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**Board of Governors of the Federal Reserve System**



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**Testimony Before the Surface Transportation Board  
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## I. Introduction

Thank you for inviting me to discuss the Federal Reserve's experience in using various models to calculate return on equity. Over the past twenty-five years, we have considered this topic in depth, and I hope the lessons we have learned and the conclusions we have reached will be of assistance as you consider your approach.

I plan to touch briefly on the Federal Reserve's background as it pertains to this subject and to provide a short overview of the return on equity models we have used in the past, and then to discuss in more depth the recent analyses and changes we have undertaken in deciding to move from a return on equity calculation that incorporates three models to one that uses a capital asset pricing model only.

## II. Background

First, it may be helpful to explain briefly why the subject of calculating return on equity is so important to the Federal Reserve. The Monetary Control Act of 1980 requires us to establish fees for our "priced" services in such a way that fosters competition from private-sector service providers while at the same time ensuring an adequate level of such services nationwide.<sup>1</sup> Over the long run we must establish, prospectively, fees for priced services provided to depository institutions on the basis of all direct and indirect costs actually incurred in providing these services, as well as imputed costs.<sup>2,3</sup> Imputed costs include financing costs, return on equity, taxes, and other expenses that would be incurred if a private business firm provided the services. These imputed costs, including imputed return on equity, are collectively referred to as the private sector adjustment factor, which we estimate annually.<sup>4</sup>

Calculating the private sector adjustment factor involves estimating the book value of Federal Reserve assets and liabilities to be used in providing priced services during the coming year and determining the financing mix used to fund these assets and the rates used to impute associated financing costs. We integrate these elements to create a *pro forma* balance sheet for our priced services. We impute other components of the *pro forma* balance sheet, such as equity, as if these services were provided by a private-sector firm in the banking industry. Accordingly, we assign equity to our priced services at a level necessary to satisfy the Federal Deposit Insurance Corporation's definition of a well-capitalized depository institution. We impute short-term debt and long-term debt to

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<sup>1</sup> The Federal Reserve's priced services include check, automated clearing house, Fedwire<sup>®</sup> funds, and Fedwire<sup>®</sup> securities transfer services. Fedwire is a registered servicemark of the Federal Reserve Banks.

<sup>2</sup> The applicable text from the Monetary Control Act of 1980 can be found at <http://www.federalreserve.gov/paymentsystems/pricing/pricingpol.htm>.

<sup>3</sup> The costs associated with providing priced services represent only a portion of total Federal Reserve System expenditures.

<sup>4</sup> Similar to the costs imputed to the Federal Reserve's priced services using the private sector adjustment factor, investment income also is imputed and netted with related direct costs associated with clearing balances to estimate net income on clearing balances for the priced services.

our priced services only to the extent that priced-services assets are not financed by the customer accounts maintained at the Federal Reserve Banks to clear payments transactions. These account balances currently are more than adequate to fund the priced-services assets reported on the *pro forma* balance sheet.

We then estimate a pretax return on equity target, which captures imputed taxes, and apply it to the dollar amount of equity capital on the *pro forma* balance sheet to determine the cost of equity for our priced services.<sup>5</sup> Conceptually, we develop this target return on equity with a shareholder's perspective in mind and consider whether we adequately compensate shareholders in the form of average equity returns given the overall risk of our business activities.

The Federal Reserve considers four main principles during its periodic review of the private sector adjustment factor methodology: (1) providing a conceptually sound basis for efficient pricing in the market for payments services, (2) maintaining consistency with actual Federal Reserve Bank financial information and practice, (3) maintaining consistency with private-sector practice, and (4) using data in the public domain in order to make the private sector adjustment factor calculations replicable.<sup>6</sup> In addition, we seek to balance the cost, complexity, and accuracy of the private sector adjustment factor methodology in implementing theoretically sound approaches.

Since the implementation of the Monetary Control Act, determining an appropriate method for developing a target return on equity for our priced services, and in particular identifying a suitable private-sector peer group, has been one of the most challenging aspects of calculating the private sector adjustment factor. This process has been, and will continue to be, an evolving one that regularly considers changes that may occur in our priced-services activities, accounting standards, finance theory, regulatory practices, and banking activity.

### **III. Historical approach to calculating a target return on equity for the Federal Reserve's priced services**

For the first twenty years that the Federal Reserve calculated a target return on equity for its priced services, the financing rates, the combination of financing types, and an income tax rate were based on results produced by a "bank holding company model" (which was an example of a Comparable Accounting Earnings model) that contained consolidated audited financial data for the nation's largest bank holding companies. We computed the target return on equity as an equally-weighted average of the ratios of each bank holding company's net income before taxes to its average book value of equity.

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<sup>5</sup> Rather than estimate a separate tax expense, the Federal Reserve targets a pretax return on equity that would provide sufficient income to fulfill its income tax obligations. To the extent that actual performance results are greater or less than the targeted return on equity, income taxes are adjusted accordingly. Other taxes are included in priced-services actual or imputed costs.

<sup>6</sup> The most recent reviews of the private sector adjustment factor process occurred in 2001 for implementation with 2002 pricing (request for public comment: 65 FR 82360, December 28, 2000; notice of action: 66 FR 52617, October 16, 2001), and in 2005 for implementation with 2006 pricing (request for public comment: 70 FR 29512, May 23, 2005; notice of action: 70 FR 60341, October 17, 2005).

During this time we explored alternatives to the bank holding company model but concluded that this approach produced the most reasonable results.

Determining an appropriate peer group for our priced services is perhaps the most difficult aspect of implementing any model, primarily because bank holding company operations are generally far more diverse than our priced-services activities, and payment services are generally a small segment of bank holding company activities. While we recognized the limitations of using bank holding companies as a peer group, they were considered to be the most reasonable proxy at the time because 1) their operations most closely resembled those of our priced services, 2) they often competed with us in providing payments services, and 3) they had audited financial data that was publicly available and afforded an appropriate sample size.

Eventually, however, other finance theories began to gain broader industry acceptance, and mergers, acquisitions, and the expansion of allowable bank holding company activities weakened the comparability of this peer group to our priced services. The bank holding company model also possessed a number of inherent weaknesses that we sought to eliminate, or at least to diminish: 1) it relied exclusively on historical data to project an expected market rate of return and did not incorporate future earnings expectations, 2) the return on equity results were substantially anchored in past accounting book values, which could be less relevant to investors than market-based measures of a firm's financial condition, and 3) the model's results could be particularly unrealistic during periods when there were large fluctuations in business cycles.

#### **IV. Adoption of a three-model approach to calculating a target return on equity for the Federal Reserve's priced services**

In order to strengthen its approach to calculating its priced services' target return on equity, the Federal Reserve initiated a fundamental review of its overall private sector adjustment factor methodology for implementation with 2002 pricing. This review prompted us to adopt an equally-weighted three-model approach using a combination of the existing Comparable Accounting Earnings-type model (the "bank holding company model") and two additional economic models: a capital asset pricing model (CAPM) and a discounted cash flow (DCF) model.<sup>7</sup>

##### *Comparable Accounting Earnings Model*

As previously mentioned, this model's sole source of data was bank holding company historical accounting information. We believed, despite the shortcomings that initially prompted our transition to the three-model approach, that the results derived from a Comparable Accounting Earnings model complemented the market-driven results of the CAPM and the DCF model when the results of all three models were combined.

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<sup>7</sup> A related research paper ("The Federal Reserve Banks' Imputed Cost of Equity Capital") is available at <http://www.federalreserve.gov/boarddocs/press/boardacts/2000/200012212/researchpaper.pdf>.

### *Discounted Cash Flow (DCF) Model*

The DCF model assumes that a firm's stock price is equal to the present discounted value of all expected future dividends. In order to calculate an implied discount rate (which is the equity cost of capital) for our priced services, the DCF approach required knowing the bank holding company peer group's individual stock prices as well as forecasts of their future dividends and long-term dividend growth rates.<sup>8</sup> The returns on equity for each bank holding company were then combined using a weighted average based on each company's market capitalization. We adopted the DCF model as part of our target return on equity calculation because it incorporated projections of future returns that were not reflected in the previous Comparable Accounting Earnings model.

### *Capital Asset Pricing Model (CAPM)*

The CAPM's basic principle is that the required rate of return on a firm's equity is equal to the return on a risk-free asset plus a risk premium. The risk premium is a measurement of the expected excess return on a market portfolio of equities (the expected market risk premium) and the correlation of the firm's returns to market returns (beta). The underlying theory of the model assumes that rational investors in efficient markets demand a premium for bearing risk; that is, the higher the risk of the entity, the higher its expected return must be to attract investors.

### *Peer group*

When evaluating the three-model approach, we again considered whether organizations other than the nation's top bank holding companies, or modifications to this peer group, would provide a better basis for determining our priced services' imputed costs. Specifically, we evaluated whether to define the peer group on the basis of service revenue instead of total assets, whether segment data from bank holding company financial reports could be used to exclude the effect of their non-comparable activities and to match more closely their capital structure to our priced-services activities, and whether service bureaus or other entities could be used as a proxy for non-bank private-sector firms engaged in payments processing activities. While evaluating these alternatives, however, we identified several obstacles related to inconsistent or unavailable financial information, a lack of comparability with the payments services we offered, and insufficient sample sizes that convinced us that the top bank holding companies continued to represent the most reasonable peer group for our priced services.

### *Combining the models*

The Comparable Accounting Earnings, DCF, and CAPM models each used different assumptions, analytical approaches, and data sources, and all three were widely

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<sup>8</sup> Instead of developing its own forecasts, the Federal Reserve has preferred using commercially available consensus forecasts, such as those published by Institutional Brokers Estimate System (IBES).

used in industry, regulatory, and academic consideration of an appropriate rate of return. Academic studies also demonstrated that using multiple models could improve estimation techniques when each model provided new information. Together, the three models provided a measure that was more reliable, consistent, and forward-looking than that of the original model alone. We elected to calculate the target return on equity for our priced services as a simple average of the results of the three models. The combination was intended to incorporate additional data and conceptual frameworks into the existing methodology and to minimize the impact of outlying observations to provide a more predictable series over time.

#### *Weighting the data*

Because the bank holding company peer group was an imperfect proxy, how we weighted observations in the models was highly relevant, and we considered various alternative weighting schemes. One approach was to calculate a value-weighted average of the returns on equity by multiplying each bank holding company's return on equity by its market valuation and then dividing the sum of these weighted returns by the total market valuation of the bank holding company peer group. Such weighting would have placed more emphasis on the largest bank holding companies and reflected existing academic and industry practice when applying it to the CAPM and the DCF model. Another alternative was to apply weighting based on balances due-to depository institutions.<sup>9</sup> This would have served to give bank holding companies with the largest correspondent banking business lines greater weight.

We ultimately chose to use a market capitalization weighting method to determine the CAPM and DCF returns on equity while retaining the commonly-used equal weighting of bank holding company returns on equity for the Comparable Accounting Earnings model.

#### **V. Adoption of a CAPM-only approach to calculating a target return on equity for the Federal Reserve's priced services**

When the Federal Reserve first adopted the three-model approach, there was evidence that multiple models were being used by academics and professionals to estimate return on equity. For example, one state's Public Service Commission was using a weighted average of different return on equity measures to determine its allowed cost of equity capital for the utilities it regulated. Because each of the models reflected a different perspective, we concluded that a simple average of the three was an improved measure of the peer group's return on equity versus what any single model provided on its own. We also viewed taking the average of the three models as a way to minimize the effect of unusual data and to provide a less volatile return on equity over time.

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<sup>9</sup> Bank holding company due-to balances are bank deposits, reported on the books of the individual institutions that make up the bank holding company, that originate from other banks and represent respondent balances held to provide transaction processing and settlement services.

More recently, however, academic, market, and financial services industry practices started to evolve, the weaknesses of the Comparable Accounting Earnings and DCF models became more widely recognized, and reliance on these models for targeting a firm's return on equity began to decline. Although the DCF model is a powerful valuation tool in theory, its results depend on analysts' ability to project cash flow and dividend growth rates accurately, and research findings suggested that analysts' dividend projections could be upwardly or downwardly biased.<sup>10</sup> Financial market history also demonstrates the inherent difficulty faced by analysts in developing accurate financial projections, given the rapid shifts in business activities as a result of increased competition, changes in the regulatory environment, technological obsolescence, and other forces. Although some public utilities still used the DCF model together with the CAPM for developing return on equity targets, the DCF method was not used by many larger financial institutions.<sup>11</sup> In addition, we received virtually no public support for using the DCF model to calculate a target return on equity for our priced services.

While the CAPM possesses many strengths, it is also the most volatile of the three methods as a result of the estimates and assumptions that drive it. This was of significant concern to us, because adopting a CAPM-only approach might result in unnecessarily volatile prices, which could adversely affect the efficient operations of the Federal Reserve Banks, other payments services providers, and the payments system in general. Historically, we have preferred, when appropriate, to adopt private sector adjustment factor methods that provide for stable, rather than volatile, returns. We also recognized, however, that the CAPM's degree of volatility was appropriately representative of returns on equity that would be expected of a similar private-sector firm.

With information suggesting that two of the three models used in our three-model approach might not be in line with current practice, and because the CAPM was widely accepted and was used more in practice than the Comparable Accounting Earnings and DCF methods, we evaluated the possibility of discontinuing the three-model approach in favor of a more appropriate method, such as a CAPM-only approach.<sup>12</sup> During this review, we worked with an external consulting firm that specialized in capital allocation and risk management and with four finance professors from U.S. academic institutions to obtain information about current private-sector practices. In addition, we requested

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<sup>10</sup> Louis K.C. Chan, Jason Karceski, and Josef Lakonishok, "Analysts' Conflict of Interest and Biases in Earnings Forecasts" March 2003, NBER Working Paper 9544, find evidence that analysts manipulate forecasts downward so that firms are positioned for positive earnings surprises at announcement dates. Patricia M. Deschow, Amy Hutton, and Richard Sloan, "The Relation Between Analysts' Forecasts of Long-term Earnings Growth and Stock Price Performance Following Equity Offerings" Contemporary Accounting Research, Spring 2000, find that analysts' projections may be overly optimistic because fees paid to analysts' firms are correlated to optimistic projections.

<sup>11</sup> J.H. Vander Weide, 2004. Prepared Testimony for the Pacific Gas and Electric Company Cost of Capital 2004 and 2005 Submission to the California Public Utilities Commission.

<sup>12</sup> R.F. Bruner, K.M. Eades, R.S. Harris, and R.C. Higgins, 1998 "Best Practices in Estimating Cost of Capital: Survey and Synthesis," Financial Practice and Education, and J.R. Graham, and C.R. Harvey, 2001 "The Theory and Practice of Corporate Finance: Evidence from the Field," Journal of Financial Economics. find that the CAPM is the dominant model for estimating cost of equity. In addition, most textbook treatments of equity cost of capital calculations are based on the CAPM (for example, see [www.Damodaran.com](http://www.Damodaran.com)).

public comment on a variety of topics, such as whether recent published accounting earnings are relevant when estimating a target return on equity, the extent to which the DCF model is used to estimate a target return on equity and what earnings estimates are the most useful, what important elements of the return on equity calculation might be excluded if we adopted a CAPM-only method, and concerns with using the CAPM to develop our target return on equity and whether the resulting volatility was acceptable.

Overall, the public comments we received were mixed regarding the theory, use, and components of our then-existing and proposed return on equity methodologies. Generally, commenters supported using the CAPM-only method to calculate a target return on equity for our priced services because it was simple and theoretically the best model. Some suggested keeping the existing three-model approach or using a modified version of it. None of the comments supported the DCF model as a standalone option. Three commenters, however, noted that the Comparable Accounting Earnings model, or other accounting-based information, could be a useful way to validate the results and assumptions of the CAPM. One commenter opposed using only the CAPM because it would create volatility in Federal Reserve pricing.

Although several commenters offered alternative models or adjustments that could be considered when calculating a target return on equity, including an Arbitrage Pricing Theory model, other multi-factor models, or adjusting the CAPM beta for differences in leverage between the peer group and Federal Reserve priced services, we found that in such scenarios, subjective judgments and assumptions must be made about what factors to include and the future behavior of those factors. We recognize that many firms use financial models, such as the CAPM, as a starting point when estimating a target return on equity and make subjective adjustments based on current or expected trends affecting the firm's profitability. Incorporating these subjective and complex adjustments did not, however, produce returns on equity that were materially different from those resulting from a single-factor CAPM.<sup>13</sup>

Overall, we found the CAPM methodology to be a well-known, widely used, and theoretically sound model that is simple and transparent compared to other approaches. Because we strive to use a private sector adjustment factor methodology that is consistent with private-sector practice and that the public can easily replicate, we elected to use the CAPM-only approach, modified to reflect better the goals of the Monetary Control Act and current professional and academic practice, to estimate the target return on equity for our priced services for implementation with 2006 pricing.<sup>14</sup>

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<sup>13</sup> The Federal Reserve examined whether economic factors other than overall market return significantly affected the stock returns of the bank holding company peer group. In the analysis, alternative multifactor CAPMs that included bank holding company payments-related revenue shares and macroeconomic interest rate spreads were considered. The analysis suggested that the standard CAPM and equity betas used to estimate return on equity were reasonable. See "Alternative Measures of the Cost of Equity Capital for the Federal Reserve Banks' Payments Services: Technical Supplement to the 2004 PSAF Review" by Barnes and Lopez at (<http://www.federalreserve.gov/boarddocs/press/other/2005/20050518/supplement.pdf>).

<sup>14</sup> In doing so, for the purpose of calculating return on equity going forward, the book value of imputed equity on the Federal Reserve's priced-services *pro forma* balance sheet is assumed to equal the market value of equity.

*Brief overview of the CAPM approach*

The CAPM provides a framework to determine the risk/return relationship required by investors in efficient markets. Because the CAPM measures the relevant market risk of a firm's stock and the contribution of the firm's stock to the market risk of a well-diversified portfolio, it can be applied to many business decisions. For example, investors, who are concerned primarily with market risk when holding diversified portfolios, can use the CAPM to make portfolio management decisions and balance the risk/return tradeoff. Business managers, who are more concerned with maximizing the return to shareholders, also can use the CAPM to make financing decisions because it produces the required rate of return expected by the market. As a practical matter, not all financial models will necessarily produce accurate estimates unless the decision maker exercises some judgment to adjust for risks that the models do not measure. Similarly, the CAPM can produce varying results that may not accurately predict future performance, depending on the formula inputs. Nevertheless, the CAPM is a useful conceptual tool because it represents the way rational people behave when managing risk and making financing decisions.

The CAPM's basic principle is that the required rate of return on a firm's equity is equal to the return on a risk-free asset plus a risk premium. The risk-free asset is an investment with no or low risk, typically measured using a Treasury rate. The risk premium is a combined measurement of the additional return investors require to forgo the safety of investing in low-risk or risk-free assets (the expected market risk premium) and the market risk of a particular company relative to the risk of the overall market (beta). The CAPM's results are highly sensitive to these inputs, which are critical to the model's usefulness and are captured in the following formula:

$$ROE_{\text{Fed priced services}} = R_f + \underbrace{[\text{Beta}_{\text{Fed priced services}} * E(R_m - R_f)]}_{\text{Expected Market Risk Premium}}$$

*Risk Premium*

- R<sub>f</sub> = risk-free rate of return
- Beta<sub>Fed priced services</sub> = beta for the priced-services peer group
- R<sub>m</sub> = return of the overall market
- E(R<sub>m</sub> - R<sub>f</sub>) = expected market risk premium
- Beta<sub>Fed priced services</sub> \* E(R<sub>m</sub> - R<sub>f</sub>) = risk premium

*Risk-free rate of return*

The risk-free rate is a significant factor because it is used to determine the market risk premium and is added to the risk premium of the peer group in the CAPM calculation. When considering what risk-free rate term to use, generally the time horizon of the investor is matched with the term of the risk-free security. In our request for public comment, we acknowledged competing views about whether a short-term or a long-term

risk-free rate is more appropriate in the CAPM. One point of view is that a short-term risk-free rate is appropriate because it is consistent with the time horizon of investors in liquid securities markets. This approach also conforms to the yearly price-setting for Federal Reserve financial services. Another point of view advocates using a long-term risk-free rate, such as the ten-year Treasury bond rate, because it more closely matches the duration of physical investments, the duration of stock market indexes used to estimate a beta, and the investment horizon of a long-term investor. This approach might also be considered to be more in line with the Monetary Control Act's requirement for the Federal Reserve to recover all costs of providing its priced services over the long run.

We specifically requested public comment on whether our priced-services target return on equity should be based on a short-term rate or a longer-term rate. We also requested comment on the reasonableness of incorporating a ten-year Treasury bond, less a term premium, to reflect an expected average short-term risk-free rate over a ten-year horizon, and on other factors that could be used to incorporate a longer-term horizon.

Comments received were varied with regard to the term of the risk-free rate to use in the CAPM. One commenter supported the then-current practice to use a short-term rate and match the term of the risk-free rate with the frequency of the Federal Reserve's pricing, and another commenter suggested using a five-year Treasury note rate. Three commenters supported using a long-term risk-free rate to better meet the long-term cost recovery objectives of the Monetary Control Act, to reduce year-to-year volatility in the return on equity, and to adopt a longer-term planning horizon. Two of these commenters supported the ten-year Treasury bond rate, while the other thought using a ten-year Treasury bond rate with a term premium adjustment was reasonable.

In considering the arguments for both short- and long-term rates, we did not believe that one approach produced conceptually superior results over the other, and that over time they should produce the same results, after adjusting for term premiums. We concluded that the three-month Treasury bill rate is appropriate for our return on equity calculation because it is consistent with the rate we use to calculate imputed income for our priced services. We also expect this approach to decrease the sensitivity to interest rate changes of the combined return on equity and imputed income that are factored into the Federal Reserve's pricing.

#### *Market risk premium*

In general, we found there are two broad approaches to estimating the market risk premium. One is based on what equity investors have earned in the past, while the other is based on projections implied by current stock prices relative to earnings, cash flows, and expected future growth. In order to make our return on equity calculation publicly replicable, we previously used historical monthly average excess returns of the market over the one-month Treasury bill rate since 1927. When using historical data to estimate the market risk premium, the time span must be neither so short that it is heavily influenced by atypical events nor so long that it captures market conditions that have little or no relationship to the current market and economy. Outlying observations in our

historical data prior to 1940 suggest that there can be fundamental shifts in investor expectations over varying historical periods, considering that different generations will have different risk tolerances based on changing economic and market conditions.

Although we did not specifically request public comment on an appropriate market risk premium, some commenters suggested that our then-existing methodology did not properly reflect more recent equity and bond market conditions and, therefore, may have been overstated. One commenter encouraged us to investigate using a market risk premium of three to six percent because it was the commenter's sense that support for a market risk premium at seven percent or higher was dwindling. Another commenter suggested that we consider estimating the market risk premium using a shorter time period that corresponds to the risk-free rate horizon.

We elected to adopt a rolling forty-year time horizon to estimate the market risk premium while continuing to use data from a widely accepted and easily accessible third-party source.<sup>15</sup> We concluded that a rolling average would better capture evolving attitudes and changes in expectations because less relevant historical data will drop out and more relevant and recent data will be incorporated in the calculation, and that forty years is sufficiently long to smooth cyclical fluctuations in realized returns but short enough to reflect trends in required returns.

#### *Beta assumptions*

A beta measures the sensitivity of a firm's returns to the overall market's returns. In order to calculate a beta representative of the Federal Reserve's priced services, a comparable peer group is needed. Conceptually, we should target the return on equity that the market would require of a comparable peer group of companies providing these same services and having the same risk profiles as our priced-services activities. When the peer group is identified, the most relevant and appropriate methods to use for the beta can be determined and applied to estimate the market risk of priced services.

Peer group. In our request for public comment, we acknowledged that bank holding companies are not a perfect proxy for our priced-services activities. But because many bank holding companies provide similar services through their correspondent banking activities, including payment and settlement services, hold respondent ("due-to") balances, which are similar to depository institution balances held by Federal Reserve Banks, and have publicly-available financial information, we considered them the most reasonable proxy at the time.

We specifically requested comment on two alternatives to choosing a suitable peer group. The first alternative was to continue selecting the nation's top publicly-traded bank holding companies, but also adding filters to the selection process to focus on capital structure, risk-weighted asset ratios, and solvency ratings. We also requested

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<sup>15</sup> This estimate is based on the Kenneth R. French data series, which is the standard data series used to estimate the market risk premium, providing the monthly return of the market over a one-month Treasury bill from 1927 to present ([http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data\\_library.html](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)).

comment on the efficacy of cross-matching the top bank holding companies by deposit balances with the top bank holding companies by due-to balances. We believed this additional selection criterion could improve the peer group sample by narrowing the group to include only those bank holding companies that were more involved in transaction processing and settlement services.

The comments we received were highly diverse and offered no real consensus. Responses ranged from eliminating bank holding companies as a peer group altogether to exclusively using non-bank payments processing companies as the peer group, screening out firms whose risk profiles had been heavily influenced by extraordinary events, developing a target return on equity based on specific bank holding company product line information (segment data), and broadening the peer group to include a core group of payments processing companies along with bank holding companies. Opinions also varied with regard to the risk of the Federal Reserve's priced services relative to that of the bank holding company peer group.

Beta estimation period. Different sample periods result in different betas, with a longer period producing a beta that is generally less sensitive to unusual market variations, and a shorter period having an opposite effect. Some financial sources suggest that using more years of historical data to calculate the beta may be less relevant to the firm's future returns than fewer years would be, because the nature of business risks undertaken by firms may have changed significantly over a longer period. The shorter period also is less likely to distort return on equity results because it excludes some past structural changes in the banking industry and in the financial markets that no longer reflect current bank holding company peer group risk profiles. In our request for public comment, we considered calculating the beta using monthly returns from the market over a rolling five-year period versus the previously-used rolling ten-year period.

Three commenters addressed the beta estimation period. One supported a rolling five-year period, provided that year-to-year volatility was not significant. Another commenter also supported using a five-year estimation period to reflect recent changes in the banking industry. The third commenter suggested using a two-year beta estimation period with weekly or daily observations to incorporate industry changes and the evolution from paper to electronic check processing.

Weighting of the peer group betas. In the previous CAPM we used to determine our priced-services beta, we market-value weighted the returns of each bank holding company in the peer group and compared them with overall market returns. As bank holding companies became more involved in non payments-related businesses, however, the extent to which market capitalization was representative of a bank holding company's payments activities and its usefulness in weighting the betas became uncertain. Value weighting, therefore, may not have produced an appropriate beta to serve as the proxy for our priced-services activities.

We considered calculating our priced-services beta using the equal-weighted returns, rather than the value-weighted returns, of each bank holding company as a better

approximation of the overall peer group. We requested public comment on which of these two options would produce a better beta estimate for our priced services, or whether an alternative weighting process would be preferable.

Only two commenters addressed the weighting of the peer group beta. One supported the use of equal weighting each bank holding company's beta to reduce the influence of firms that have large market capitalization but a small concentration of payments processing activities, and added that additional weighting by segment results would provide additional precision. Another commenter stated that value weighting is more theoretically sound.

Beta of 1.0. Historical betas use the past returns of both a firm and the market to estimate the firm's beta for the future. Historical betas, however, may not be good predictors of the future risk of a firm, which may be facing different risks than it did in the past. In our request for public comment, we suggested that the long-standing difficulties associated with selecting a peer group and estimating the appropriate peer group beta could be eliminated by assuming a beta of 1.0 for our priced services. Finance literature suggests that betas, as an empirical rule, move toward 1.0 over time, and experience shows this to be the case for correspondent banks and other firms that provide payments processing services. Assigning a beta of 1.0 to a firm assumes that investing in the firm's equity carries the same risk as the market and that investors require the same return on that firm's equity as they do on the market as a whole. Betas greater than 1.0 indicate greater sensitivity to market changes, and betas below 1.0 indicate less sensitivity.

To simplify the beta estimation process, we considered assigning our priced services a beta of 1.0 and requested public comment on incorporating the concept that all firm betas will be 1.0 over time in the priced-services beta calculation.<sup>16</sup> By doing so, a peer group would no longer be needed to estimate the CAPM return on equity. We also solicited feedback on whether a beta equal to 1.0 for our priced services is a reasonable simplifying assumption when computing the CAPM, if important elements that should be factored into the CAPM equation are eliminated with this assumption, and if an adjusted beta should be considered, what the best method is for implementing it.

Of the five commenters that addressed the beta-equal-to-1.0 assumption, three expressed a preference for developing a beta based on a peer group. These commenters, however, recognized the difficulty facing the Federal Reserve in finding a comparable peer group and recommended that we use a different peer group to calculate the beta. One commenter supported the idea of setting the beta equal to 1.0, indicating that this is a reasonable simplifying assumption in view of the uniqueness of the Federal Reserve's payments business. Another indicated a preference for a static beta as opposed to one

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<sup>16</sup> An alternative way to incorporate the concept that all firm betas will revert to 1.0 is to weight the historical beta and the beta of 1.0 to determine the firm's adjusted beta. For example, finance literature suggests and financial firm practice supports applying a two-thirds weight on the historical beta and a one-third weight on the beta of 1.0. The adjusted beta will reduce volatility and be a truer measure of risk over the long run while moving the beta estimate closer to 1.0.

determined using a peer group as a way to minimize volatility in return on equity targets, but made no suggestions for deriving the beta.

Finding a comparable peer group has been one of the most challenging aspects of targeting a return on equity for the Federal Reserve's priced services. Over the years, we have considered a number of ways to refine the original bank holding company peer group. From the comments we received and in recognition of the many theoretical and practical challenges we have faced over the years in applying a peer group approach, we elected to forgo the long-standing process of identifying a peer group to calculate a target return on equity for our priced services. Even though the long-run average of the priced-services beta is close to 1.0 under the previous CAPM methodology, the continued use of bank holding companies as a peer group would give a false sense of precision. Instead, we believe that assuming a static beta of 1.0 for our priced services is simple to understand, administer, and monitor while providing reasonable results.

## **VI. Conclusion**

Our decision to replace the three-model approach with a CAPM-only method reflected our desire to alleviate the ongoing dilemma of identifying an appropriate peer group for our priced services and to adopt a simpler, more straightforward, and transparent approach that is widely accepted within academic and industry circles. Using the CAPM-only model for our 2006 and 2007 pricing processes has produced the results shown in Attachment I.

Thank you again for the opportunity to provide this information. We appreciate this opportunity to share our experiences in estimating return on equity with you and would welcome future dialogue at the staff level. I will now be happy to answer any questions you may have.

## ATTACHMENT I

### After-Tax Estimate of Return on Equity for Federal Reserve Priced Services

$$\begin{array}{l} \text{ROE} = \text{Rf} + [\text{Beta} * \text{E}(\text{Rm} - \text{Rf})] \\ 2006: \quad 8.91\% = 3.33\% + [1.0 * 5.58\%] \\ 2007: \quad 10.82\% = 5.18\% + [1.0 * 5.64\%] \end{array}$$