bank.
5/ Assuming a 50 percent recovery rate, in line with regulatory risk weights applied to assets.
6/ Based on aggregated data, including branches.

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III. INSURANCE SECTOR

38. **The insurance sector stress tests are structured as far as possible in the same way as the banking sector tests, with the addition of insurance risk stresses for the life insurance sector.** The sample covers about the same proportion of the industry, the tests common to both sectors are defined and calibrated similarly, and results are presented relative to metrics that capture both flow and stock concepts. The test and the analysis of the results seeks to take into account the long term nature of much insurance business and the importance of assumptions about the behavior of insurance companies and their policyholders in the event of stress—because the latter bear much of the risk, and there are degrees of freedom in the allocation of risk.

A. Coverage

39. **The stress testing exercise has been carried out for the six largest Manx life insurers representing over three-quarters of the insurance sector in terms of both liabilities and assets.** The sample accounted for 82 percent of total sectoral insurance liabilities (approximately GBP 35 billion). All insurers included within the sample are subsidiaries of large insurance groups, including two from UK insurance groups and two from insurance groups elsewhere in Europe. Table 3 provides an overview of the sector.

B. Methodology

40. **The results were calculated by the companies themselves following guidance from the Insurance and Pension Authority (IPA) and then reviewed by the IPA and its external actuarial advisers, Watson Wyatt.** The test procedures and definitions of shocks were applied to the end-2007 financial reporting data.

41. **We did not test for persistency risk, where policyholders cash in early at a higher rate than assumed in the insurers' reserving bases.** This may occur where there is a large, sudden, and persistent rise in interest rates, which induces people to move savings out of life products into alternative (higher return) instruments. Other factors that affect persistency include the level of equity markets, changes in the tax or regulatory requirements, and, for individual companies, perceptions of their financial strength. It is worth also considering the resilience of the life sector against such an extreme occurrence as a further test of its financial soundness. The IPA has noted, however, that insurance companies' reserves do include significant margins in relation to persistency risk and that for most companies, a worsening of persistency would lead to improved solvency cover in the short term.

Table 3. Isle of Man: Insurance Sector Indicators

(in GBP millions unless indicated otherwise)

	2002	2003	2004	2005	2006	2007	2008 Sept.	Percent of total
Life								
Gross premiums	3,860	3,133	3,975	6,666	9,441	8,427	6,268	89.9
Net premiums	3,314	2,911	3,515	4,125	8,526	8,394	5,788	
Investment income	-1,753	1,703	1,190	2,913	1,889	2,415	-2,888	
Net claims	1,525	1,472	2,186	2,965	3,794	4,959	3,362	
Expenses	196	204	193	239	258	292	192	
ROE (return on equity after tax, percent)	11.84	16.53	41.79	50.16	39.16	18.62	5.04	
Total assets	14,900	18,059	20,578	26,677	33,562	38,634	37,279	91.2
Investments, of which:	14,586	17,635	20,185	26,114	32,864	37,702	36,618	
Government securities	692	670	716	750	1,004	919	3,735	
Corporate securities	587	590	714	587	1,028	640	722	
Equity	6,379	8,082	9,125	12,508	15,283	18,370	23,654	
Deposits	1,547	2,146	2,271	3,596	4,660	5,444	6,989	
Futures and options	0	1	0	0	0	0	0	
Other	5,395	6,238	7,036	6,084	7,544	8,519	1,216	
Real estate and real-estate related	0	0	156	175	200	218	229	
Insurance Debtors	45	35	57	91	126	205	72	
Cash	471	424	804	1,335	1,503	1,481	586	
Liabilities								
Share capital	190	195	180	209	195	199	201	
Share premium	36	6	7	15	15	7	15	
Linked policy liabilities	13,861	16,598	19,169	22,170	28,358	32,869	32,368	
Non-linked policy liabilities	472	518	452	551	484	502	500	
Technical provisions	-17	-1	-30	-32	-74	-127	-114	
Profit reserves	-21	28	40	51	124	138	158	
Required minimum margin 1/	43	51	57	65	82	91	87	
Excess solvency 2/	215	250	252	338	371	377	510	
Coverage ratio (in percent) 3/	400.0	390.2	342.1	420.0	352.4	314.3	483.1	
Captives								
Gross premiums	845	961	969	764	706	833	707	10.1
Net premiums	618	645	698	532	533	605	502	
Investment income	131	192	188	133	170	180	96	
Net claims	486	409	413	387	375	367	404	
Expenses	24	32	53	42	43	50	20	
ROE (return on equity after tax, percent)	8.27	18.40	18.86	15.60	15.82	19.73	11.24	
Total assets	4,632	4,416	3,503	3,804	3,644	3,377	3,597	8.8
Investments	2,645	2,258	2,227	1,969	1,873	3,171	1,802	
Insurance debtors	315	409	260	191	509	347	346	
Cash	554	899	699	763	1,023	1,134	1,074	
Liabilities								
Unearned premiums	505	334	347	299	504	186	272	
Claims (incl IBNR)	1,451	1,589	1,196	1,234	1,633	1,312	1,618	
Other liabilities	221	271	368	232	237	390	92	
Share capital	428	429	531	610	486	512	517	
Share Premium	500	232	290	200	273	273	241	
Profit reserves	1,254	1,396	846	921	1,055	1,036	1,262	
Required minimum margin 1/	47	39	47	38	36	38	37	
Excess solvency 2/	1,573	1,534	1,340	1,384	1,514	1,469	1,427	
Coverage ratio (in percent) 3/	3,246.8	3,833.3	2,751.1	3,542.1	4,105.6	3,765.8	3,856.8	
Total gross premiums	5,153	4,513	5,452	7,800	10,558	9,784	6,974	100.0
Total assets	20,850	23,943	25,630	32,105	38,606	43,654	40,877	100.0

Sources: Insurance and Pensions Authority and staff estimates.

1/ Defined as the mandated minimum stock of net available assets, which are computed as net assets minus reserves.

2/ Defined as the difference between net available assets and the required minimum margin.

3/ Excess solvency to the required minimum margin.

42. **A shock can have two effects on the solvency position of an insurance company (Appendix I):** an instantaneous change in the value of the company's assets (i.e., a stock effect represented by capital gains or losses) and a progressive change in the return on the company's assets (i.e., a flow effect represented by asset income level changes). To facilitate the interpretation of the stress tests, the effects of the assumed shocks are presented as the "coverage ratio," or the ratio of net admissible assets to the required minimum margin (RMM) of solvency (i.e., 100 percent means that admissible assets equal the minimum solvency requirements).

C. Metrics and Calibration of Shocks

43. **The insurance sector shocks parallel the single factor tests performed on the banking sector.** The assumed shocks under the first two interest rate tests (I1, I2), FX risk (F1, F2) and asset price risk (A1 and A2) are the same as in the tests for the banking sector. Tests I3-I6, F3-F4 were not applicable because insurance companies have negligible exposure to these risk factors and an extra asset price risk was conducted to reflect the life insurance companies exposure to residential and commercial real estate. Additional, insurance-specific tests are as follows:

Box 5. Insurance Risks

- M1: Mortality: a permanent increase in mortality rates of insured lives (i.e. mortality over normal prevailing rates) of 25 percent. This shock should only be applied to insured lives (i.e. not to annuitants).
- M2: Morbidity: a permanent increase in morbidity rates (i.e., morbidity over normal prevailing rates) of 25 percent.
- M3: Longevity: a permanent reduction in annuitant mortality of 25 percent across all current and deferred annuitants. This shock should only be applied to annuitants, i.e., not to insured lives.

44. **The stress tests examine the impact over a very short term horizon (e.g., one year) and are expected to affect the whole insurance sector simultaneously.** While these might represent the most likely short-term shocks, they do not cover all the material risks to the solvency of an individual life insurer, particularly given the unit linked nature of the underlying business. Operational risk, persistency risk, expense risk, and new business risk are all potentially significant and will often be more significant over time than, say, equity risk or interest rate risk. Furthermore, the exposure to and impact of these risks are likely to vary substantially from company to company and hence these risks do not lend themselves easily to a standardized stress testing exercise. Perhaps more importantly, these

risks tend to become significant over a medium-term time horizon (e.g., 3–5 years). To assess the resilience of life insurers to this type of tests, the IPA requires companies to identify the shocks that would be most significant to their business and to compute the solvency margin under these shocks over a number of years (this is done in the context of their "Financial Condition Reports"). The level of capital is then evaluated in the context of future potential calls on capital, the potential access to capital, and mitigating actions that could be taken by the IPA or the insurer.

D. Results

45. **The results, which are presented in Table 4, are expressed in terms of:** (i) the post-shock coverage ratio (Column 1); and (ii) the average percentage point change from the pre-shock coverage ratio, with the minimum and maximum percentage point change across insurers (Columns 2–4).

46. **The stress test results confirm that the Manx life insurance sector exhibits considerable resilience against shocks.** The results principally reflect the sector's low exposure to risk: most business is unit-linked and key risks are either limited (mortality risk) or to a large extent borne by policyholders (market risk). The effects of shocks to mortality risk are negligible and insurers have limited credit or property risk.

47. **Market risk shocks for falls in share prices, and changes in interest rates, have a more significant impact on the solvency coverage ratio than credit or property shocks.** Insurance companies must hold reserves equal to the difference between future expenses and expected future charges, most of which are linked to funds under management. The present value of future expenses is sensitive to movements in interest rates (higher rates lead to higher discounting of future expenses), while future charges are sensitive to changes in fund values and hence all market movements. Nevertheless, the results show that on average, minimum solvency requirements are still comfortably covered in all the shocks (in practice, the IPA ordinarily expects firms to meet a margin of at least twice the formal minimum—but this level is also well-covered after the shocks).

48. **The results indicate a very sound level of capitalization, which is encouraging.** At first sight, it may seem to indicate that the sector is holding significantly more capital than is required to cover its risk exposure. But this is not necessarily the correct interpretation. First, the stresses considered do not encompass all the risks that companies are exposed to, nor do they reflect combinations of risks occurring simultaneously. Allowance for these factors should be considered in interpreting the level of capitalization presented in the stress results. Second, the mathematical reserves do not represent the market value or fair value of liabilities, as would broadly be the case under the proposed Solvency II regime, but contain material margins of prudence. The implicit risk margin in the mathematical reserves is generally significantly more material than the explicit risk margin of the RMM. Expressing

the solvency coverage ratio as a multiple of the RMM alone therefore overstates the extent to which available capital covers the aggregate margins for risk held by companies.

49. **Given these factors, the coverage ratio that would be presented under a Solvency II-type risk-based capital approach would be quite different from the IOM solvency coverage calculation.** Under a Solvency II approach, the mathematical reserves or technical provisions would be lower, being assessed based on market or fair value, but the capital requirements would be higher. The solvency coverage ratio would therefore be lower on a Solvency II basis.

50. **Although the coverage ratio would be lower under Solvency II, the expectation is that the underlying capital coverage of the IOM insurance sector would improve if there were a move to a Solvency II basis at some point in the future.** This is because, under the current Solvency II proposal, the existing solvency approach in the IOM for unit-linked business is typically more prudent than the one expected under the Solvency II basis. While the coverage ratio would be lower under Solvency II, the aggregate level of excess assets over capital requirements would be expected to be higher than under the current solvency approach in the IOM.

Table 4. Isle of Man: Stress Test Results for the Life Insurance Sector

	Coverage Ratio 1/	Average 2/	Min.	Max.
	(1)	(2)	(3)	(4)
	In percent	Percentage point change		
Pre-shock coverage ratio	421.54			
Interest Rate Risk				
I1: 200 bp parallel upward shift of the sterling yield curve.	466.23	44.70	0.00	191.33
I2: 200 bp parallel downward shift of the sterling yield curve.	338.06	-83.47	-353.35	0.50
FX Risk				
F1: 20% pound appreciation against all other currencies.2/	425.44	3.91	-156.89	140.31
F2: 20% pound depreciation against all other currencies. 2/	411.75	-9.79	-155.55	95.06
Asset Price Risk				
A1: 35% price decline of shares on foreign stock markets.	488.26	66.72	-50.88	1028.87
A2: Rated securities are downgraded by two categories.	421.50	-0.04	-18.60	12.32
A3: 20% price decline in residential and commercial real estate.	424.18	2.64	-5.62	12.32
Insurance Risk				
M1: Permanent 25 % increase in mortality rates of insured lives.	399.96	-21.58	-82.83	3.85
M2: Permanent 25 % increase in morbidity rates.	421.54	0.00	0.00	0.00
M3: Permanent 25 % in annuitant mortality rates.	418.46	-3.07	-17.18	0.00

Sources: IPA and staff estimates.

1/ Net admissible assets to required minimum margin (coverage ratio is 100 if admissible asset equal minimal margin).
2/ Unweighted average across the eight life-insurance.

Appendix 1. Understanding The Dynamics For The Life Insurance Sector

51. **There are two principal sources of the volatility in the assets of the company available to meet the required minimum margin:** (i) the mismatch between assets and liabilities in the long term business fund; and (ii) the volatility of surplus assets in the shareholders fund.

Mismatch in the long term fund

52. **The surplus in the long-term business fund (Column 3) is the difference between Column 1 and Column 2 and the change in this value in the stresses illustrates the mismatch between assets and liabilities in the long term fund.** The impact of this mismatch is not particularly significant for the applied shocks (Table 3). This is because the vast majority of the business written by the life insurers is unit-linked with very limited guarantees, resulting in low exposure to economic and mortality shocks. In unit-linked business, the assets (Column 1) are closely matched with their corresponding (i.e., unit) reserves (Column 2).

53. **However, there will still be a small mismatch between the remaining non-unit reserves and their corresponding non-unit assets, which are invested in a range of investments (e.g., equities, cash, bonds).** In simple terms, the non-unit reserves can be thought of as the excess of the present value of the expected future expenses of administering a policy over the present value of the expected future charges under the policy. The present value of future expenses is sensitive to movements in interest rates (higher interest rates leading to higher discounting of future expenses), but generally insensitive to other market movements. On the other hand, future fund management charges, which normally represent a very significant proportion of the present value of future charges, are sensitive to market movements. Consequently, a stress that reduces fund values (e.g., depreciation of the pound sterling) will normally reduce the present value of future charges and increase the non-unit reserves.

Volatility of shareholder assets

54. **Movements in shareholders' fund are the main driver for changes in the net admissible assets (Column 5) available to meet the required minimum margin (i.e., explicit capital requirement).** The net admissible assets in Column 5 are broadly the sum of the shareholders' funds (Column 4) and the surplus in the long-term business fund (Column 3), except for some minor adjustments (e.g., for assets that are deemed inadmissible for solvency purposes). According to the stress tests, movements in the shareholders' funds, which are invested in a range of investments and directly exposed to market risks, are more significant than those due to the mismatch in the long term fund and hence, the main driver of the coverage ratio (Column 7). The required minimum margin (i.e., the explicit capital requirement) is computed as a percentage of the reserves and will move largely in line with the unit funds (e.g., it will fall when equity prices fall).