

Actuarial Society of South Africa

EXAMINERS' REPORT

May 2022

Subject F107/B100 — Banking Fellowship Principles

INTRODUCTION

The attached report has been prepared by the subject's Principal Examiner. General comments are provided on the performance of candidates on each question. The solutions provided are an indication of the points sought by the examiners, and should not be taken as model solutions.

General comments on the aims of this subject and how it is marked

The aim of the Banking Principles subject is to instil in successful candidates the key principles of banking and to introduce students to the different types of activities undertaken by banks, including their associated risks, and the quantification of these risks.

A mix of question styles is used, covering knowledge of the material set out in the core reading, application of this in calculations and case studies and higher order skills such as synthesis and collation of recommendations.

Candidates are awarded marks for all reasonable answers including different but still reasonable numerical solutions. Marks are awarded for working in the case of numerical answers.

Candidates who give well-reasoned points, not in the marking schedule, are awarded marks for doing so.

Comments on candidate performance in this diet of the examination

This was the first sitting of the Banking Principles subject.

The paper covered a range of syllabus objectives and included questions that required candidates to apply knowledge to the circumstances described. Candidates who were able to apply their knowledge to specific scenarios in the questions were successful, with better prepared candidates able to generate a number of valid points.

Surprisingly, some straight forward bookwork knowledge questions were not well answered.

Many candidates did not provide sufficient breadth and depth in their responses and failed to generate a sufficient number of points for the marks on offer.

QUESTION 1

BankBSM is a medium sized bank offering a combination of retail and wholesale products. You have recently been appointed as the head of BankBSM's Balance Sheet Management team. The Bank's CRO has asked you to outline the principles of capital management.

- i. Explain what is meant by Expected and Unexpected Losses in the context of setting regulatory capital requirements for credit risk.

[5]

Expected loss

- Banks' normal course of business involves exposing themselves to risk of loss due to customer loan default.
- Losses will vary from one year to the next and are, usually, closely correlated to the economic cycle.
- The extent of losses will be dictated by the amount of exposure, product type, customer quality and the existence of collateral.
- It is not possible to know in advance what the extent of losses in the next 12 months (or any time period) will be.
- Banks will estimate the average level of losses they expect to incur over the next budgeting period based on:
 - historical experience,
 - any anticipated risks that may emerge,
 - and planned management actions.
- Expected Losses for Credit Risk Capital may be determined through the use of an internal ratings based approach (IRB), which makes use of PD, LGD, EAD estimates.
- There may be constraints in terms of the amount and quality of data required or methodology in order to comply with regulatory capital requirements.

Unexpected loss

- Actual loss rates may exceed expected loss rates, for example if historical rates were used to estimate expected losses and the last 5 years had seen the economy booming with the central bank raising interest rates remaining low.
- It is also possible for actual loss rates to be lower than expected loss rates, depending on where in the economic cycle you are.
- It is these unexpected losses that banks require a buffer of capital to absorb if the bank is to manage itself on a going concern basis this buffer must be sufficient to absorb losses and still remain above the regulatory minimum (which depends on the jurisdiction and specific regulatory requirements).
- Under the internal ratings-based (IRB) approach, regulators base the capital requirement on the value at risk calculated using a 1-year time horizon and a 99,9% confidence level.

- The capital given by the above equations is intended to be enough to cover unexpected losses over a 1-year period that we are 99,9% certain will not be exceeded.
- The supervisory authority reserves the right to apply a scaling factor (less than or greater than 1.0) to the result of the calculations, if it finds that the aggregate capital requirements are too high or low.
- Should the buffer fail to absorb the extent of unexpected losses, the bank would no longer be a going concern. This is because a bank that falls even 1 basis point below the regulator's minimum will likely suffer a loss of confidence which may trigger a run on the bank (as well as the inevitable credit rating downgrade).
- Unexpected losses are harder to estimate than expected losses.

ii. Briefly describe the Pillar 2 Supervisory Review and Evaluation Process, under the Basel framework.

[5]

- Pillar II (Supervisory Review and Evaluation Process) requires banks to implement a process for assessing their capital adequacy in relation to their risk profiles over a planning period of at least 3 years as well as a strategy for maintaining their capital levels in the event of risk contingencies including those risks not adequately considered under Pillar I. This is the Internal Capital Adequacy Assessment Process (ICAAP).
- The ICAAP which comprises all of a bank's procedures and measures designed to ensure that there exists:
 - The appropriate identification and measurement of all balance sheet risks
 - An appropriate level of internal capital in relation to the bank's risk profile
 - The application and further development of suitable risk management systems
- Pillar II also requires the prudential authority to review all banks for their capital adequacy and to impose any necessary supervisory measures following such review.
- The supervisory review process which covers the processes and measures defined in the principles listed above, including the review and evaluation of the ICAAP process, an independent assessment of the bank's risk profile, and where necessary instructing the bank to undertake further prudential measures.
 - These measures include individual capital requirements, referred to as pillar 2B requirements.
 - And specific risk items such as changes in governance, systems and controls pertaining to specific risk types
- The management actions contained in the ICAAP are actioned when certain indicators are reached, for example levels of capital adequacy. These actions are recovery actions to rectify the capital and or leverage concerns identified.

- The ICAAP also forms the background to the recovery plan. This plan will be invoked in the event of significant stress events.
- Supervisors should review and evaluate banks' internal capital adequacy assessments and strategies, as well as their ability to monitor and ensure compliance with regulatory capital ratios. Supervisors should take appropriate supervisory action if they are not satisfied with the result of the process.
- Supervisors should expect banks to operate above the minimum regulatory capital and should be able to require banks to hold capital in excess of this minimum.
- Supervisors should seek to intervene at an early stage to prevent capital from falling below the minimum levels required to support the risk characteristics of a particular bank and should require rapid remedial action if capital is not maintained or restored.

iii. Describe the two types of capital assessment required as part of an ICAAP exercise.

[3]

- Point in time capital assessment as at the date chosen for the ICAAP submission:
 - Pillar 1 – 8% of RWA of credit, market, and operational risks.
 - Pillar 2A – additional capital requirements for risks not captured in Pillar 1 (e.g. Interest Rate Risk in the Banking Book (IRRBB), Pension Risk and Credit Concentration Risk). A material risk assessment (MIRA) is performed to ensure that all material risks are managed / capitalised adequately.
- Forward-looking capital assessment using stress test results:
 - Maintain a capital surplus – total available less total required capital must be in surplus after considering management and recovery options where necessary.
 - Determine whether an additional capital buffer is required to enable a bank to remain in surplus during periods of stress.
 - Determine the Capital Planning Buffer (CPB) (under the current regime) equal to the most adverse movement in the capital surplus (i.e. the level of this buffer should be set equal to the additional capital required in a downturn scenario to ensure that the bank can continue to meet the increased capital requirements that would arise due to adverse circumstances).
 - This buffer is drawn upon when there is a downturn in the economic environment and adverse circumstances appear in the economic cycle.

Credit may be awarded for discussion of baseline vs scenario capital assessment, RC vs EC capital assessment, top-down vs bottom-up capital assessment.

BankBSM is in the midst of finalising the adoption of Basel III for the purposes of capital management.

iv. Outline the main shortcomings of Basel II.

[2]

- Additional compliance costs around IT infrastructure and technical modelling staff.
- Additional complexity and model risk introduced via internal models.
- The increased reliance on rating agencies which may not always have perfect information.
- The small-bank disadvantage: smaller banks are unlikely to be able to develop internal models and as such may face more onerous capital charges than larger banks that can develop more specific and nuanced internal models.

Any comment on other reasonable shortcomings was awarded marks.

This question was poorly answered considering that it was mainly bookwork.

Part (i) was generally not well answered. Many candidates failed to mention the concepts of PD, LGD and EAD. A few candidates went off topic and discussed IFRS9 provisions in too much detail.

Part (ii) was not answered well. Many candidates failed to mention the basic capital assessment and supervisory requirements under Pillar 2. Better candidates were able to describe the involvement of the supervisory authority in the process. Most candidates may have picked up on the hint of an ICAAP being included under Pillar 2 from part (iii) of the question.

Part (iii) was poorly answered by majority of the candidates. Several candidates failed to attempt this part.

Part (iv) was answered well by majority of the candidates. Candidates were awarded marks for including additional shortcomings of Basel II.

QUESTION 2

LargeCorp is an established bank that focuses on the non-retail (corporate customers) lending market. Since inception, loan originations have been assessed through using a purely qualitative application scorecard that is performed by the Credit Risk Managers. LargeCorp's management have become concerned about the inability of this purely qualitative scorecard to adequately assess credit risk in this portfolio.

Over its years of operation, LargeCorp have been focused on collecting the necessary data to make use of a more statistical approach to credit assessment at origination for non-retail customers.

- i. Outline the considerations with respect to establishing a data set for the purpose of developing a statistical non-retail scorecard.

[5]

- The master modelling dataset needs to be established. This is the dataset that will be used to inform the ratings study, by linking all exposures with the record of every exposure's risk characteristics/features that are candidates for the final ratings models at the appropriate dates with the outcome (default data) for each exposure.
- Consideration would need to be given to the period of data available, as well as the granularity of required information.
 - Several years of data is likely to be required in order to develop a statistical model.
 - The level of granularity of data will also inform the extend of sophistication and segmentation possible for the model.
- As LargeCorp is an established bank, it is likely to have a sufficiently large customer base from which it can draw data in order to develop the statistical model.
- Some of this data could relate to external ratings obtained from ratings agencies such as Moody's or S&P.
- Historically, some of the older applications may have been paper-based, and so an exercise would need to be undertaken to digitise these.
- Before beginning a model development exercise, it would need to be established that the model development data set is accurate and complete. This data would therefore need to be validated.
- A data exploration exercise would be carried out to identify outliers, measure the extent of missing values and highlight any possible data issues in the data set.
 - Outliers may have excessive impact on model estimates and should be addressed either through truncation of records or via exclusion.
 - Features with high levels of missing values or inconsistent patterns on missing values over time may negatively impact model application.
 - This may be especially relevant during the pandemic where data over the past two years may be affected by payment holidays and other external factors that are unlikely to continue into the future.

- Outliers will need to be carefully considered for a Non-Retail portfolio as there may be limited default data available for modelling.
 - Finally, a process would need to be established which ensures that the required data can be gathered and stored in a consistent manner going forward.
- ii. Discuss the steps you would follow in developing a statistical application scorecard model for the non-retail portfolio.
- [8]
- The first step would be to define the purpose of the model in order to determine the development population and the default definitions to be used.
 - As the model will be used for underwriting purposes (to rate new applications) it will also be important to understand if the model outputs will be used as inputs into the quoting engine (i.e. is it purely to assess whether to accept / reject the customer, or whether it affects pricing)
 - Consideration should also be given to whether the model will be used to rate the back book as well, and whether the model will be used for impairment calculations (for example to establish the origination rating for staging purposes under IFRS 9).
 - The model target definition (i.e. default definition) would need to be specified through data analysis.
 - The target definition would need to be applied to every record, ensuring the target is sensitive enough to changes to credit risk and credit costs, but not overly sensitive to trigger false credit events.
 - Consideration would need to be given to whether a customer level definition of default needs to be developed that encompasses the overall arrears status of the customer.
 - For example:
 - Being in default (3 payments in arrears or more) on any of the products linked to the customer may result in the overall customer being seen as being in default.
 - Missed payments alone are not usually sufficient in Non-Retail portfolios for credit scoring purposes, and so the default definition would need to consider other factors such as being over limit, or a minimum level of expected payment.
 - The development and validation data period and sample set will need to be established. Sufficient data needs to be kept aside in order to perform out of time and out of sample testing after model development. Consideration would also need to be given to the position in the economic cycle.
 - Exclusions would be recorded to ensure that the data set used to inform the model (the modelled population) will reflect the application population and experience:
 - For example, it would be necessary to exclude historic lines of business that will not be continued in future (e.g. policy exclusions).

- The model would also exclude records that were exposed to experience not expected to repeat in the prediction period (e.g. lock-down periods).
- Characteristic/ feature evaluation to narrow set of candidate features/ characteristics for use in model.
- The characteristic/ feature evaluation would entail:
 - Evaluating potential characteristics and classing of characteristic values using optimising algorithms and evaluation statistics.
 - Specifically testing for non-intuitive trends that are inexplicable.
 - This would need to consider the existing scorecards factors. These and potential additional factors assessed for inclusion will need to be reviewed by business to ensure that they make sense and business buy-in is obtained.
- The model construction process would entail:
 - Using the chosen statistical or machine learning routine to configure the optimal combination of characteristics to produce a single rating per exposure in the population.
 - Test for overfit by validating performance statistics with a significant hold-out sample.
 - This is likely to be an iterative process of optimisation and would involve expert judgement in the case of a Non-Retail model due to limited default data.
- Once the model is constructed, a final intuitive review would be conducted to ensure all changes in characteristics/ feature values result in sensible changes in the rating (both in amount and direction).
- The rating would then be calibrated to the applicable probability of default outcome window and definition as appropriate for use in the model with reference to the principles of correspondence and exposure-at-risk.
- The outcome period considered may be longer than for a retail portfolio to ensure sufficient defaults are captured as part of the model building exercise. This would then need to be scaled / adjusted to reflect a 12-month window (or other depending on model purpose).
- Some adjustments may be required for COVID-19 impacts as default and customer data over the pandemic period may not be relevant going forward.
- In cases where ratings will be applied by inference to actual experience the calibration exercise and or the model build exercise needs to consider the possibility that the inferred performance may be different from what may really transpire (“reject inference” in the case of new business underwriting model).

LargeCorp has successfully developed a statistical non-retail scorecard.

- iii. Outline some of the considerations in the application of this new scorecard in loan originations. [5]

- After the build and calibration of the scorecard it would be very valuable to run previously scored applications through this new version of the scorecard.
- In order to do this, it is assumed that data required for the new model is captured for the old applications so that these old applications can be rated through the new scorecard. This may not be possible if some information required at the point of application was not captured.
- Old applications received (applications used for generating the default experience) will allow the business to see what the swap sets will look like (so for example which applications previously approved will now be declined).
- This would also assist in setting appropriate cut offs for accepts, reject, and referral cases. Some of these cut offs may need to be updated to reflect that the statistical model is likely to be a more accurate assessment of credit quality.
- The old versus new offers can be compared (in terms of facility size, rates offered) along with the relevant default rates (this will allow the business to potentially calculate the default experience benefit of the new scorecard).
- Recent applications received can be assessed which will allow the business to understand how the new scorecard and offerings will impact the latest approval rates, volumes written, risk mix, and average fees and rates expected to be earned.
- This information will assist with potential tweaks to the facility offerings as well as the risk appetite limits (if the new offerings will result in potential breaches).
- Once the scorecards have been calibrated the offers to be made to the customer need to be tweaked / adjusted based on the new outputs of the scorecard as well as based on the risk appetites that are in place for each product.
- Facility sizes and rates will need to be decided both independently (based on required ROEs and ROAs per product) as well as possibly at customer level (to try to reduce the challenging conversation where rates and offers differ significantly at the point of application across product).
- Policy filters or additional accept / decline and refer rules will need to be developed (probably making use of the original rules that currently exist per product) to create a good mix of filter rules for this scorecard.
- The business or individual products may choose to have rules that are specific to their products.
- The statistical scorecard will be better at risk differentiation for specific sub pops or products so might initially need to have blended approach between using new and old approaches.
- Could also consider champion challenger approach to get credit team to buy into decision and prove its superior to old approach. Consider for referrals where credit managers skills should be employed.
- It is likely that the output of the rating system will be integrated into the judgmental/ committee type process used to approve and price new loan proposals. To do so would also entail a process of

introduction/ training/ insight sharing with the loans officers to ensure they appreciate the strengths and weaknesses of the model for use in the decision-making process.

Traditionally, LargeCorp have made use of multiple product level scorecards for its customers (i.e. each loan application is scored separately for different products and a customer may have two different credit scores across two products). One year after implementation of the statistical scorecard, LargeCorp have further refined their credit originations process to make use of a single customer score.

- iv. Outline some of the benefits and challenges of using a single customer score at the point of origination. Note, no comparison to the qualitative model is required.

[4]

Benefits:

- There should be some cost benefits to scoring a client once for multiple products instead of scoring a client multiple times at the point of application.
- For example, there is potentially a single set of paperwork and less time spent in the process.
- A single customer score makes more logical sense for a non-retail customer as the quantitative scorecard is likely to make use of their financial statements data (financial ratios) and other qualitative factors (management quality), which may be more consistently calibrated into a single scorecard.
- The customer experience at point of application should also be far improved as the full potential product offering for the client can be displayed immediately.
- More product sales might be made as a customer will have the opportunity of being offered alternative options should the credit they applied for be declined. All potential available offerings will be displayed and will hopefully result in the customer taking the product offering that is best suited to the customer needs.
- This may also avoid / reduce client frustration should they be declined for one product and potentially accepted for another product.

Challenges:

- There is a risk that with a single customer score being generated that the overall ranking of the scorecard may not be better than that of the individual product level scorecards (at customer level).
- This could result in anti-selection and mispricing of individual products (even if the scores are calibrated to the relevant product experience).
- There are scorecard development costs (people and process) and costs associated with the analysis required to ensure that a single scorecard is feasible (monitoring and validation).
- This would include the costs associated with implementing a single score into the Bank's existing systems ensuring end-to-end integration of data, scores, and application approval.

- There is also potentially significant front end system development in order to allow the system to display several offerings (and potentially allow the customer to take several products simultaneously).
- In context of a corporate the loan, the proposal may have a material bearing on the fortunes/ balance sheet of the company (or not). E.g. extension of current working capital facilities will not have a big effect, but a large loan that may be used to acquire new assets may have a large bearing on the balance sheet and outlook for the company. So, while a single rating is very valuable and important, the context of the proposal under consideration remains very important and the underwriting process needs to remain clear.

This question was poorly answered. The question included concepts that would have been introduced in earlier subjects.

Part (i) was not answered well. Better candidates were able to outline several considerations, ensuring relevance to a non-retail portfolio. Weaker candidates did not focus on the questions at hand and went into too much by detail describing the underlying variables that may be required for a scorecard.

Part (ii) was not answered well. Better candidates followed a structured approach in defining a model purpose, data definitions, variable identification, out of sample selection, calibration and importance of validation in a model build. Weaker candidates generally failed to cover a sufficient number of points given the number of marks available.

Part (iii) was poorly answered by majority of the candidates. Better candidates were able to provide commentary on the level of segmentation, back book vs front book, and the possible use of expert judgement.

Part (iv) was generally answered well. Candidates were able to generate a fair number of benefits and challenges.

QUESTION 3

A model development team in a bank is currently developing forecasting models for the retail portfolio. They are constructing an economic indicator function based on macroeconomic variables to support forecasting for multiple purposes.

The economic indicator (EI) function is as follows:

$$EI_t = w_1 \cdot \widetilde{GDP}_{t-3} + w_2 \cdot \widetilde{PPI}_t + w_3 \cdot \widetilde{RIR}_{t-1}$$

where:

w_1, w_2, w_3 represent calibrated weight parameters

$\widetilde{GDP}_{t-3}$ is the standardised variable for the Gross Domestic Product (GDP), with a 3 quarter lag.

$\widetilde{PPI}_t$ is the standardised variable for the Property Price Index (PPI), with no lag.

$\widetilde{RIR}_{t-1}$ is the standardised variable for the Reference Interest Rate (RIR), with a 1 quarter lag.

The interpretation of the function is that a positive value of EI represents an improving economy, and a negative value represents a declining economy.

A variable (Y) is standardised by using the formula, where the mean and standard deviation are obtained from historical observations:

$$\tilde{Y}_t = \frac{Y_t - \text{mean}(Y)}{\text{standard deviation}(Y)}$$

The values of the macroeconomic factors and the relevant parameters are shown in the table below, together with a forecasted scenario.

		GDP	PPI	RIR
mean		240 000	100	10.0%
standard deviation		120 000	105	5.0%
weights		w1 = +0.7	w2 = +0.5	w3 = - 0.5
Historic values	t-4	255 000	122	10.25%
	t-3	246 000	130	10.25%
	t-2	248 000	112	10.25%
	t-1	250 000	115	10.25%
Forecasted scenario	t	230 000	112	9.50%
	t+1	220 000	108	8.50%
	t+2	210 000	98	7.50%
	t+3	208 000	95	8.00%

The forecast shown above represents a severe scenario over the next 12 months in which the central bank reduces interest rates to assist the general economy, while GDP and PPI drop sharply.

The team suggests that this economic indicator model could be used to forecast credit risk impacts for all products in the retail book. The retail portfolio includes: Credit Cards, Unsecured Personal Loans and Home Loans.

- i. Comment on the suitability of the economic indicator function, including its components, for this purpose.

[6]

- The variables GDP, PPI and RIR are expected have an impact on a retail portfolio.
- In a retail portfolio, the lags could be shorter or longer depending on the portfolio and particular economic variable.
- The variables GDP and PPI are expected a positive impact, and an increase in RIR is expected to have a negative impact on the economy. This is seen in the signs of the weights.
- The weights suggest that PPI and RIR have the similar absolute impact. It could be the case that RIR impacts the retail portfolio to a larger extent and should have a larger weight assigned to it.

Any reasonable comment on weights and signs

- The GDP at 3 quarter lag seems reasonable as the changes in GDP will be felt later. The lags on GDP are longer than on RIR and PPI, which also seem reasonable.
- The 1 quarter lag on RIR seems reasonable as most pricing on retail is variable and is expected to impact the quickest.

- The PPI variable seems to be a quicker impact which may be faster than expected for a retail portfolio.

Any reasonable comment on lags

- The team has decided to use the same function for all the products: secured and unsecured. The same function may not be appropriate for this purpose.
- For example, PPI is expected to impact the secured portfolio directly, more than that of credit cards or personal loans.
- Lags are also expected to be different for these different portfolios.
- For example, personal loans may be impacted first in a worsening environment and only thereafter credit cards.
- There may be more appropriate economic variables to use for these specific portfolios.
- For example, debt-to-disposable income may be a more appropriate variable for unsecured products.
- There could be sub-segments of a particular product which could have different relationship to macroeconomic variables.

Any reasonable comment on appropriateness

- ii. Calculate the economic indicator function values over the forecast period for the scenario provided, and comment on the results.

[6]

- The first step will be to calculate the standardised variables of GDP, PPI and RIR.
- The next step will be to apply the relevant weights and lags to the standardised variables to produce the EI output at each forecast period.

$$EI_t = 0.7 \times \widetilde{GDP}_{t-3} + 0.5 \times \widetilde{PPI}_t + (-0.5) \times \widetilde{RIR}_{t-1}$$

	$\widetilde{GDP}_t = \frac{Y_t - 240000}{120000}$	$\widetilde{PPI}_t = \frac{Y_t - 100}{105}$	$\widetilde{RIR}_t = \frac{Y_t - 10\%}{5\%}$	EI_t
t-4	0.13	0.21	0.05	

t-3	0.05	0.29	0.05	
t-2	0.07	0.11	0.05	
t-1	0.08	0.14	0.05	
t	-0.08	0.11	-0.10	0.07
t+1	-0.17	0.08	-0.30	0.13
t+2	-0.25	-0.02	-0.50	0.20
t+3	-0.27	-0.05	-0.40	0.17

Comment

- The EI steadily increases over the periods.
- The EI seems to improve over the scenario, rather than decline.
- The EI does not move largely into a negative number.
- Given that a negative EI is a declining economy, one would have expected it to be negative at some point during the forecast.
- The EI output does not match the scenario narrative.
- GDP and PPI reflect a declining economy in the forecast, whereas the RIR looks to improve the overall EI.
- RIR seems to outweigh the other variables and may be inappropriate to use in this particular scenario.

If no comment then max 5 marks only.

- iii. The CFO has commented that the model is not producing the desired output when applied to the portfolio over the forecasted scenario. Suggest reasons as to why this may be the case.

[4]

- The model is possibly not producing an extreme output over the forecast period as expected by the CFO.
- This could be due to one or multiple factors including: model parameters, forecasted parameters and application of the economic function.
- The CFO may be expecting different impacts on the different portfolios, and one function would not give the variation expected.
- The model was possibly not calibrated for extreme scenarios and hence the usefulness is reduced, which could also be due to incorrect variables or weights applied.
- The lags on the particular variables may prevent the full impact of the scenario crystalising over the forecast period.
- The economic variables themselves may not behaving as expected over a stressed scenario and therefore giving counter-intuitive results.
- It is unclear as to how this economic indicator function actually translates into overall results that the CFO checks. It may be the case that the process that translates the function into results may not be working correctly.

- This is quite evident in this scenario that interest rates are falling, and this usually signals an improvement in the performance of a credit portfolio. This then becomes a difficult exercise as the model is calibrated to expect a decrease in interest rates as an improving economy.

iv. Describe briefly some suggestions that you could put forward to the CFO to meet her current needs, given that the current model is not producing the desired output.

[6]

- Use different formulations of the economic indicator function if available.
- This could be different combinations of: variables, lags and weights variables. Care should be taken in that valid model formulations be used.
- A model without variables giving counter-intuitive results should be tested.
- Possibly test the impact of removing the interest rate variable from the model and compare results.
- The model team could consider checking if other similar economic forecasting models are used in the bank, for example forward looking economic models for IFRS9. These models could assist in benchmarking the output.
- The CFO could look at previous stress testing exercises outputs to assist with extreme scenario formulation.
- The team could consider comparing a previous extreme scenario of actual performance of the portfolio and use this to infer results to the forecasted scenario.
- The CFO could look at external assistance: e.g. auditors or consultants to benchmark what has been done in the market.
- As this is an extreme scenario, the model team could look at overlaying results from other types of models including output from Economic Capital models. For example, credit risk economic capital may assist in observing credit loss distributions.
- The scenario is not a typical debt cycle scenario where rates go up to curb high inflation. So, there is some other reason for this scenario that the normal model would not capture. This results in considerable scope for judgmental overlays to adjust the blind-spots of the model in this scenario.
- The team should consider using expert judgment into the final outputs. This could include a panel of internal experts on their respective products.
- A combination of various approaches would ultimately assist the CFO.

This question was generally poorly answered given the analytical nature of the question and the number of available points a candidate could generate to answer parts (i), (iii) and (iv).

Part (i) was generally poorly answered given the amount of valid points on offer. Many candidates did not comment on the weights and lags of the variables. Several candidates also did not appreciate that using a single function for secured and unsecured products may not be appropriate.

Part (ii) was answered generally well with marks for workings available. A number of candidates managed to score full marks on this part. Some candidates did not take note of the variable standardisation required and missed out on some marks.

Part (iii) was poorly answered. Many candidates did not consider that the model may have not been built to handle extreme/severe scenarios.

Part (iv) was generally poorly answered. Many failed to generate enough points for the marks on offer. Candidates failed to suggest testing alternative model formulations or to consider other models used in the bank which provide forecasting (e.g. IFRS9 or stress testing models).

QUESTION 4

- i. Define the following in the context of banking: liquidity risk and the Liquidity Coverage Ratio (LCR).

[3]

- Liquidity risk is the uncertainty in meeting, or not meeting, all the obligations when they become due, or being unable to do so without unacceptable losses.
- LCR is defined as:

$$\frac{\text{Stock of High Quality Liquid Assets (HQLA)}}{\text{Total net cash flows over the next 30 days}}$$

- The LCR ratio is normally required to be greater than 100%.
- High quality liquid assets (HQLA) are defined as assets that can be easily converted and immediately in private markets into cash at no (or little) loss of value to meet the liquidity needs of the bank.
- Total net cash outflows are defined as the total expected cash outflows minus total expected cash inflows in the specified stress scenario for the subsequent 30 calendar days.

- ii. Outline reasons as to why corporate deposits usually have a higher outflow rate assumption than compared to retail deposits in the LCR computation.

[4]

- Corporate depositors are seen as more sophisticated and can quickly move money around when there are signs of trouble.
- Corporate depositors usually have the ability to move large amounts of money quickly.
- Their transfer limits are usually much larger than retail depositors.
- Retail customers may face greater challenges with limits such as: daily limits, overall transfer limits depending on the account.
- Retail customers don't usually have multiple bank accounts (or similar) to move out of one bank to another institution. Corporates are usually multi-banked.
- Generally, only a small proportion of retail customers are considered sophisticated (e.g. high net-worth) and able to move money around quickly. With changes to access in technology this is now not necessarily the case.
- In some regions retail deposits are secured by deposit insurance and therefore retail customers are more protected than compared to corporates.
- Many retail customers have balances below the deposit safety threshold and therefore may not consider taking out their money quickly.
- LCR looks at outflows in times of economic stress, hence higher values required for prudence.
- In times of stress, corporates may need to utilise their funds for ongoing expenses at a faster rate than retail customers.

A bank's assets, liabilities and equity (in local dollar currency) are shown in the balance sheet below.

Assets	(L\$ million)	Liabilities and Equity	(L\$ million)
Retail loans	900	Retail deposits (stable)	500
		Retail deposits (non-stable)	850
SME (small business) loans	350	Retail term deposits (> 3 months)	100
High Quality Liquid Assets		SME (small business) deposits	100
-- Cash	100		
-- Domestic sovereign debt securities	100	Non-financial corporate deposits	50
-- Qualifying corporate debt securities	50		
Other assets	300	Equity	200
Total Assets	1 800	Total Liabilities and Equity	1 800

- iii. The liquidity measurement team is planning on drafting an estimate of the LCR. In the next 30 days, the Bank is expecting L\$ 50m in contractually due loan repayments from fully performing retail and non-financial corporate customers, and L\$ 10m from the central bank. Given this information, and stating any assumptions made with respect to LCR factors, calculate the LCR for the bank.

[5]

Table of assumptions (*one of many possible*):

HQLA	Haircut factor	Outflows	Outflow factor
Cash	0% (only)	Retail deposits (stable)	5%
Domestic sovereign debt securities	0% (only)	Retail deposits (non-stable)	10%
Qualifying Corporate debt securities	15%	Retail term deposit (> 3 months)	0% (only)
		SME (small business) deposits	10%
Inflows	Inflow factor	Non-financial corporate deposits	40%
Retail/Corporate loan	50%		
Central bank	100%		

$$\text{HQLA} = 100 \times 100\% + 100 \times 100\% + 50 \times (1 - 15\%) = 242.5$$

$$\text{Outflows} = 500 \times 5\% + 850 \times 10\% + 100 \times 0\% + 100 \times 10\% + 50 \times 40\% = 140$$

$$\text{Inflows} = 50 \times 50\% + 10 \times 100\% = 35$$

$$\text{LCR} = \frac{242.5}{140 - 35} = 231\%$$

Generally good attempts at the calculation. A range of possible solutions were accepted. Some candidates made additional assumptions such as: equity outflows and some term deposits maturing, and credit was given for these assumptions.

- iv. The CFO of the bank has suggested that maintaining an LCR ratio over 150% is not optimal for the bank. Briefly discuss this comment.

[4]

- Consistently targeting an LCR above the regulatory 100% could be a sign of strong liquidity risk management.
- A target above the minimum should be received positively from stakeholders such as: shareholders, creditors, bank customers and the regulator.
- The additional buffer may be well received during further stress testing exercises, such as recovery and resolution planning exercises.
- There is an opportunity cost of holding HQLA, these funds could be utilised for other purposes.
- It could be the case that the bank could derive better returns by utilising other assets instead of holding HQLA.
- The return on HQLA is expected to be minimal as these should be low risk and highly liquid assets.
- A bank's net interest margin could be eroded when the return on HQLA is lower than the cost of holding deposits.
- The RORWA or ROE of the bank could improve if assets held under HQLA have lower risk weights associated with it.
- If competitors are holding LCR of above 150%, it may be prudent to keep it at a similar level. This could be due to a possible expected stressed outlook for the economy.
- It could be a sign that the net cash outflows (denominator) is not optimal. For example, holding longer term deposits, which have a lower outflow, actually increase the cost of funding overall.

- v. Describe three other liquidity risk metrics that are often used in a bank's liquidity risk function.

[6]

Loan to deposit ratio (LDR)

- It measures the relationship between lending and customer deposits over the same defined period, and is a measure of the self-sustainability of the bank (or the branch or subsidiary) or otherwise the reliance on wholesale funding.
- Generally, a limit of between 85% and 95% represents business best practice.
- This will vary depending on the particular business model and risk-tolerance of the individual bank and country it is operating within.

Liquidity Risk Factor

- The liquidity risk factor (LRF) measure is a static snapshot which shows the aggregate size of the liquidity gap, i.e. it compares the average tenor of assets to the average tenor of liabilities.
- The average is calculated as a weighted average of either (or both) the behavioural and contractual tenors, weighted by nominal amounts or (where appropriate) actual drawn balances.
- On its own, a one-off LRF number is of little value. It is important to observe the trend over time and the change to long-run averages, so as to get early warning of the build-up of a potentially unsustainable funding structure.

Concentration report and funding source report

- This report shows the extent of reliance on a single source of funds. An excess concentration to any one lender, sector, or country is an early-warning sign of potential stress points in the event of a crash.
- Banks should not become over-reliant on any one source of funds. Outside the retail deposit sector, they should be wary of excessive reliance on one class of depositor.
- Most banks would set a single-customer, or sub-group deposit limit that it would need to manage.

Net stable funding ratio (NSFR)

- NSFR requires banks to maintain a stable funding profile in relation to the composition of their assets and off-balance-sheet activities.
- The NSFR promotes funding stability and seeks that banks diversify their funding sources and limit their dependency on short-term wholesale markets.

$$\frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} > 100\%$$

- Available stable funding (ASF) is measured based on broad characteristics of the relative stability of an institution's funding sources.
- Required stable funding (RSF) is measured based on the broad characteristics of the liquidity risk profile of an institution's assets and off-balance-sheet exposures.

Any other relevant liquidity risk measure was considered.

This question was generally answered well, with better prepared candidates being able to apply bookwork concepts.

Part (i) was generally answered well as it was bookwork. A large number of candidates failed to define the numerator and denominator of the LCR.

Part (ii) was answered generally well as it was adapted from bookwork. Better candidates were able to contrast behaviours of retail and non-retail customers, including the possible role of deposit insurance for retail customers.

Part (iii) was answered well as there were marks available for providing assumptions made. Better candidates set out each component and stated assumptions clearly.

Part (iv) was generally well answered. Candidates were able to relate a higher LCR to lower return assets and opportunity costs for the bank.

Part (v) was answered well considering it was bookwork.

QUESTION 5

BigBank is one of the largest multinational banks globally. BigBank's management believe that there are opportunities for further expansion either through organic growth or through the acquisition of other banks, especially as some of their competitors are exiting certain markets.

- i. Outline the considerations to take into account when choosing which market(s) to expand into.

[9]

There are several considerations that would need to be taken into account:

- Availability of Banks / Portfolios for acquisition:
 - The first consideration would be to perform an assessment of whether there are any known M&A opportunities.
 - In some instances, these are announced publicly, and in other instances, it may be handed discreetly until the deal is nearly finalised.
 - The list of potential options would inform the choice of potential markets for BigBank to expand into.
- The bank's overall approach to business growth needs to be considered (in terms of why the bank is considering to expand into other markets):
 - If this is for diversification benefits it is important to understand exactly why. For instance, if it is to move into a currency / economy that will react differently to that of its current operations during economic stresses, then ideally one would look to select markets with the least correlation to the current markets of operations (in these specific metrics).
 - If it is to further grow the bank and brand (as perhaps the market is saturated), then the consideration may turn to how big those banking markets are, how competitive they are, how easily you can get into the markets etc. as the goal is more centred around growth specifically and less focused on diversifying some of the country specific risk out of your operations.
 - The relative levels of profitability of the banks within the markets or regions need to be considered (e.g. ROE, ROA)
 - Consideration also needs to be given to public perception of entering certain markets / regions.
 - BigBank may have an availability of excess capital and so would consider options which may maximise returns via expansion.
- Local legislation / regulations / tax within the regions in question:
 - The bank needs to gain an understanding with respect to general compliance / regulatory requirements (e.g. Credit Acts) to ensure it abides by these regulations in each territory. It is also important to understand if any are prohibitive regulations in place that will make trading challenging.

- Will the Regulators in these markets allow international banks to join the market, and what restrictions will they have in place for non-local banks (including ensuring this will not result in anti-competitive outcomes)? This may be a function of the political situation within the country and how protective of the country is of its local banks and market.
- Will BigBank require approval from its current regulator at a Group level to allow the acquisition or venture in new territories (as this may put some additional capital strain on the bank overall)?
- Do countries have policies to attract foreign direct investment in banks?
- Given that BigBank is a large multinational, it is likely familiar dealing with a range of different requirements.
- Political situation in the territories:
 - Ideally BigBank would want to expand into markets and regions with a stable political situation, as well as an outlook that is stable. This is also important to rating agencies in the rating assessment of banks
 - BigBank would also need to consider the reputational impacts (on its overall brand) of expanding into a specific country (for instance expanding into a region with human rights abuses could be seen as the bank aligning itself or agreeing with these practices). This could have negative impact on the bank's existing business model.
- Macroeconomic situation of the markets in question:
 - Both the current economic situation as well as the outlook over the medium to long term should be analysed.
 - This includes understanding what the economic strengths of the country are, and how much they rely on specific industries (especially if the country is highly dependent on just a few industries as this increases the risk of future economic challenges – concentration risk).
- Level of competition within those markets:
 - Ideally BigBank must understand the number of competitors within the local markets (their relative sizes and expertise) to understand who and what they would be competing against should they enter those markets.
- The size of the local market:
 - Need to understand the numbers of customers, total value of the market, how much of an unbanked or underbanked market there is in order to understand the opportunity / potential of the market.
 - Also need to consider the potential to make inroads into the local market, especially if it is already saturated with respect to the number of local banks in place (unless the bank plans to buy one of them).
- The ability of the bank to enter market:

- Will the bank be able to purchase a local bank (cost / available equity wise, can the bank raise additional funding for this if required)?
- If so, are there any worth looking into in any of the territories (right size, product mix, level of exposure)
- If not, will the bank have the ability to enter the market by starting from scratch.
- What was the experience of other banks trying to enter the market?
- Funding requirements and Operational costs:
 - The bank needs to consider how it would fund such a venture. Is there free capital available, and how much (as this will determine exactly what limitations there are in terms of the opportunities the bank can explore)
 - And if not, does the bank wish to raise funding in the market
 - Significant investment in data and systems may be required.
- Capital requirements
 - BigBank needs to determine under which capital regime the different territories and banks currently operate (e.g. Basel II / Basel III) as this will assist in understanding the additional capital required within those territories and if this will impact the overall regulatory framework under which BigBank has to operate
 - There may be some diversification benefits between the countries (low correlation in economic performance for instance) which will allow overall capital benefits.
- There may be different reporting requirements within the countries in question, and this could complicate the aggregation of the group's financials. For example, compliance with IFRS9 provisioning methodologies.
- There would need to be a full due diligence performed on any available institutions to understand both the price and the quality of the potential purchase.
- However, if an organic approach is followed, expansion will move slower and would require a detailed business case.
- Language and availability of staff. As BigBank is already a large multinational, it is likely familiar with operating in different markets, and aware of the need to be able to employ local staff. There may be challenges associated with the availability of skills in certain markets, which would matter to a greater or lesser extent depending on BigBank's approach (organic growth or acquisition).

After careful consideration the BigBank decides to expand into Country B, through acquisition of a local bank. There are only four banks operating in Country B. The target bank currently provides the following products: Transactional Accounts (Retail and Business Current Accounts) and Unsecured

Loans. The market share of the target Bank within the local market (share of advances and profit share per product as a percentage of the whole industry) is as provided below:

Market Share for Target Bank as a % of whole industry		
Product	Loans and Advances	Profit
Transactional Accounts	45%	30%
<i>Retail</i>	55%	25%
<i>Business</i>	40%	40%
Unsecured Loans	25%	10%

The bank's profits are split between the products in the following proportions:

Product	Target Bank Share of Profit after Tax
Transactional Accounts	80%
<i>Retail</i>	40%
<i>Business</i>	40%
Unsecured Loans	20%

ii. Discuss the considerations in purchasing this specific bank.

[10]

- The bank being purchased is not a “full-service bank” in the sense that there are no Credit Card, Vehicle Finance, Overdrafts or Mortgages books. It also seems to have limited exposure to the Commercial / Corporate banking segments.
- Therefore, the purchase will not have the advantages of being diversified across all products and does not have the advantages of having some element of collateralised products. The entire book is unsecured (from a lending perspective)
- However, BigBank is buying into an institution that has a large number of Transactional) Accounts (45% of total market share in Country B) which means there is a decent customer base with which the bank can look to sell into should the bank decide to enter the other product markets.
- Transactional / Current Accounts typically have fairly large “lazy deposits” attached to them, which means in purchasing this bank there is already some level of self-funding that comes along with it.
- If the bank does wish to compete with the other banks with their missing products it will have to ensure it can develop / purchase / adapt systems to allow for these missing products.
- This comes with its own challenges in the sense that the bank would be starting “from scratch” in the market if it wished to enter this part of the market (from a branding perspective)
- However, given that BigBank is a large multinational operating in a number of markets, it is likely that it has existing products and infrastructure available that could be leveraged to expand their product offering of the target bank in Country B.

- Market shares of products:
 - This bank has a large market share in the Transactional / Current Accounts space (45% of the overall market).
 - A potential concern with a large market share is that it poses some concentration risk and represents limited additional growth potential.
 - Retail Transactional Accounts make up 55% of loans and advances in terms of overall market share.
 - The Business Banking Transactional Accounts segment makes up 40% of loans and advances in terms of overall market share.
 - Given the lower levels of market share in Unsecured Loans, this indicates growth opportunity (25% of loans and advances), however in lower yielding business lines (10% of profit).
 - Overall the target bank appears relatively well diversified across the three products (although largely transactional products and hence not well diversified across all potential banking product types).

- Profitability of the products currently on book:
 - The relative profitability of Transactional / Current Accounts is 30% of the total market.
 - The target bank relies on the Transactional Accounts segment to generate 80% of its overall profits.
 - Transactional Accounts for the Retail segment appears to have a disproportionate market share in terms of loans and advances (55%), however only takes up 25% of the total profit in the market. This may indicate that their Transactional Retail product is priced lower, e.g. to target lower income clients, or that they are pricing very competitively to grow market share.
 - Presuming that they are still making profit per client, their low pricing (e.g. free bank accounts) may not be a concern. Especially since they are capturing 25% of the entire country's profit from that segment, in a country where there are four banks with significant market share to compete with.
 - Also retail bank accounts are very sticky, so they may have scope to increase certain fees if necessary, without losing too many clients to competitors.
 - This could mean that there is potential to tweak the strategy for either more profitability (by pricing up but this will be at the expense of market share) or differentiating the product more (on risk for instance) to improve the ROEs (as there is plenty of business on the books).
 - Transactional Accounts for Business Banking looks to have a proportionate market share and profit share as a percentage of the total market. This indicates that the product is likely performing well.

- There is also a risk that if the competitor banks start pricing similarly or more competitively, or improve processes to match the target's, then there is a risk of both losing market share and some level of profitability (in absolute terms).
 - The unsecured loans product appears to be of concern. The bank has a proportional market share (25% given there are 4 large banks), however the profit share is particularly low (at only 10%). This could be as a result of several things:
 - Could have been the strategy to grow the book, pricing highly competitively, to grow market share.
 - There may be issues with the loan application process in that too many customers are accepted on unprofitable terms.
 - Unsecured Loans contribute 20% of the target's overall profits.
- Given that there are 4 banks in Country B, and that the target bank makes up 45% of Transactional Accounts, it could be that the target bank may be a fairly large retail bank, and hence pricing for acquisition could be a concern.
 - The bank being purchased has a relatively large reliance on the Transactional and Business Cheque products for its total profitability (80%).
 - It would be good for the bank to look to diversify its product offering as long-term profit growth and stability will be improved the more sources of income the bank has.

This question was generally answered well.

Part (i) was answered well. Many candidates were able to provide a large number of relevant considerations in the context of BigBank. Weaker candidates only listed some high-level explanations. Candidates would have been able to draw upon prior experience (e.g. subject A311 Actuarial Risk Management [CP1 Actuarial Practice]) to provide potential solutions.

Part (ii) was poorly answered, with some candidates appearing to have run out of time. Candidates did not write a sufficient number points for the marks on offer. Better candidates made reference to the information provided in the question and were able to infer specific considerations.