



澳門金融管理局  
AUTORIDADE MONETÁRIA DE MACAU

## Appendix 1

### Sources and Effects of Interest Rate Risk

(extracted from Basel Committee on Banking Supervision's paper "Principles for the Management and Supervision of Interest Rate Risk")

#### **A. Sources of interest rate risk**

13. Repricing risk: As financial intermediaries, banks encounter interest rate risk in several ways. The primary and most often discussed form of interest rate risk arises from timing differences in the maturity (for fixed-rate) and repricing (for floating-rate) of bank assets, liabilities, and OBS positions. While such repricing mismatches are fundamental to the business of banking, they can expose a bank's income and underlying economic value to unanticipated fluctuations as interest rates vary. For instance, a bank that funded a long-term fixed-rate loan with a short-term deposit could face a decline in both the future income arising from the position and its underlying value if interest rates increase. These declines arise because the cash flows on the loan are fixed over its lifetime, while the interest paid on the funding is variable, and increases after the short-term deposit matures.
14. Yield curve risk: Repricing mismatches can also expose a bank to changes in the slope and shape of the yield curve. Yield curve risk arises when unanticipated shifts of the yield curve have adverse effects on a bank's income or underlying economic value. For instance, the underlying economic value of a long position in 10-year government bonds hedged by a short position in 5-year government notes could decline sharply if the yield curve steepens, even if the position is hedged against parallel movements in the yield curve.
15. Basis risk: Another important source of interest rate risk, commonly referred to as basis risk, arises from imperfect correlation in the adjustment of the rates earned and paid on different instruments with otherwise similar repricing characteristics. When interest rates change, these differences can give rise to unexpected changes in the cash flows and earnings spread between assets, liabilities and OBS instruments of similar maturities or repricing frequencies. For example, a strategy of funding a one-year loan that reprices monthly based on the one-month US Treasury bill rate, with a one-year deposit that reprices monthly based on one-month LIBOR, exposes the institution to the risk that the spread between the two index rates may change unexpectedly.
16. Optionality: An additional and increasingly important source of interest rate risk arises from the options embedded in many bank assets, liabilities, and



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OBS portfolios. Formally, an option provides the holder the right, but not the obligation, to buy, sell, or in some manner alter the cash flow of an instrument or financial contract. Options may be stand-alone instruments such as exchange-traded options and over-the-counter (OTC) contracts, or they may be embedded within otherwise standard instruments. While banks use exchange-traded and OTC options in both trading and non-trading accounts, instruments with embedded options are generally more important in non-trading activities. Examples of instruments with embedded options include various types of bonds and notes with call or put provisions, loans which give borrowers the right to prepay balances, and various types of non-maturity deposit instruments which give depositors the right to withdraw funds at any time, often without any penalties. If not adequately managed, the asymmetrical payoff characteristics of instruments with optionality features can pose significant risk particularly to those who sell them, since the options held, both explicit and embedded, are generally exercised to the advantage of the holder and the disadvantage of the seller. Moreover, an increasing array of options can involve significant leverage which can magnify the influences (both negative and positive) of option positions on the financial condition of the firm.

## **B. Effects of interest rate risk**

17. As the discussion above suggests, changes in interest rates can have adverse effects both on a bank's earnings and its economic value. This has given rise to two separate, but complementary, perspectives for assessing a bank's interest rate risk exposure.
18. Earnings perspective: In the earnings perspective, the focus of analysis is the impact of changes in interest rates on accrual or reported earnings. This is the traditional approach to interest rate risk assessment taken by many banks. Variation in earnings is an important focal point for interest rate risk analysis because reduced earnings or outright losses can threaten the financial stability of an institution by undermining its capital adequacy and by reducing market confidence.
19. In this regard, the component of earnings that has traditionally received the most attention is net interest income (i.e. the difference between total interest income and total interest expense). This focus reflects both the importance of net interest income in banks' overall earnings and its direct and easily understood link to changes in interest rates. However, as banks have expanded increasingly into activities that generate fee-based and other non-interest income, a broader focus on overall net income - incorporating both interest and non-interest income and expenses - has become more common. Non-interest income arising from many activities, such as loan servicing and



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various asset securitization programs, can be highly sensitive to, and have complex relationships with, market interest rates. For example, some banks provide the servicing and loan administration function for mortgage loan pools in return for a fee based on the volume of assets it administers. When interest rates fall, the servicing bank may experience a decline in its fee income as the underlying mortgages prepay. In addition, even traditional sources of non-interest income such as transaction processing fees are becoming more interest rate sensitive. This increased sensitivity has led both bank management and supervisors to take a broader view of the potential effects of changes in market interest rates on bank earnings and to increasingly factor these broader effects into their estimated earnings under different interest rate environments.

20. Economic value perspective: Variation in market interest rates can also affect the economic value of a bank's assets, liabilities, and OBS positions. Thus, the sensitivity of a bank's economic value to fluctuations in interest rates is a particularly important consideration of shareholders, management, and supervisors alike. The economic value of an instrument represents an assessment of the present value of its expected net cash flows, discounted to reflect market rates. By extension, the economic value of a bank can be viewed as the present value of the bank's expected net cash flows, defined as the expected cash flows on assets minus the expected cash flows on liabilities plus the expected net cash flows on OBS positions. In this sense, the economic value perspective reflects one view of the sensitivity of the net worth of the bank to fluctuations in interest rates.
21. Since the economic value perspective considers the potential impact of interest rate changes on the present value of all future cash flows, it provides a more comprehensive view of the potential long-term effects of changes in interest rates than is offered by the earnings perspective. This comprehensive view is important since changes in near-term earnings – the typical focus of the earnings perspective – may not provide an accurate indication of the impact of interest rate movements on the bank's overall positions.
22. Embedded losses: The earnings and economic value perspectives discussed thus far focus on how future changes in interest rates may affect a bank's financial performance. When evaluating the level of interest rate risk it is willing and able to assume, a bank should also consider the impact that past interest rates may have on future performance. In particular, instruments that are not marked to market may already contain embedded gains or losses due to past rate movements. These gains or losses may be reflected over time in the bank's earnings. For example, a long-term, fixed-rate loan entered into when interest rates were low and refunded more recently with liabilities bearing a higher rate of interest will, over its remaining life, represent a drain on the bank's resources.