FRBSF Economic Letter

Federal Reserve Banks' Imputed Cost of Equity Capital

The Federal Reserve System is an important participant in the nation's payments system—the infrastructure used for transmitting payments among individuals, firms and government entities. For example, according to the Rivlin report of 1998, the twelve Federal Reserve Banks processed about one-third of the estimated 45 billion checks transferred between banks in the United States in 1996. The Federal Reserve also provides other payments services, ranging from automated clearinghouse services to cash processing for financial institutions.

Until about 20 years ago, the prices the Federal Reserve charged for these services were not systematically linked to its costs. But in 1980, in an effort to promote a more efficient national payments system, Congress passed the Monetary Control Act (MCA), which encourages more competition between the Federal Reserve and private sector providers of payments services. The MCA requires the Federal Reserve Banks to charge fees for their payment services that will recover all direct and indirect costs of providing the services. The MCA also requires the Federal Reserve Banks to recover imputed costs–that is, the costs that would be paid if the services were provided by a private firm; these include costs such as taxes and the cost of capital. These imputations are known collectively as the private sector adjustment factor (PSAF), and they make up between 10% and 20% of the Federal Reserve Banks' total cost of providing payment services.

This *Economic Letter* reviews a recent study that analyzed the imputed cost of equity capital used in the PSAF calculations for the Federal Reserve's payments services. This study is part of a broader analysis and revision of the PSAF that is currently under consideration and that will take effect in 2002. The results have practical implications for payments services, and should also be of interest to researchers and public officials interested in imputing capital costs for banks and other regulated industries.

The cost of equity capital
A firm's cost of capital is the weighted average of its cost of raising debt financing and the cost of issuing equity to potential shareholders. Since

the Federal Reserve Banks do not incur costs from raising capital in these ways, its overall cost of capital has to be imputed. Since 1980, the Federal Reserve Banks' imputed cost of capital has been the average cost of capital for a peer group of large U.S. bank holding companies (BHCs). The BHC peer group used currently in the annual PSAF calculations is the top 50 BHCs ranked by asset size at year end. Although payments services are often only a small part of the broad range of financial activities these BHCs engage in, using the peer group is reasonable, given the similarity of services they provide and the public availability of BHC financial data.

The cost of equity capital for the BHC peer group was historically determined according to an accounting procedure known as the comparable accounting earnings (CAE) method. Using this method, a firm's return on equity capital (ROE) is the ratio of the net income generated by its assets and the book value of its equity. In essence, this ratio gauges the value generated by the firm's equity and hence the equilibrium price at which the firm could fund itself in the equity markets. As currently implemented, this ROE measure is calculated for each BHC in the peer group using data provided in its annual report, and the individual measures are averaged. The calculation accounts for the BHCs' taxes and debt payments. The individual ROE measures are for a given year, and to damp year to year fluctuations, a given year's final ROE measure is an average of the annual ROE measures over the past five years.

The historical ROE measures derived under the CAE method and used by the Federal Reserve's PSAF calculations have fluctuated widely since 1981, ranging from a low of about 6% in 1991 to a high of about 16% in 1997 and 1998. The average value over this period is about 11.4% with a large standard deviation of 2.8 percentage points. The low point in 1991 was caused by low BHC returns due to the general economic slowdown during that period and the poor performance of the banking sector as a whole. Since then, the series has increased sharply due to the record economic expansion and the robust performance of the banking sector.

Although commonly used, the CAE method is limited because it is "backward-looking"—that is, it relies on purely historical data. The problem is that, in general, past earnings may not be a good indicator of future earnings due to temporary fluctuations over the business cycle. So using the CAE method could introduce significant lags in the ROE measures used in pricing the Federal Reserve's payment services. This lag effect is exacerbated by the five-year averaging used currently. The CAE method also cannot incorporate changes in investors' expectations of a firm's long-term prospects for future earnings in the same way that methods based on market values can.

Alternative methods of ROE calculation

To address these shortcomings, a recent study by Green, Lopez, and Wang (2001) proposed two alternative methods for determining the equity capital cost of the BHC peer group. These methods use stock market information that is based on the market value of assets and hence incorporates the forward-looking element of investor expectations.
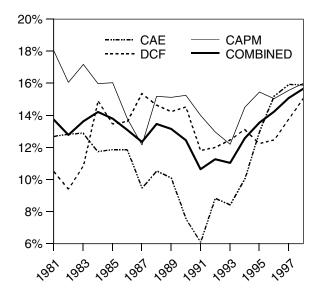
The first method is known as the discounted cash flow (DCF) method. The intuition behind it is the basic financial insight that today's stock price equals the present discounted value of a firm's expected future dividends. Of course, it is difficult to forecast dividends for *all* future periods, so financial economists often assume that the dividends for the first few periods grow at variable rates, while the dividends after that grow at a long-term constant rate. Such forecasts of near-term dividends and long-term growth rates are commonly generated by equity analysts and are publicly available. These forecasts were used to estimate the ROE for the BHC peer group. That is, for the PSAF calculations, the individual BHC's ROE measures were calculated and then weighted according to market capitalization to generate the peer group's ROE for a given year.

Figure 1 shows that the DCF measure of ROE is typically higher and less variable than the CAE measure. The average value since 1981 is about 13%, which is higher than the CAE average and directly reflects equity analysts' views on expected BHC earnings. The range of DCF values is from about 9.5% to just over 15% with a standard deviation of 1.7 percentage points.

The second alternative method is derived from the well-known capital asset pricing model (CAPM), which is a commonly used model for analyzing stock returns. This method is forward-looking since it is based on stock market prices, which incorporate equity investors' expectations of firms' future earnings. The intuition behind this method is that a

Figure 1

Imputed Costs of Equity Capital for PSAF Calculations

firm's cost of equity should be equal to the return that it provides relative to a diversified stock portfolio, such as the entire stock market. For this method, a stock portfolio consisting of the peer group BHCs' stocks weighted according to their market capitalizations at the end of a year is constructed. This portfolio's historical correlation with the overall stock market, commonly known as the portfolio's beta, is estimated. The peer group's ROE is then calculated as the sum of the risk-free Treasury rate plus the product of the portfolio beta and the overall stock market's equity premium (i.e., the market return minus the risk-free Treasury rate).

The average ROE based on the CAPM method over the period is about 15%—the highest of the three methods, but also the least variable, with a standard deviation of 1.6%. This ROE measure is highly correlated with the overall stock market return. In fact, the peer group's average portfolio beta over the period is quite close to one, that is, to a perfect correlation. Hence, the CAPM method provides an ROE measure that very directly incorporates the market valuations of the peer group into the PSAF calculations.

Proposed measure of equity capital costs

Although related, the three methods do not yield identical ROE estimates because each suffers from a type of measurement inaccuracy. The accounting data used in the CAE method do not necessarily measure the quantities that are economically relevant for ROE; the forecasted future cash flows used in the DCF method are just educated guesses that could be incorrect; and the CAPM method

is based on several assumptions regarding stock returns that have been shown to be inconsistent with observed data. However, in practice, an actual ROE number is required for the PSAF calculations.

The question of which method is "correct" for the purposes of the Federal Reserve's payment services is difficult to answer. In certain cases, the accuracy of competing models can be gauged with respect to observable outcomes. However, since the cost of equity capital for the Federal Reserve's payments services cannot be directly observed, clear quality judgements among our three methods are not possible. In light of this difficulty, Green, Lopez and Wang (2001) include all of the measures in their proposed ROE calculation by taking a simple average of the three, which is a common practice in the academic and practitioner literature.

As Figure 1 shows, this combination series is typically higher than the CAE series and has an average of 13.2% over the sample period. By construction, the combined measure is less volatile with a relatively small standard deviation of 1.3 percentage points. Although this proposed ROE measure would have raised the imputed cost of equity capital for the PSAF calculations, it would more accurately represent the stock market expectations for and the asset valuations of the defined peer group.

Of course, this weighting scheme is not the only one possible. For example, for several years the New York State Public Service Commission has used a weighted average of different ROE measures in determining its allowed cost of equity capital for the utilities it regulates. As reported by DiValentino (1994), the Commission initially chose variations of these three ROE methods and applied equal weights to them. Recently, however, the Commission changed its weighting scheme to place a two-thirds weight on the DCF method and a one-third weight on the CAPM method.

Conclusion

The Monetary Control Act of 1980 requires the Federal Reserve to charge fees for its payments services that recover direct and indirect costs, including the cost of equity capital. To calculate this equity capital cost, the CAE method based on the annual accounting data for a peer group of large BHCs that were potential competitors in providing such services was used. This method is flawed because it is "backward-looking" and may not be a good indicator of actual asset value. To address these flaws, the method discussed here incorporates two other measures of equity capital cost that are derived from equity market data, which is "forward-looking" in nature. These three methods are then averaged since each falls short of an ideal measure. Over time, these weights may change to accommodate new developments or changes in public policy concerns. Overall, the proposed ROE measure should be an improvement, since it is based more closely on the academic finance literature and actual practice by other industry regulators.

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