

8. Financial Markets

Introduction

8.1 This chapter covers market-based FSIs required for assessing the health of the financial system. The chapter is divided into two sections: interest rate and securities market indicators. The interest rate FSIs provide information on the interest rates charged by and to deposit takers, thus providing an indication of profitability and competitiveness in the banking sector, along with information on the spread in interbank rates that can provide early indications of credit risk concerns among deposit takers. The securities market FSIs provide information on the liquidity of the securities markets in which deposit takers are active and on which they can partially rely to help manage their liquidity.

Interest Rates

Introduction

8.2 To support the monitoring of the financial health and soundness of deposit takers, the *Guide* encourages the compilation of the following two interest-rate-based FSIs: (1) the spread between reference lending and deposit rates (SLDR), and (2) the spread between the highest and lowest interbank rate (SIR).

8.3 Spreads between lending and deposit rates can serve as indicators of trends in deposit takers' net interest income, and hence of *profitability*. The interest rate spread can also provide information on deposit takers' *pricing behavior*. However, further information would be required to understand the causes of behavior: for instance, wide spreads may arise from high risk due to underdeveloped collateral systems or weak protection by the judicial system, while widening spreads over time might reflect increased risk premiums rather than a lessening of competitive pressures.

8.4 Interest rate spreads, such as those between borrowers with different credit risk profiles, can serve to indicate the level of *perceived risk* within the financial system. Therefore, the spread between the highest and lowest interbank rates would help to capture banks' *own* perception of problems and risks facing banks with access to the interbank market.¹

Measuring the Spread Between Reference Lending and Deposit Rates

8.5 There is no standard definition of reference or representative rates. To measure the SLDR, the *Guide* recommends at a minimum the calculation of the weighted average of all lending and deposit interest rates on loans and deposits (excluding loans and deposits among deposit takers) during a reference period in the portfolio of resident deposit takers. The interest rate spread could also be calculated on a domestically controlled, cross-border consolidated basis, thus providing an indication of profitability, but it would be reflecting activity in different markets. Using loan and deposit amounts as weights, the spread between the weighted average lending and deposit rates gives the *overall interest spread* (in basis points) between loans and deposits.

8.6 Loans and deposits among deposit takers are excluded because the focus of this FSI is on the profitability of the deposit-taking sector as a whole and on its pricing behavior in intermediating the savings of other sectors. While the *Guide* recommends compilation of an aggregate interest rate spread at a minimum, more disaggregated information on spreads

¹In discussions on the draft *Guide*, it was suggested that other measures of deposit takers' credit risk could be monitored, including spreads of bank paper over sovereign debt and spreads on subordinated debt. See also Gropp, Vesala, and Vulpes (2002). The credit derivatives market is also a potential source of market information on the credit risk of individual entities. Such measures go beyond the agreed FSIs.

could be compiled as needed, such as for nonfinancial corporations and households.

8.7 A method of calculating the weighted average lending rate is to divide the accrued amount of interest income on loans reported by deposit takers for a given period (numerator) by the average position of loans (denominator) for the same period. The weighted average deposit rate can be computed by dividing interest expense on deposits (numerator) by the average position of deposits (denominator) for the same period.² Positions should be averaged using the most frequent observations available.

8.8 In principle, using this method, the weighted average interest rate for a portfolio of n loans (types of deposits) can be constructed as follows:³

$$\text{Weighted average interest rate} = \sum_{i=1}^n R_i L_i / \left(\sum_{t=0}^T S_t / T \right),$$

where R_i = interest rate for Loan i that is outstanding during the period,⁴

L_i = loan i ,

S_t = stock of loans observed at time t , and

T = total number of observations during the period.

8.9 This method of calculation could minimize the reporting burden on deposit takers if data on accrued amounts of interest on loans and deposits are readily available from the accounting systems of deposit takers, as typically data on deposit takers' positions in loans and deposits are regularly reported to central banks in balance sheet reports required for the compilation of monetary statistics.⁵ Compilers need to

²Islamic instruments that are classified as deposits or loans but do not provide capital certainty or a prefixed positive return should be excluded from the denominator.

³For example, if during the period of the first quarter there are end-month observations for December (200), January (100), February (200), and March (300), then S_t is the sum of the four observations (800) and T is the number of observations (4), so the denominator in the equation would be $800/4 = 200$.

⁴The amount of accrued interest in the numerator depends on the time over which the associated loans are outstanding. For instance, for a loan that is issued midway through the quarter, the numerator should capture accrued interest over one and one-half months only.

⁵The ideal is to have frequent observations of positions, thus matching the data in the numerator. If less frequent observations of positions are available, then the numerator may capture flows unrelated to the amounts in the denominator. If loans and/or deposits in the denominator are valued at fair value, the implicit interest rate will move in line with changes in market rates.

ensure that the numerator and the denominator cover the same set of deposit takers.

8.10 Another method of calculating average weighted interest rates for a given reference period is to use contracted interest rates (that is, price data), using the loan (deposit) amounts as weights. The weights are determined by dividing the outstanding value of each loan (type of deposit) at the end of the period by the outstanding value of all loans (deposits) at the end of the period. Two steps are involved: (1) multiply each weight (which can be derived for each loan separately or for a group of loans with the same contracted interest rate) by the contracted rate for each loan (or group of loans), and (2) sum the results to get the overall weighted interest rate. Thus, an overall average weighted interest rate can be constructed as follows:

$$\sum_{n=1}^N \left(\text{rate}_n \times \frac{\text{Value of loan}_n}{\text{Total value of loan book}} \right).$$

Key definitions

8.11 Under accrual accounting, interest costs accrue continuously on debt instruments, thus matching the cost of funds with the provision of funds. The rate at which these costs accrue is known as the interest rate, and for deposits and loans it is typically established by contractual arrangement. Interest rates may be fixed or variable. Charges such as fees that reflect payments for the provision of services should be excluded from the interest rate calculation. For compiling the SLDR, annualized interest rates should be calculated.⁶ Loans and deposits are defined in Chapter 4. The reporting population is the deposit-taking sector, as defined in Chapter 2, on a resident basis (although data could also be compiled on a domestically controlled, cross-border consolidated deposit taker basis).

End- and average-period interest rates

8.12 Average-period interest rates are more closely related to profitability and pricing behavior than end-period rates and are not subject to the possibility of exceptional daily fluctuations. However, an SLDR

⁶For instance, to produce an annualized rate, interest rates per quarter should be compounded to the power of four. So, an interest rate of 3 percent per quarter is an annualized rate of 12.55 percent, which is the result of $(1.03)^4$.

based on end-period rates, directly measured, with appropriate metadata, provides reliable information. Such a spread between lending and deposit rates would be calculated as the difference between the weighted averages of end-period interest rates for the different types of loans and the different types of deposits (that is, three-month and six-month). The weights for each type of loan and deposit would be calculated using end-period position data (see paragraph 8.10).

Outstanding and new business

8.13 The *Guide* recommends at a minimum the compilation of an SLDR for outstanding business, as this is directly related to profitability. For the purposes of this FSI, *outstanding business* is the stock of deposits placed with deposit takers and the stock of loans extended by deposit takers, excluding deposits from, and loans to, other resident deposit takers. The stock of loans is measured after specific provisions. The interest rate on outstanding business covers all business that has been agreed in all periods prior to the reference date and is still outstanding.

8.14 To reflect more closely current market developments and deposit takers' pricing behavior, rather than outstanding business, countries could also compile an SLDR for new business, particularly if the necessary data are readily available. *New business* is defined as deposits placed with deposit takers and loans extended by deposit takers during the reference period. New business includes "rolled over" or renewed loans and deposits.⁷ Interest rates on new business allow for the monitoring of deposit takers' pricing behavior in response to current financial market developments, such as changes in central bank intervention rates.

Nonperforming loans

8.15 In Chapter 4, the *Guide* recommends that interest should no longer accrue on nonperforming loans resulting in an implicit interest rate of zero. While there might be some analytical benefit in excluding NPLs from the SLDR calculation (see below), the *Guide's* preferred approach is to include such loans in the calculation. In other words, when compiling

⁷That is, an existing contract has reached its maturity, and either party could refuse to renew (roll over) the contract.

the interest rate on loans, positions in NPLs (less specific provisions)⁸ should be included in the denominator and zero interest included in the numerator. Excluding such positions would give a misleading—an overstated—indication of profitability, as it would significantly widen the spread.⁹ Indeed, movements over time in the SLDR could be analyzed with the help of data on outstanding NPLs.

8.16 However, if NPLs are significant in deposit takers' portfolios, to provide additional information on deposit takers' pricing behavior, another SLDR could be calculated that excludes the position in NPLs from the denominator in the compilation of the loan interest rate.

Lending at prescribed interest rates

8.17 In some economies, a certain amount of lending by deposit takers can be directed to priority sectors at prescribed interest rates for the purpose of economic development. As in the discussion above on NPLs, the *Guide* prefers that such loans and the interest that accrues be included in the calculation of an SLDR, because excluding such business could give a misleading indication of profitability. Nonetheless, if significant, another SLDR could be calculated that excludes such prescribed lending and the average interest rate received. In such circumstances, there may be analytical interest in information on the total amount of such lending.

Subcategorization

8.18 As noted above, while the *Guide* recommends at a minimum the compilation of the SLDR on all outstanding business (excluding among deposit takers), this SLDR could be supplemented with information on various subcategories. This is because the SLDR might change for a variety of factors, such as changes in the composition of business and the introduction of new competition, which are not apparent by considering the overall spread alone. For example, the overall interest rate spread might increase if

⁸Specific provisions have already reduced profits, as well as capital and reserves, and thus are deducted from the denominator (that is, from loans).

⁹An alternative approach, although not the preferred one, is to calculate the interest rate on loans excluding NPLs but disseminate the relative size of NPLs in the total loan portfolio. Any metadata provided with disseminated data should specify whether this is the approach taken.

(1) the sectoral concentration of loans becomes more heavily weighted toward the household sector (consumer loans) at the expense of the corporate sector, and the interest rates offered by deposit takers on consumer loans are tending to be higher than those on corporate loans, or (2) the portfolio of loans becomes more weighted toward longer-term loans, in the context of a normal yield curve. Deposit rates can be similarly affected. Indeed, only limited judgments could be drawn about the factors influencing changes in profitability and/or pricing behavior in the financial system solely from the use of the SLDR for all outstanding business.

8.19 In this context, the SLDR for all outstanding business could be supplemented with SLDRs for

- Both the nonfinancial corporations sector and the household sector;
- Both short-term and long-term (original maturity) interest rates;
- Peer groups, to ascertain the pricing behavior of different subgroups within the total resident deposit takers; or
- Both domestic and foreign currency business.

Frequency of compilation

8.20 The *Guide* recommends quarterly compilation and encourages monthly compilation. It is recognized that the accrued interest data on deposits and loans needed to compile information on average interest rates may often be reported in deposit takers' income and expense statements only on a quarterly basis.

Measuring the Spread Between the Highest and Lowest Interbank Rate

8.21 Interbank rates measure the cost of funds to deposit takers in the domestic interbank market—the cost of borrowing the excess reserves of other deposit takers. The source of these data is usually interbank dealers or brokers.

8.22 Deposit takers may be charged different rates depending on their size or financial strength. An increasing spread between the highest and lowest interbank rates could indicate an increasing risk premium being charged on the deposit taker facing the highest rate—that is, deposit takers would themselves be perceiving an increasing risk of lending within the banking system. This may be limited to the weakest deposit taker or may be more systemic in nature.

8.23 However, there can be limitations with this indicator. For instance, in an economy with government-owned deposit takers, such deposit takers might continue to obtain the best interbank rates even if they are close to being insolvent. Moreover, the framework through which central banks provide liquidity to money markets influences the overall liquidity of these markets as well as the extent to which individual banks under stress are able to maintain access to liquidity. Moreover, a single outlier can change the value of the indicator substantially.¹⁰ The specific techniques used by the central bank for market operations can also affect the spread of interbank rates, for example, the timing of interventions and the instruments used. In addition, a perceived increase in risk might also be reflected in informal limits on the quantities (rather than the price) of funds that a deposit taker could borrow in the interbank market.

8.24 Interbank rates are usually short term in nature. Since this FSI provides information on deposit takers' own perceptions of risks facing other banks, and perceptions can change very quickly, the *Guide* encourages weekly compilation of SIRs, using end-period rates for loans of the same maturity (overnight or weekly).¹¹ While the agreed FSI is a spread, there might also be analytical interest in the dissemination of the highest and lowest interest rates themselves; for instance, these rates could be compared with others in the financial markets.

Securities Markets

Introduction

8.25 Securities markets can support financial stability by diversifying the channels of financial intermediation and allowing perceived risks to be monitored on a continuous basis. For these reasons, although it goes beyond the agreed FSIs, the *Guide* encourages the compilation of securities market data, including information on the total outstanding value of resident securities market issuance, at a minimum, by sector.

8.26 However, conditions in financial markets may not always be favorable to raising funds through bor-

¹⁰Thus, it might be analytically useful to also look at the spread excluding the highest and lowest rates.

¹¹The credit derivatives market is also a potential source of market information on the credit risk of individual entities.

rowing, and experience has shown the necessity for maintaining prudent levels of liquid assets. Moreover, the liquidity of assets depends on how quickly and with what certainty they can be sold in the market. Therefore, to supplement the core indicator on the liquidity of banks' assets,¹² the *Guide* encourages the compilation of indicators on market *depth* and *tightness*.

Market depth and tightness

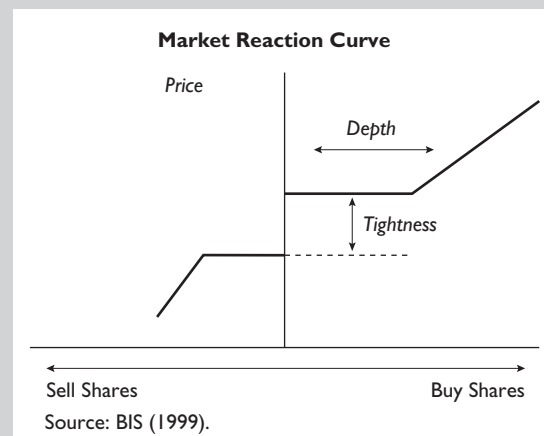
8.27 While liquidity is difficult to define, two important dimensions of it are market depth and tightness. *Market depth* relates to the ability of a market to absorb large trade volumes without a significant impact on market prices and can be proxied by the average daily turnover ratio—that is, the ratio of the average daily number of trades to the outstanding stock of securities. A higher turnover ratio typically indicates a more liquid market. *Market tightness* indicates the general cost incurred in a transaction irrespective of market price and is measured by the average bid-ask spread—that is, the difference between prices at which market participants are willing to buy (bid) and sell (ask) assets. Bid-ask spreads tend to be narrower in more liquid and efficient markets.¹³

8.28 Figure 8.1 illustrates the concepts of market depth and market tightness. The demand and supply “curves” to the left and right of the price axis represent the price a seller or buyer faces when trading various numbers of shares. A buyer of shares faces a higher price in the market than a seller of shares. Market tightness is graphically depicted by the vertical distance between the buy and sell price. The horizontal distance between the vertical axis and the demand/supply “curve” represents the depth of the market at a particular price.

¹²To further supplement the analysis of the core indicator, through an analysis of the distribution of option prices, financial derivatives markets can be a source of information on the implied probability distribution of a future asset price—that is, provide an indication of the likelihood that a particular price might be realized. For example, see Bliss and Panigirtzoglou (2002).

¹³Bid-ask spreads may reflect (1) the cost of processing orders, (2) costs arising from asymmetric information among potential transactors, (3) the cost for the dealer of holding the asset (inventory) to meet potential demand (the so-called carrying cost), and (4) oligopolistic market structure. The price volatility of the asset can also be a factor.

Figure 8.1. Market Depth and Tightness



Immediacy and resilience

8.29 In addition to market depth and tightness, other important dimensions of market liquidity include immediacy and resiliency.¹⁴ *Immediacy* represents the speed with which orders can be executed and settled, and thus reflects, among other things, the efficiency of trading, clearing, and settlement systems. *Resilience* is the speed with which price fluctuations arising from trades are dissipated or the speed with which imbalances in orders (such as more buy than sell orders, or vice versa) are reversed with new orders. In short, it is a measure of the speed by which “transitory” price movements are corrected. A measure of resilience is described in Appendix III.

Market structure

8.30 Being aware of the institutional microstructure of markets can be important when using liquidity indicators, as different structures can complicate analysis of liquidity indicators across countries, across markets in the same country, and across time.

8.31 Particularly relevant is whether a market is quote or order driven. In a *quote-driven* (dealer) market, dealers quote bid and ask prices and may take positions, while in a pure *order-driven* (auction) market, potential buyers and sellers submit orders,

¹⁴See also Sarr and Lybek (2002) for a fuller discussion of market liquidity.

and brokers or an electronic system match them in a central order book. In a quote-driven system, dealers provide immediacy and can even accommodate large orders by holding securities (inventory) to help match temporary imbalances between buyers and sellers. In a pure auction market, liquidity is supplied through limit orders¹⁵—orders placed with a broker to buy or sell a predetermined number of shares at a specified price or at a better price than the specified price. In practice, many auction markets rely on market makers¹⁶ to supply additional liquidity to the market. Bid-ask spreads and turnover during periods of stress might differ between quote- and order-driven markets.

8.32 Other market structure features that can influence liquidity include the extent of *market transparency*, such as the timing of the disclosure of traded prices and quantities, and the efficiency and cost of *clearing and settlement systems*.¹⁷

Measuring Market Depth and Tightness

8.33 Indicators of market depth and tightness can be compiled for a wide range of traded financial assets. Because of the link between market-based liquidity indicators and the indicator on deposit takers' liquid assets, turnover ratios and bid-ask spreads should, at a minimum, be compiled for financial instruments included in the wider measure of liquid assets. The natural starting point is to compile indicators for a benchmark domestic government or central bank debt security that is used by the national authorities to influence liquidity conditions in their domestic economy. Depth and tightness indicators for other securities—including equities—may also be useful, particularly if they are within the definition of liquid assets. Similarly, the depth and tightness of the local foreign exchange markets are also relevant if foreign-exchange-denominated securities qualify as liquid assets.

8.34 A breakdown of turnover and bid-ask indicators between on-the-run and off-the-run securities can also be useful in monitoring market liquidity condi-

tions.¹⁸ Empirical evidence suggests that liquidity differentials that typically exist between on-the-run and off-the-run securities may become more acute prior to and during periods of financial stress.¹⁹

8.35 Major exchanges located in the domestic economy can be used as a source of data for compiling market turnover ratios and bid-ask spreads. Other sources can include dealer associations, central banks, and commercial databases.²⁰ While high-frequency data on the volume of trades and bid-ask prices are usually available from most exchanges, it is recognized that in some economies data may be infrequently collected centrally, and regularly compiled and consistent data may be limited to certain types of securities.

8.36 To the extent that deposit takers hold securities issued by nonresidents, or hold so-called international securities that are listed on local and overseas exchanges, it is important also to monitor depth and turnover indicators for key foreign financial asset markets, especially if liquidity conditions differ across markets for the same asset.

8.37 Coverage of all market makers may not be necessary to capture trends in turnover ratios and bid-ask spreads, because in highly liquid markets price and size quotes tend to converge across market makers. Nevertheless, market liquidity can vary across assets and over time. The top five market makers, or at least those accounting for a minimum of 75 percent of market turnover, should therefore be covered. Automated electronic market making can also be covered.

8.38 While the transaction price and transaction size might be used to capture realized prices and volumes in the market, bid and ask deals may be undertaken at different times, biasing the resulting “spread.” For this reason, quoted bid-ask prices and volume data are preferred.

¹⁵Limit orders also allow an investor to limit the length of time an order can be outstanding before cancelled.

¹⁶Market makers are agents that make publicly disclosed quotes for unrelated parties.

¹⁷Sarr and Lybek (2002, p. 38), provides a list of micro- and macrofactors affecting asset and market liquidity.

¹⁸On-the-run securities are the most recently issued securities of a given original maturity. All other securities are defined as off the run.

¹⁹See, for example, Reinhart and Sack (2002) and Furfine and Remolona (2002).

²⁰Compilers who approach a commercial database vendor will need to make their own judgments about whether the product being offered meets their needs.

Turnover ratio

8.39 The *Guide* recommends that the turnover ratio for a benchmark domestic government or central bank debt security be calculated as the number of securities traded during a trading period, divided by the average of the number of securities outstanding at the beginning and the end of the trading period:

$$T_t = \frac{N_t}{[(S_t + S_{t-1})/2]},$$

where N is the number of securities traded during a given period, and S is the number of securities outstanding at the end of a given period.

8.40 The *Guide* encourages the compilation of the turnover ratio on a daily basis or, at a minimum, on a weekly basis.

8.41 While the turnover ratio might also be calculated using the value of securities traded and outstanding in a given period, such a measure could be biased by volatile movements in prices within the period. To gauge market size, information on the total value of securities outstanding on instruments for which turnover data are presented could be collected.

8.42 The number of trades executed during official trading hours of the markets should be captured in the turnover ratio.²¹

8.43 There is a lack of data on foreign exchange market turnover except for the triennial central bank survey of foreign exchange (and derivative market) activity conducted by the BIS.²² This survey defines foreign exchange turnover as the gross value of all new deals entered into during a given period, both for spot and derivative instruments, measured by the nominal value of the contracts. Information on bid-ask spreads in foreign exchange markets is more readily available.

²¹The increasing prevalence of trading outside official exchange hours, as well as the use of off-hours futures for securities, suggest that there may be an increasing need for supplemental statistics on off-hours trading, especially since liquidity conditions in those markets may differ substantially from conditions during regular trading hours.

²²The most recent survey collected data on turnover in foreign exchange markets from 48 central banks during 2001 (BIS, 2002). The BIS publication also includes the detailed methodology for the survey.

Bid-ask spread

8.44 The *Guide* is of the view that a natural starting point is the bid-ask spread on a benchmark domestic government or central bank debt security. The simplest measure of the bid-ask spread is the difference between the best (highest) bid and the best (lowest) ask price in the market. Thus, XYZ security with a best bid price of 120.375 and a best ask price of 120.5 has a bid-ask spread of 0.125. It is recommended that both the bid and ask prices be collected. To facilitate comparison of bid-ask spreads across assets of differing value, the *Guide* recommends that bid-ask spreads be expressed as a percentage of the midpoint of the bid and ask price of the asset. For example, ABC security with a bid price of 10.375 and an ask price of 10.5 has a bid-ask spread of 0.125, the same as for XYZ security. But the bid-ask spread for ABC security is larger relative to the value of the security:

- Spread for ABC security as a percentage of mid-price = $(0.125) / (10.4375)$
- = 1.20 percent of midprice.
- Spread for XYZ security as a percentage of mid-price = $(0.125) / (120.4375)$
- = 0.10 percent of midprice.

8.45 More generally, the spread as a percentage of midprice can be calculated as follows:

$$S = \{[AP - BP]/[(AP + BP)/2]\} \times 100,$$

where S is the spread, AP is the ask price, and BP is the bid price.

8.46 For traded debt securities such as bonds and bills, the bid and ask quotes can be in terms of yield rather than in terms of price. In such instances, the *Guide* recommends that the bid and ask yields be separately reported and converted into price terms so that the midpoint and spread in price can be observed. Methods of calculating bid and ask prices from yields can differ depending on the maturity of the instruments and the specific market practices for quoting yields. However, the type of information required for conversion typically includes the par value, the quoted yield, and the maturity (or for longer instruments, the duration) for the instrument. Box 8.1 provides some conversion equations and numerical examples of calculating bid and ask spreads in price terms from yields.

8.47 The number of securities that can be traded at the best bid and best ask price provides an important

Box 8.1. Converting Bid-Ask Spreads from Yield Quotes into Price Terms

For traded debt securities such as bills and bonds, this box provides numerical examples of how to convert bid and offer quotes in yield terms into price terms. These examples are illustrative; national market practices for quoting yields can differ.

Bills

On July 31, 2002, it is assumed that a bill has the following characteristics:

| Maturity | Days to Maturity | Bid Yield | Ask Yield |
|------------------|------------------|-----------|-----------|
| October 26, 2002 | 86 | 6.03 | 6.02 |

The discount yield on the bill maturing October 26 is 6.03 percent based on the bid price of the bill and 6.02 percent based on the ask price of the bill.¹ If the yields are quoted as *bank discount yields* such that

$$r_{bdy} = \frac{\text{par value} - \text{market price}}{\text{par value}} \times \frac{360}{n},$$

then rearranging the equation the market price can be computed as follows:²

$$\text{market price} = \text{par value} \times [1 - r_{bdy} \times (n/360)].$$

Using the bid and ask yields as inputs, and assuming that the par value is \$10,000, the bid and ask prices can be derived as follows:

$$\begin{aligned} \text{Bid price} &= \$10,000 \times \{1 - [0.0603 \times (86/360)]\} = \$9,855.95 \\ \text{Ask price} &= \$10,000 \times \{1 - [0.0602 \times (86/360)]\} = \$9,856.19. \end{aligned}$$

The bid-ask spread as a percentage of the midprice can be calculated as $(9,856.19 - 9,855.95)/[(9,856.19 + 9,855.95)/2] = 0.002$ percent.

If the bid and ask yields on bonds are quoted as *bond equivalent yields* rather than bank discount yields such that

$$r_{bey} = \frac{\text{par value} - \text{market price}}{\text{market price}} \times \frac{365}{n},$$

then the market price can be computed as follows:

$$\text{market price} = \frac{\text{par value}}{1 + \left(r_{bey} \times \frac{n}{365}\right)}.$$

¹The bid price is the price at which a customer can sell the bill to a dealer in the security, whereas the ask price is the price at which the customer can buy a security from a dealer.

²The local method used for calculating the bid and ask yield may differ from the discount yield method, for example, the bond equivalent yield might be used; in deriving the bid and ask prices from yields, the formula relevant to local practices should be used.

Using the bid and ask yields as inputs, and assuming that the par value is \$10,000, the bid and ask prices can be derived as follows:

$$\begin{aligned} \text{Bid price} &= \$10,000/1 + [0.0603 \times (86/365)] = 10,000/1.014207 \\ &= \$9,859.91 \\ \text{Ask price} &= \$10,000/1 + [0.0602 \times (86/365)] \\ &= 10,000/1.0141841 = \$9,860.14. \end{aligned}$$

The bid-ask spread as a percentage of the midprice is $0.22/9860.03 = 0.002$ percent.

Bonds

It is assumed that a bond has the following characteristics:

| Coupon | Original Maturity | Remaining Maturity | Par Value | Bid/ Offer |
|---------------|-------------------|--------------------|-----------|------------|
| \$60 annually | 30 years | 5 years | \$1,000 | 8.03/7.97 |

therefore the value of the bond can be written as follows:

$$\text{price} = \sum_{t=1}^T \frac{\text{coupon}}{(1+r)^t} + \frac{\text{par value}}{(1+r)^T},$$

or,

$$\text{price} = \text{coupon} \times \frac{1}{r} \left(1 - \frac{1}{(1+r)^T}\right) + \text{par value} \times \frac{1}{(1+r)^T},$$

where T is the number of periods to the maturity, and r is bid/offer interest rate for each period.

Accordingly, the bid and offer prices of the bond in the above example can be derived as follows:

$$\begin{aligned} \text{bid price} &= 60 \times \frac{1}{0.0803} \left(1 - \frac{1}{(1.0803)^5}\right) + 1,000 \\ &\times \frac{1}{(1.0803)^5} = \$919.01 \end{aligned}$$

$$\begin{aligned} \text{ask price} &= 60 \times \frac{1}{0.0797} \left(1 - \frac{1}{(1.0797)^5}\right) + 1,000 \\ &\times \frac{1}{(1.0797)^5} = \$921.28. \end{aligned}$$

The bid-ask spread as a percentage of the midprice is $2.27/920.15 = 0.25$ percent.

context for interpreting the bid-ask spread, and the *Guide* encourages the dissemination of this information along with the best bid-ask spread. In particular, any asymmetry in the number of securities that can be bought and sold at the best bid and best ask price should be monitored along with the price quotes. For example, the number of securities that a market maker is willing to sell at 120.5 might be 1,200, while the number of securities that a market maker is willing to buy at 120.375 might be 500, indicating more sell than buy pressure in the market at the quoted price. Sustained over time, such asymmetries convey useful information about the speed and certainty with which deposit takers can dispose of their liquid assets.

8.48 For consistency with the turnover ratio, the bid-ask spread should be compiled on a daily basis or, at a minimum, on a weekly basis. The frequency of price observations can be on a tick-by-tick basis, but preferably at least two quotes per day should be taken (for example at 10:30 a.m. and 2:30 p.m.). If price observations are taken on a less than hourly basis, care is needed to avoid biases related to systematic volatility of intraday price quotes. In particular, empirical work suggests that spreads are typically higher around the opening and the closing of the market, with sharp fluctuations immediately before and after the lunch break. The daily (or weekly) bid-ask spread can be computed as the average of the bid price less ask price observations during the period.

8.49 Beyond the simple measure of the best bid-ask spread described above, there are two additional ways of calculating the bid-ask spread that take into account the quantity of securities that can be traded at the quoted prices.

- A “normalized” version of the simple bid-ask spread can be calculated by taking the difference between bid and ask prices for the same or a similar quantity of securities. For example, suppose that the best sell price for XYZ securities is 120.50 for 1,200 securities. Suppose that on the bid side 1,200 XYZ securities can be sold only in two tranches as follows: 500 at 120.375 and 700 at 120.125. The “normalized” bid-ask spread is 0.271.²³

²³ $120.50 - \{[120.375 \times (500/1,200)] + [120.125 \times (700/1,200)]\} = 0.271$

- A weighted average of all bid-ask prices, not just the best in the market, can also be calculated, using the bid-ask size as weights. For example, given the following bid and ask quotes:

| Ask quotes Total ask size = 6,700 | | | Bid quotes Total bid size = 2,200 | | |
|--------------------------------------|------------|---------|--------------------------------------|------------|---------|
| Size | Percentage | Price | Size | Percentage | Price |
| 1,200 | (18) | 120.50 | 500 | (23) | 120.375 |
| 2,000 | (30) | 120.625 | 700 | (32) | 120.250 |
| 3,500 | (52) | 120.750 | 1,000 | (45) | 120.125 |

the weighted average bid-ask spread can be calculated as

$$\begin{aligned}
 & [(0.18 \times 120.50) + (0.30 \times 120.625) + (0.52 \times 120.750)] \\
 & - [(0.23 \times 120.375) + (0.32 \times 120.250) + (0.45 \times 120.125)] \\
 & = [(21.58 + 36.01 + 63.08) - (27.36 + 38.26 + 54.60)] \\
 & = (120.67 - 120.22) \\
 & = 0.45.
 \end{aligned}$$

More generally, the weighted average bid-ask spread can be calculated as

$$\sum_{n=1}^N \left[\left(\frac{AS_n}{TAS} \times AP_n \right) - \left(\frac{BS_n}{TBS} \times BP_n \right) \right],$$

where AP_n and AS_n are, respectively, the n th ask price and n th ask size; BP_n and BS_n are, respectively, the n th bid price and n th bid size; total ask size is given by $TAS = \sum_{n=1}^N AS_n$; total bid size is given by $TBS = \sum_{n=1}^N BS_n$; and N is the number of observations.

Annex. Structural Indicators for Financial Markets

8.50 In different countries, financial markets are at different stages of development, and this can affect analysis of FSIs, particularly for market-related indicators. While collection systems may not be sufficiently advanced to provide data on activity in the various types of financial markets, it may be beneficial to policymakers and analysts to be provided with some indication of the types of markets that exist and their stage of development.

Table 8.1. Stage of Development in Domestic Financial Markets for a Hypothetical Country

| | Overall Evaluation (Entries Are Illustrative) | Comments |
|---------------------------|--|----------|
| Money markets | | |
| Interbank | *** | |
| Treasury bill | ** | |
| Central bank bill | — | |
| Certificate of deposit | ** | |
| Commercial paper | * | |
| Bankers' acceptances | * | |
| Repurchase agreements | ** | |
| Securities markets | | |
| Government bonds | ** | |
| Corporate bonds | * | |
| Asset-backed securities | * | |
| Equity | ** | |
| Foreign exchange markets | | |
| Spot | *** | |
| Forward | ** | |
| Swaps | ** | |
| Other derivatives markets | | |
| Futures | * | |
| Options | * | |
| Swaps | * | |
| Other financial markets | | |
| Commodities | — | |
| ***Very important | | |
| **Important | | |
| *Exists, not important | | |
| —Nonexistent | | |

8.51 For this reason, Table 8.1 can be useful; it also goes beyond the agreed FSIs. The table is intended to provide a summary presentation of the state of development of domestic financial markets, indicating also the extent to which national authorities consider specific markets to be important. Table 8.1 provides a hypothetical example for illustrative purposes. Additional information on whether the market is order- or quote-driven could be added.

8.52 Payment system information is not covered in Table 8.1. However, an example of the type of payment system information that could be made available is provided in the so-called *Red Book* published

Table 8.2. Example of Data Request During an FSAP¹

Markets. Describe the number and nature of financial markets (provide copy of pertinent rules and regulations) and list the instruments traded.

Foreign exchange market. Local currency versus U.S. dollar (spot, forwards, and derivatives, if any).

Money market. Provide data for the following:

- Certificates of deposit with different maturities
- Repurchase agreements (repos) (including repos for intraday liquidity to support a Real Time Gross Settlement [RTGS] system)
- Treasury bills with up to one year maturity in local and foreign exchange
- Central bank bills with up to one year maturity in local and foreign exchange
- Commercial paper, if any
- Derivatives, futures, options, forward-rate agreements, and so on

Government securities market. Provide data for the following:

- Notes (1-, 2-, and 5-year), both benchmarks and off-the-runs, and indexed notes, if available
- Bonds (10-, 15-, and 30-year), both benchmarks and off-the-runs, and indexed notes, if available
- Futures and other derivatives, if available

Equities. Provide data for the following:

- The number of listed companies and total market capitalization
- Ten most traded equities
- Derivatives, futures on indexes, and so on

Data. Provide the following data on respective markets for the last three years, if available:

| | |
|--------------------|---|
| Frequency: | Daily |
| Price: | Bid and ask prices/interest rates, if available Minimum and maximum prices/interest rates during the day (or period of observation), if relevant Average prices/interest rates, where relevant Closing prices/interest rates, where relevant Market indicators (market index, if available) |
| Turnover: | Turnover during period (value per day or month) Average number of trades during day |
| Outstanding value: | Value at market price of pertinent most traded issues Value at market price of total market |

¹Source: Sarr and Lybek (2002).

by the BIS's Committee on Payment and Settlement Systems (BIS, 2003c).²⁴

8.53 Table 8.2 provides examples of structural data requested in Financial Sector Assessment Programs (FSAPs) conducted by the IMF and World Bank.

²⁴The objective of the *Red Book* is to provide a clear and reasonably comprehensive description of a country's payment systems to a reader who has some familiarity with payment systems in general but who knows little or nothing about the particular arrangements in that country.